

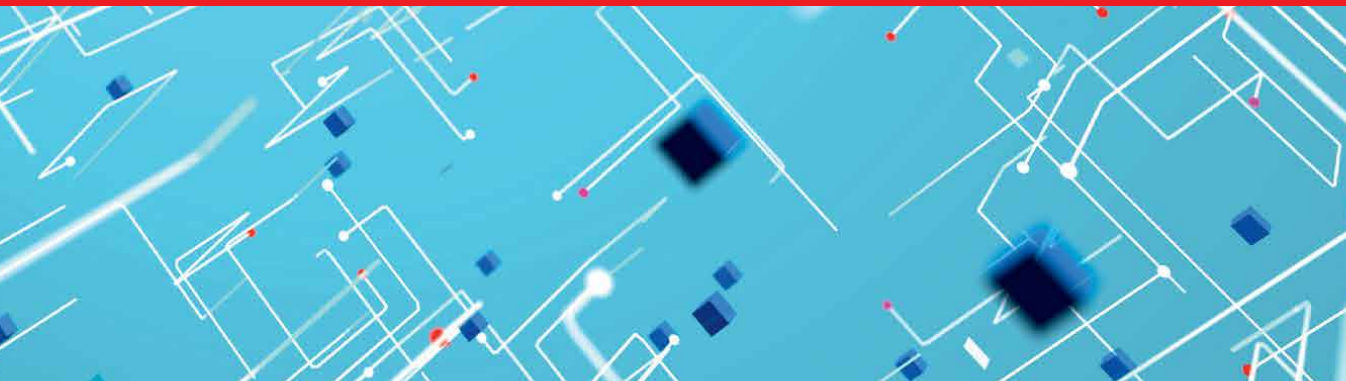


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Massive Open Online Courses

Current Practice and Future Trends

Edited by Sam Goundar



Massive Open Online Courses - Current Practice and Future Trends

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Meet the editor



Professor Dr. Sam Goundar is an international academic, having taught at twelve different universities in ten different countries. He is the editor-in-chief of the *International Journal of Block-chains and Cryptocurrencies* (IJBC), *International Journal of Fog Computing* (IJFC), *International Journal of Creative Computing* (IJCrC), and *International Journal of Cloud Applications and Computing* (IJCAC). He is the associate editor of *Tsinghua Science and Technology* and guest editor of the special issue on “Digital Banking and Financial Technology”, *Journal of Risk and Financial Management* (JRFM). He is also on the editorial review board of more than twenty high-impact factor journals. Dr. Goundar has 126 publications in journals and book chapters to his credit. He has also written and edited fifteen books.

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Preface

MOOCs introduction

Welcome to the world of Massive Open Online Courses (MOOCs), an innovative and transformative revolution in education. In this preface, we embark on a journey that explores the dynamic landscape of online learning, a realm where knowledge knows no boundaries and students from all corners of the globe come together to pursue their passions and enrich their lives. Over the past decade, MOOCs have reshaped the way we approach education, breaking free from traditional constraints and opening up new avenues for learning. Developed in response to the growing demand for accessible and affordable education, MOOCs have swiftly become a driving force behind the democratization of knowledge. The rise of digital technology and internet connectivity has granted unprecedented access to a wealth of information, empowering learners of all backgrounds and ages to engage with top-notch courses from renowned institutions and instructors.

This book is a comprehensive guide to the MOOC phenomenon, offering an in-depth exploration of its history, evolution, and profound impact on global education. We delve into the origins of MOOCs, tracing their roots to early experiments in online education, and follow their rapid development into the vast ecosystem of learning platforms available today. From pioneers like Coursera, Udacity, and edX to emerging platforms tailored to specific disciplines, we examine how MOOCs have diversified to cater to a wide array of interests and learning styles. Beyond the mechanics of MOOCs, we delve into the core principles that underpin this transformative approach to learning. We explore how the self-paced and flexible nature of online courses allows learners to take control of their educational journey, tailoring their experiences to suit their individual needs and schedules. The global reach of MOOCs also brings together diverse communities of learners, fostering cross-cultural interactions and collaborative learning environments that enrich the educational experience.

Throughout this book, we shed light on the benefits and challenges of MOOCs, discussing the opportunities they present and the potential obstacles they must overcome. We address questions about the effectiveness of online learning compared to traditional classrooms, the importance of learner motivation and engagement, and the role of online credentials in today's job market. Additionally, we examine how MOOCs are reshaping the roles of educators and learners, emphasizing the need for continuous adaptation in this rapidly evolving educational landscape. Whether you are an educator curious about incorporating online tools into your teaching practice, a lifelong learner seeking to expand your horizons, or a policy-maker interested in the future of education, this book offers valuable insights into the world of MOOCs. We present a nuanced perspective on the challenges and opportunities in this ever-evolving field, inspiring readers to embrace the potential of online education and participate in shaping the future of learning.

In closing, we invite you to embark on this exploration of MOOCs, where knowledge transcends geographical boundaries, where curiosity is the guiding light, and where the pursuit of education becomes a collaborative global endeavor. May this book inspire and inform, fostering a deep appreciation for the power of technology in advancing education and transforming lives.

MOOCs current practice

MOOCs have continued to flourish and evolve, transforming the educational landscape and impacting learners worldwide. In their current practices, MOOCs have expanded their course offerings, diversified their content, and refined their methodologies to cater to a broader audience of learners. One of the most significant developments in MOOCs is the expansion of course subjects and specializations. Initially centered on technical and computer science fields, MOOC platforms now host a vast array of subjects, spanning the humanities, social sciences, arts, business, and more. Learners can explore topics as varied as literature, history, data science, marketing, psychology, and environmental studies, among many others. This diverse array of courses allows learners to pursue their interests, whether they are seeking personal enrichment, professional development, or academic advancement. We finally have a flexible learning system that takes into consideration our personal needs.

Moreover, MOOCs have embraced a multimodal approach to content delivery. In addition to video lectures, courses now incorporate interactive elements, quizzes, assignments, discussion forums, and peer-reviewed projects, offering a more immersive and engaging learning experience. Learners can benefit from the flexibility of self-paced courses, enabling them to balance their education with work, family commitments, or other responsibilities. To enhance learner outcomes and retention, many MOOC platforms have incorporated adaptive learning technologies. These technologies analyze learners' performance and tailor the learning experience to suit individual needs, providing personalized content recommendations and adaptive challenges. This data-driven approach allows learners to focus on areas where they require more support, thereby maximizing the effectiveness of their learning journey. Future research should obtain more diverse, multimodal data pertaining to social engagement and researchers should employ automatic analysis methods to improve measurement accuracy.

Recognizing the importance of credentials, many MOOC providers have introduced certification options for course completion. Learners can earn verified certificates, micro-credentials, or even full-fledged degrees in partnership with accredited institutions. These credentials have gained recognition in the job market, with employers increasingly valuing the skills and knowledge acquired through reputable MOOC programs. Collaborations between MOOC platforms and educational institutions have also become more prevalent. Many universities now offer blended learning experiences, combining traditional classroom instruction with online components through MOOCs. This symbiotic relationship benefits both learners and educators, fostering innovation in teaching methods and expanding access to high-quality education. Course instructors should provide technical support ("scaffolding") for self-regulated learning to enhance student engagement with MOOCs.

MOOCs future trends

Looking ahead, MOOCs continue to push the boundaries of education, experimenting with emerging technologies such as augmented reality, virtual reality, and artificial intelligence to further enhance the learning experience. Additionally, the ongoing development of global partnerships and initiatives seeks to address issues of accessibility and inclusivity, making education accessible to learners from diverse socioeconomic backgrounds and geographic locations. MOOCs have become a formidable force in the realm of education, fostering a spirit of lifelong learning and transcending traditional barriers to knowledge. As they continue to evolve, MOOCs hold the promise of shaping a more inclusive, interconnected, and empowered generation of learners eager to embrace the challenges of the future. The MOOCs market is expected to grow in the future. The availability of study infrastructure, such as laptops and personal computers, is driving the market expansion.

MOOCs are gaining popularity among knowledge seekers due to their low cost and lack of formal requirements. MOOCs are designed to be scalable to large online masses, with free participation and without formal requirements to provide the opportunity to learn through hundreds of public and private universities or organizations for millions of individuals around the world. In addition, MOOCs are expected to become more interactive and engaging in the future. They will be designed to provide more personalized learning experiences that cater to individual needs. MOOCs will also be used more frequently for corporate training and professional development. In the future, MOOCs are expected to witness a greater integration of immersive technologies such as virtual reality and augmented reality, creating more engaging and interactive learning experiences for students. Additionally, MOOC platforms are likely to focus on fostering stronger connections between learners, and facilitating collaborative learning environments that encourage peer-to-peer interactions and knowledge exchange.

Organisation of the book

This edited book is organized into four sections with thirty-two chapters. The first section on “Massive Open Online Courses (MOOCs)” includes eight chapters that deal with general topics of MOOCs and focuses on what MOOCs are and how they are being used. The second section, “Learning Pedagogies”, also includes eight chapters. The chapters discuss different learning pedagogies and teaching techniques that have been applied or can be applied to improve teaching, learning, student retention, and successful outcomes. The third section, “Teaching and Learning”, includes eight chapters that focus on the transition from traditional classroom-based learning to MOOCs-based and/or online learning. A couple of chapters discuss how MOOCs-based learning became an alternative to learning during the COVID-19 pandemic. The fourth and final section, “Country Case Studies”, includes eight chapters that examine how MOOCs have been applied in different countries like China, India, Russia, Indonesia, Pakistan, South Korea, and Africa. The authors discuss opportunities and issues of MOOCs based on the country context and perspectives.

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I would like to thank Ms. Ivana Barac at Intech Open for her support throughout the publication process. I would also like to thank the authors for their excellent chapters.

This book would not have been possible without their submissions, tireless efforts, and contributions. I hope we can collaborate again in the future and publish more books together.

I hope readers will enjoy this book and find it useful. I also hope it will inspire and encourage readers to conduct their own research and write about MOOCs. Once again, I congratulate everyone involved in the writing and publication of this book.

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Section 1

Massive Open Online
Courses (MOOCs)

Chapter 1

MOOC as a Way of Dissemination, Training and Learning of Telecommunication Engineering

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Abstract

In this chapter, the use of massive open online courses (MOOCs) for the dissemination, training capabilities and learning of telecommunication engineering is described taking as example the successful MOOC 'Ultra- Dense Networks for 5G and its Evolution' developed under the European innovative training network (ITN) TeamUp5G. MOOCs are usually understood as a way of teaching or learning for massive potential students. Indeed, this is the main goal of any MOOC. However, we also propose its use for training and dissemination. The ITN TeamUp5G is a training network for 15 PhD students of seven different institutions (universities and companies) where the students make research on different interconnected topics for the common goal of Ultra dense networks for 5G. At the same time they researched, they prepared a MOOC to disseminate their most recent advances and their challenges. For the MOOC, they needed to collect their thoughts, organize their knowledge and establish a common vision of the whole system. The cooperative work, the cross-related meetings and, the preparation of all the materials for the MOOC were very interesting and useful in their training process. The whole experience of designing and creating the MOOC is described in detail along with the challenges and lessons learned.

Keywords: telecommunication, 5G, e-learning, edX, life-long learning, ultra-dense networks, TeamUp5G

1. Introduction

Massive open online courses (MOOCs) are widely seen by students as the perfect option for acquiring new skills, learning new concepts, developing their career and including new knowledge in their curricula in an easy and practical way. In fact, this is the common view for most of the people. There are MOOCs in almost every discipline [1]. In this book chapter, we are going to focus on a MOOC devoted to engineering, although some of the main concepts, applications and lesson learned could be straightforwardly applied to other disciplines.

Sometimes students access MOOCs because they want to learn specific contents or skills. Some others, they do for other reasons such as the completion of some knowledge they already own, but they are willing to improve or reinforce, curiosity on some specific topics or only for pleasure or culture. In all these cases, the MOOC is used by external participants and must be designed for that. Videos, questionnaires, activities must be carefully planned for obtaining three main goals, namely the transmission of knowledge (educational), variety of activities to guarantee the learning process and attractive productions for the engagement of students. It is worth saying that MOOCs are most of the times followed voluntarily by students, so the engagement is very important. Any wrong decision on video or activities can seriously affect the participation of the people and thus void the learning process and effort [2].

Several universities and institutions have created and shared their own experience on virtual and remote content creation through MOOCs development over the years. Authors from [3] submitted experimental findings from the Virtual Instrument Systems in Reality laboratory. The authors of [4] compared the results of several courses on signal processing and digital communication they had created over the years. In [5], a study about MOOCs' effectiveness in improving undergraduate students' performance in a normal Digital Signal Processing (DSP) class was conducted. There is also a discussion in [6] on the advantages and disadvantages of MOOC courses for microelectronics. Recently, in [7], an exhaustive analysis of MOOCs on the higher education in Saudi Arabia is presented showing an important impact on the University system and the outcomes. A more recent research has shown that they are eight factors that affect the outcomes and effectiveness of a MOOC directly, namely behaviour intention, learning engagement, students' motivation, perceptions, satisfaction, performance, self-regulation and social networks across the world [8].

Along with the MOOCs, some universities also provide small private online courses (SPOCs), associated to specific classes. Those SPOCs complement the in-person courses or subjects with videos, activities and interactive materials that can only be accessed by the students on these courses. They can also be seen as blended courses where some contents are shown in an SPOC and others in class [9] and proof of excellent outcomes exists [10, 11]. This is also used in companies for training. It is important to highlight here that an SPOC is different from a self-paced open online course (SPOOC), which is similar to a MOOC although the itinerary, times and schedule are adapted to the student's needs. It is very common for a MOOC to be converted into an SPOOC after one or two editions: all the materials and activities are there from the beginning and the students decide when access to them. As a drawback, SPOOCs do not have the possibility of supervision and guidance by the professors and the encouragement and dynamism of the course are limited. The forum is still open, but it is static, and it is not usually supervised by a moderator.

From the point of view of MOOCs devoted to telecommunication engineering, there are more than 100 official MOOCs/SPOOCs closely related to its topics such as digital

signal processing, information theory, time and frequency analysis, internet of things (IoT), wireless communications, modulations, signal and systems, programming and many others. Those MOOCs are mainly hosted by relevant universities such as EPFL, Curtin University and Universidad Carlos III de Madrid (UC3M) or technological research centres such as MIT, Georgia Tech, Tokyo Tech, among others. The number of discussions in the literature is large, but to the best of our knowledge, there was no MOOC focusing on the fifth generation of mobile communications (5G) and its advancement, which led to the creation of the MOOC addressed in this book chapter.

Although the ultimate goal of a MOOC is the learning contribution for the students, a recent study on the literature showed that they are also used for research purposes on how to improve traditional education and learning (see references in [12] and references therein).

On the other hand, MOOCs can also be used as a tool for training PhD students in the following sense. Nowadays, the world is changing rapidly and so the learning methods. New doctors in engineering need to acquire not only research capabilities and a deep knowledge on the state of the art in their fields (in this case, ultra-dense networks for 5G), but also skills and abilities for the new technological, visual and online era. According to the last European policies in open research under the Horizon 2020 and Horizon Europe [13], research must be oriented to citizens, open, close to real problems and fair in order to advance in the different fields and to improve citizens' life and society. Thus, researchers must accommodate this new scenario and way of researching. In this sense, the dissemination of results, the collaboration and the way of making visible their work for the society move to a more visual, open and online. In this new scenario, MOOCs appear as a way of dissemination and training. However, the conception of a MOOC, its design and production are not an easy task, so new PhD students need to learn how to do it properly. For these reasons, a MOOC can be seen as another training for the PhD and a new way of dissemination according to the new rules. In this book chapter, our experience on designing and creating a MOOC is shared.

The project 'New RAN TEchniques for 5G UltrA-dense Mobile networks' (TeamUp5G) [14] is a prestigious Marie Skłodowska-Curie action Innovative Training Networks (MSCA ITN) in the frame of the European Commission's Horizon 2020 framework [15], with grant-agreement number 813391. The team is investigating the evolution of the 5G wireless communications and has been preparing an extensive MOOC under the scope of 'Ultra-Dense Networks for 5G and Its Evolution'. The goal is sharing the recent research advances and the knowledge about the main technological innovations and new 5G mobile networks applications.

From the best knowledge of the authors, there is no other experience like this in training PhD students. Motivated by MOOCs' role in the scope of higher education while providing a positive impact on student's performance, a well-designed, structured and open comprehensive accessible online course has been prepared by the TeamUp5G team. As an outcome of this joint effort, this book chapter provides the detailed steps and procedures about the methodology adopted and experienced during the preparation of the MOOC, highlighting the acquired experience, challenges, potential opportunities, training capabilities and main advantages.

2. MOOC structure and goals

The rapid technological development over the past few decades has led to a continuous flow of new discoveries and innovations in science and technology.

Meanwhile, new patents and scientific advancements are constantly being made, bringing new challenges for integrating them into our everyday lives. It is important that qualified professionals are able to learn and use new technologies effectively in order to promote social progress. After taking a closer look at the scope of the necessary road map for the target technology and its evolution affecting the telecommunications industry, we have identified gaps that can be filled by our MOOC. Our team has noticed a gap between the latest innovative evolutionary technologies and the way current students see the future of networks, especially 5G and beyond technologies. Bridging this gap is beneficial for students, professionals and researchers as they can keep their knowledge up to date and understand the latest technologies in communications and networking. Source materials providing information about the topics of our MOOC can be grouped into two classes: general dissemination documents and research publications. General dissemination documents (e.g. materials provided at university undergraduate and postgraduate levels and online resources from the internet) usually do not summarise the target technologies in a well-developed plan. At the same time, research publications commonly focus on a specific topic, requiring substantial background knowledge. Therefore, there is a concrete possibility that university students and young researchers would build their expertise on 5G and beyond technologies by sourcing information from both classes following a disorganised approach. It is easy to predict where similar behaviour could lead: a chaotic knowledge of the subjects and/or a general feeling of dissatisfaction.

2.1 Objectives

The gaps mentioned in the previous section are observable enough to require particular care to address them. Since the key feature of our MOOC was the simplicity of explanation, the structured strategy depicted in **Figure 1** was employed. The aim is

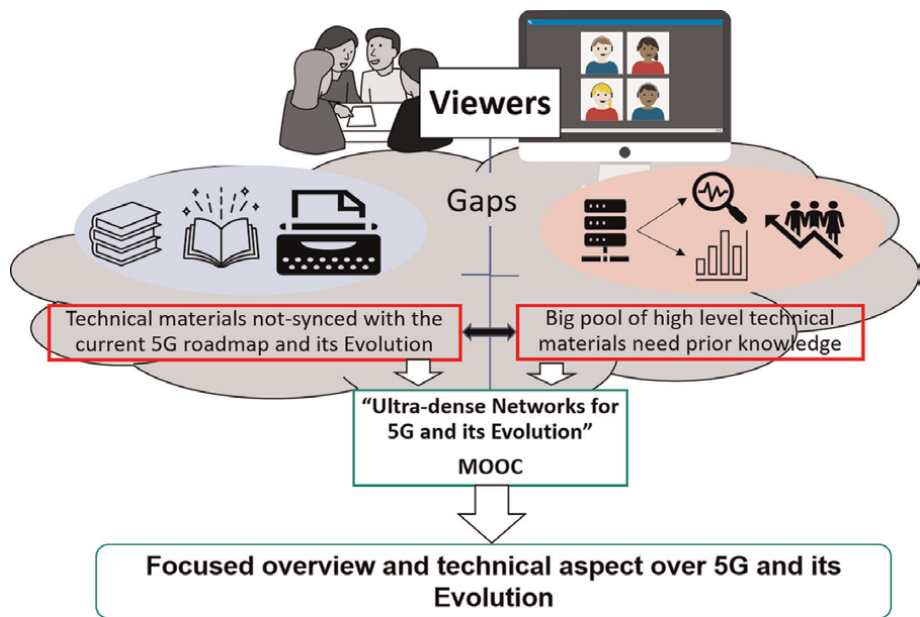


Figure 1.
Showcasing of the objectives (created from free open licence CC).

to transfer this knowledge by covering both the technical principles and fundamentals of each enabling technology, as well as a higher-level view of 5G and beyond mobile networks. It is critical to take into account the need for an innovative strategy for such knowledge exchange to achieve successful results. Thus, the present MOOC package effectively covers both the high-level vision and the technical perspective of the 'Ultra-dense Networks for 5G and its Evolution'.

The MOOC covers a wide range of topics, mainly related to 5G and its evolution, its system requirements and new transmission technologies. It addresses aspects of interference management and energy efficiency, low power networks, packet and multi-band scheduling, data sensing, spectrum sharing, carrier aggregation, full-duplex communication, beamforming, use cases and prototypes (such as augmented and virtual reality), security/privacy, unmanned aerial vehicles (UAVs) and simultaneous radar and communications (RADCOM), complemented by a vision of the future ahead (e.g. 6G and terahertz communications).

Overall, through our produced MOOC, we target the transfer of knowledge in a comprehensive and transparent technical language (dissemination). After developing a good understanding of the vision for the audience, we progressively share the technical perspective of each key technology. Such process would enable the audience to get enough readiness to understand the latest technological developments. Eventually, it will broaden their horizons about the topics discussed which may lead to enhancements of their knowledge and future contributions to both academia and industry.

2.2 Targeted audience

We designed the MOOC to be simple, understandable and intelligible, targeting an audience with diverse background knowledge, requirements and obligations. In this sense, the target audience is made of professionals and students who are related or simply interested in the research and development of 5G New Radio networks and their evolution. The core concepts are consistently expressed for beginners and students, with the aim of making them easier to understand while building strong foundations. On the other hand, individuals with experience in the telecommunications industry may get familiar with the most recent objectives and cutting-edge research fields that the European Union and related corporations are willing to fund, investigate and develop. Finally, this MOOC can be useful for educators who wish to teach their students the principles and basic ideas of 5G networks.

2.3 Content formatting

The 'Ultra-dense Networks For 5G And Its Evolution MOOC' [16] was prepared by an international team made of 14 early-stage researchers (ESRs) under the supervision of highly qualified professors from different backgrounds and disciplines. The course is divided into six modules, each of them containing five different items that cover a wide range of concepts and technologies related to 5G networks and further additional wireless technologies. Learning, assessment and motivational materials have been developed for each item, as shown in **Figure 2**. In particular, the main learning materials consist of video-recorded presentations and textual extensions. The video-recorded presentations were entirely filmed at the UC3M facilities due to the COVID-19 pandemic and the differences in terms of equipment available to the various partners. This could have caused an audio-visual mismatch which could have impaired the overall experience. By keeping both the environment and the recording

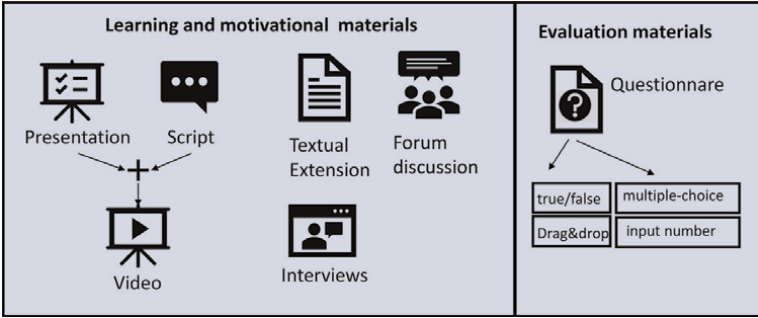


Figure 2.
Block diagram of the content formatting to summarise the contents.

equipment constant throughout the MOOC, we were able to achieve consistent results. Based on the input given by the experienced staff of the UC3M, the researchers prepared detailed scripts to be shown on a teleprompter during the recordings, as an aid for the presenters. The scripts also included notes on engagement and motivation, to keep the audience in a state of higher mental concentration. A total of about 2 hours of material was produced for each module, split among 10 minutes of video content, 50 minutes of written information to support the video material and 1 hour of questions and forum discussion.

In addition to supporting the presenters, the scripts were also used to produce text transcriptions on the *edX* platform. Furthermore, a separate auxiliary textual extension of them was prepared. The goal of the textual extensions was to provide the participants with additional information that could not be included in the videos due to time restrictions. Moreover, they can also be used as in-class materials in the event that the MOOC is used as an aid in higher education institutions.

Finally, in order to verify the knowledge gained by the participants, an assessment process was implemented. In this context, the participants have to answer true/false, multiple-choice, drag and drop and input-type questions. Moreover, after the finalisation of each module, the students are encouraged to further participate in a discussion forum. In this forum, both students and teachers can interact for learning engagement purposes. Such a round-table allows the participants to exchange ideas and concerns about the current and possible 5G features, with the seniors passing on knowledge to the younger ones. Apart from the pure learning purposes, the discussion forum activities may concretely lead to envision novel 5G features and use cases.

All these activities can also be seen as a training process for the ESR: looking for information, organising knowledge, summarising, presenting in an easy and visual way to the audience and preparing extra material for further research.

3. Resources

3.1 Team and project

TeamUp5G is a multi-partner research training network whose beneficiaries come from academic and non-academic sectors to form a structured, international, intersectoral and interdisciplinary research and training environment. The PhD students and young researchers are spread in different European countries. It aims to

optimise the existing 5G in various domains in terms of throughput, energy and spectral efficiency. Some challenges are the demand for increasing data rates and users served per km² and the energy efficiency of the entire system. The goal of the educational training network (ETN) is to propose metrics and develop energy-aware algorithms and protocols to enhance small cells in ultra-dense deployments, making use of massive antenna solutions (mMIMO), millimetre wave (mmWave) bands and Visible Light Communications (VLC), in relevant scenarios, through a combination of analytical work, simulation and prototyping. The details and information regarding our ESRs, their works and the hosting institutions can be found in [14].

3.2. University facilities and prior experience

The technical team of UC3M and some of the involved supervisors had prior experience creating and organising MOOCs [17]. UC3M provided around 35 different MOOCs both in English and Spanish in the *edX* and *MiriadaX* platforms. For instance, the course on mobile communications from the Signal Theory and Communications department at UC3M is published in *edX* [18]. This MOOC is open to the public and targets an audience who have no previous knowledge on mobile communications. UC3M experience guided the journey of this MOOC and helped the team to overcome the challenges.

As stated before, the MOOC was fully recorded at UC3M, utilising the in-campus Audio/Video (AV) facilities. UC3M has three recording studios, to allow university staff and students to generate teaching materials for various purposes, such as MOOCs or teaching innovation projects. The rooms are provided with all the recording facilities such as HD cameras, a system for mixing and compositing images in HD, special background lighting for generating a virtual background and a teleprompter, as shown in **Figure 3**. Concerning the prior experiences in MOOC production, UC3M has experienced staff for editing, mixing and processing videos. UC3M also provides support for the creative process such as covers, course images and original creation of materials, such as animations or even small interactive materials.

3.3 ETN contributions and resources

The MOOC ‘Ultra-Dense Networks for 5G and its Evolution’ results from a great teamwork, supervision and constant guidance. In its production, 14 ESRs and nine



Figure 3.
Recording room facilities available at UC3M Leganés campus.

supervisors have participated. From the 14 ESRs, two acted as both producers and supervisors of the MOOC, as it happened with three of the supervisors of the TeamUp5G project. The other 12 ESRs and the other six supervisors acted only as producers and as supervisors of the MOOC, respectively. Each producer was responsible for the content of the MOOC relevant to one's research area. The contributions by the supervisors were invaluable in coordinating the teams, reviewing and providing continuous insights on improving the content. In Section 4, the MOOC's structure and contents are discussed in detail. To ensure high-quality videos and synchronisation, UC3M took the responsibility of recording and coordinating the MOOC. Some producers could not travel to the UC3M premises amid the COVID-19 pandemic. For this reason, some of the producers residing in Madrid recorded most of the videos. However, leveraging on the research stays at institutions in Madrid and project meetings, several ESRs could record their videos in their visits.

4. Production of the MOOC

In order to give a picture on the timing for the production of the MOOC, this section includes information about the timeline of the main tasks (with details of the months and duration of each task), the creation of the material (with details of the involved actors and processes followed for its creation), the copyright compliance (performed by the MOOC authors and the supporting audiovisual team at UC3M), the contribution from the non-academic sector and the quality assurance (performed by the MOOC authors and the supporting audiovisual team at UC3M). **Figure 4** shows an overview of the timeline, involved tasks, copyright and quality processes of the production of the MOOC.

4.1 Main tasks and timeline

The kick-off meeting was in early March 2021, when the MOOC structure was defined. The two major goals were to begin the video production phase in late July 2021 and to finish the entire MOOC in January 2022, in order to begin the lessons at the end of February 2022. Six different modules were identified, each one divided into five items, spanning from introductory topics to more advanced technical ones. To structure the overall work, a table of contents for each item was proposed in April 2021. Based on this defined structure, the production of the presentations and scripts of all modules was carried out during May and June 2021. A common template was used to maintain a homogeneous look and feel throughout the entire MOOC, always

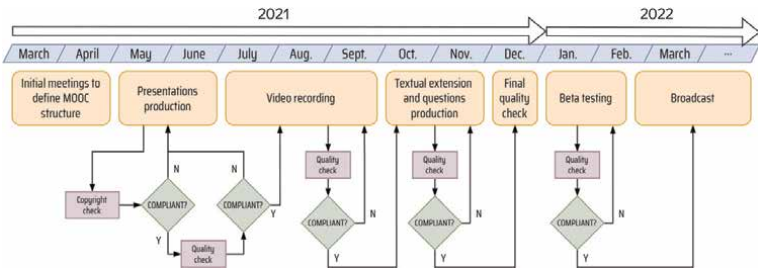


Figure 4. Overview of the production timeline, involved tasks and copyright and quality steps of the MOOC production.

taking into account the requirement that the MOOC was going to be provided utilising the *edX* platform. Therefore, bearing this in mind, we focused on having as less text as possible in the videos, in order to keep an adequate level of attention from the viewers. Also, a great number of illustrations (both images and schematics) were used to take advantage of visual learning, since many of the videos were expected to be visualised utilising small screens such as those present in smartphones and tablets. In the end, this phase has proven to be the most challenging one, both in terms of research and time. Since the maximum duration for each video was set to 7 minutes, the use of written scripts became essential to ensure that we would comply with this limitation. This fact also forced the authors to be as efficient as possible in the content formatting to try to add as much clear information as possible in the little time that was available.

The videos were recorded during June, July and September 2021, supported by the previously created presentations and scripts. Among the parties involved, only the UC3M had the required facilities for multimedia production (i.e. filming and video production) and the best way to have a centralised quality control was to record all the videos at the UC3M premises. This was done using a small subset of the authors that were in charge of the recording process. This subset was made of both instructors and speakers. The filming process took about 3 months in total.

Apart from the video, a textual extension as extra studying material was provided, in which more information than that available in the videos was offered as optional. This allowed the authors to better explain some concepts that might not be clear only from the videos. The starting points for the textual extensions were the previously written scripts utilised for the video recording process. As stated before, some particularly complex topics were further extended to provide a more complete picture. In order to provide an homogeneous result, a common template was used for all the textual extensions. The textual extensions were created in October and November 2021.

The evaluation questions were created in parallel to the creation of the textual extensions, during the months of October and November 2021. Two different evaluation phases were defined: a test related to each item and a more general test for the entire module. The item-wise test contained six questions and a starting point topic (including references) to be used for general discussion purposes. The module-wise test featured 10 questions about any item included in the module. Both the item and module tests featured different test modalities, such as true/false, multiple-choice, drag and drop and numerical response, to avoid them becoming too uniform and tedious.

All these three previously described steps (video recording, textual extensions and evaluation) were supported by an active involvement of the UC3M audiovisual team. This interaction ensured that a high-quality product was developed, always taking into account the particularities of the *edX* platform, as we will further detail in a following subsection. This quality assurance process was performed in December 2021 and served to correct any issues and to ensure a proper quality of the contents and resources produced.

Besides, a forum discussion was proposed in each item to motivate the active participation of all the students of the MOOC, which is something that the *edX* platform regards as useful. The audiovisual team at UC3M took care of the upload process of the contents, adapting them to the specific format required by *edX*. Every time that the content of a full week was uploaded to the platform, the beta testing process was carried out for each of the content in that week. This beta testing was the last step, and it was performed in January and February 2022. **Figure 4** shows the

general timeline of the MOOC, where one can see the steps of copyright check and quality check in different parts of the production, where there was an active involvement of the authors and the UC3M audiovisual team.

4.2 Organisation and creation of the study material

As previously stated, the content of the MOOC was divided into six modules, each with five items:

- Module 1 – ‘Ultra-dense networks and small cells’ introduces to the audience the concept of ultra-dense network, the 5G paradigm, the new scenarios foreseen as well as innovative applications. Besides, it introduces the emerging technologies for 5G that are key to its development and will be explained in the course.
- Module 2 – ‘New transmission technologies’ focuses on the physical layer transmission technologies such as massive MIMO, beam forming and full-duplex technologies, as well as VLC. These technologies are key to physically support the transmission and reception of signals to ensure the required 5G performance.
- Module 3 – ‘Interference management and energy efficiency’ presents scheduling mechanisms for the use of the wireless resources, the cell-free paradigm, which has implications in both physical and MAC layers, and approaches for energy efficiency, which is becoming increasingly critical in a world where energy is a scarce resource.
- Module 4 – ‘Spectrum sharing and carrier aggregation’ introduces the fundamentals of Carrier Aggregation (CA), the coexistence of small cells and Low Power Wide Area Networks and architectures for spectrum sharing.
- Module 5 – ‘Use cases and prototyping’ presents some testbeds and their importance to validate the theoretical developments in real scenarios, the privacy issue in communications, which is critical given the sharing of more data, and some insights about augmented and virtual reality applications (AR/VR) and immersive media rendering.
- Module 6 – ‘The future ahead’ introduces the emerging technologies that are getting an increased interest for the future 6G generation, such as RADCOM, THz communications, extreme massive MIMO, etc. This module also provides with an early discussion about what the authors think 6G will be, and the experience of the TeamUp5G ETN is also summarised.

The content for each of the items was created by the ESRs and supervisors within the TeamUp5G ETN following an iterative process of planning, development and checking. Besides, it is important to highlight that TeamUp5G members were spread all over Europe, which together with the pandemic situation originated by COVID-19, highly limited the in-person planning and brainstorming events for the MOOC development. This meant that almost all the content creation process was carried out online, mainly with email exchanges and teleconference meetings, which led to a more strict and tight planning of the meetings and deadlines to ensure proper adjustment to the overall timeline.

After defining the MOOC structure and recording capabilities (i.e. facilities and human resources), the specific content of each item was discussed between the members of each module, targeting coherence and avoiding content overlap between items. This discussion was a nice experience that allowed ESRs and supervisors to share knowledge and find ideas for networking. The next step was the writing of the main ideas for the script of the video and the initial structure of the items. Each item had been assigned a set of creators (both ESRs with their respective supervisors) and a set of checkers (other ESRs and supervisors). This avoided the typical problem of creator's blindness, in which the creators of something do not see the faults in their creation. The first step of initial content creation was done by the ESRs and reviewed by their supervisors for each of the modules, and feedback was given to the researchers in charge of the items. The second step was done by the other set of ESRs and supervisors to validate the content from the point of view of a not so expert audience. In this second step, the audiovisual team of the UC3M was involved in order to check for image quality/copyright issues and unclear descriptions. The initial iteration of this process identified several issues such as the heterogeneity of the slideshows (e.g. design, animations, fonts and number of slides) and the use of images with poor quality or subject to copyright. Many of the original images were conceived to be used in a conventional classroom during teaching activities, so they did not fulfil the required quality for a MOOC. Consequently, in a second iteration, a slideshow/video template and specific strict guidelines were provided for the content creation, which ensured homogeneity between items. When the slideshows and scripts were ready, the video recording process started, which led to the production team to provide specific guidelines for recording, but induced changes in the already approved slideshows. Some of the main issues found were the use of a large amount of text in the slideshows. Replacing it with illustrations was challenging because of the copyright compliance, explained in the next section. The videos were ensured to not exceed the 7-minute timing constraint and achieved the required presentation quality.

4.3 Copyright compliance

Any useful lecture requires well-designed illustrations to provide useful and complementary visual information to the explained topic. Public and massive lectures as those in a MOOC not only require the quality and suitability of the selected illustrations to be high, but also to ensure that all of them, with no exception, are copyright compliant. The selection process is more complex, as the content creators not only need to find or produce high-quality illustrations but ensure only the ones with appropriate licencing are selected. We mainly used the following sources: commercial or licence-free online repositories, proprietary academic or industrial resources and original illustrations by the MOOC contributors. This process led to some delays and repetitions since in the initial steps, for simplicity, the authors tend to utilise the resources that are already available from previous works. Unfortunately, since these works are either published papers or lectures' materials, they cannot be used since they would result in copyright non-compliance.

Even though all the processes in the MOOC creation were performed cautiously to ensure copyright compliance given the aforementioned requirements, all the illustrations and images that were included in the developed resources (presentations and textual extensions mainly) were double checked by the UC3M audiovisual team which had access to special-purpose copyright validation tools and was able to validate each resource's licence individually. This process resulted, once again, in an iterative

production between the creators (ESRs and supervisors) and the validators (UC3M audiovisual team).

4.4 Contribution from the non-academic sector

The TeamUp5G consortium involves multiple non-academic partners (mainly private companies) which contributed with their expertise to give a more practical approach to the MOOC:

- **Nokia Bell Labs:** the team from Madrid is focused on the study of the most relevant use cases for 5G and beyond ecosystems. Their research is focused on immersive media offloading and industry 4.0. With their expertise, they have produced or revised the lectures related to the description and analysis of 5G use cases. Therefore, they actively participated in the development of Modules 1, 5 and 6.
- **PDMFC:** a Portuguese company with the goal of providing solutions in areas such as digital transformation, big data, cloud or security. The contributing team of PDMFC has actively contributed also to the Modules 1, 5 and 6. More concretely, they have developed the items related to network security and how it can be improved with the use of machine learning techniques.
- **IS-Wireless:** a Polish company that targets software-defined 4G and 5G deployments, with a strong presence in the Open RAN community. Its knowledge has been gathered in the items related to cell-free communications, while they have also supported the development of Modules 1, 2, 3 and 6.

4.5 Quality assurance

A successful MOOC requires a high-quality content with updated and relevant topics, which have to be adequately explained. They also have to be up to date and have to give a professional appearance. For this reason, we have followed a multi-layer quality assurance approach. The first quality check came from the authors themselves: we strongly encouraged all the authors to make a huge effort to produce high-quality content with the goal of reducing the overhead from successive quality checks. Most of the authors were PhD students, and the research also served them as a learning process to produce content for their PhD papers and theses.

Consequently, the second checking layer consisted in their direct supervisors, which had a crucial role in the development of the MOOC given their extensive experience in the production of learning materials and teaching. To add an additional layer for quality checking, we used a peer-to-peer approach, in which the authors and contributors had to check other contributors' work. As stated before, this step ensured that the creator's blindness problem was avoided, which occurs when a creator of a certain piece of art or content cannot see the deficiencies in his or her own creation. In every production step, each author had to review at least two contributions from other authors, which brought a proper balance between the effort performed by the reviewers and a good diversity of opinions.

Lastly, the UC3M audiovisual team, given their extensive expertise in editing, reviewing and uploading MOOC contents, was in charge of performing an appearance and sound quality assurance to check the videos and textual extensions were clearly

presented so that the audience would not have any trouble in understanding the content.

We believe this process has helped us streamlining the production of the MOOC while ensuring high-quality standards. Finally, all the content was checked by the production team, who was in charge of evaluating the quality from the audiovisual point of view. Each of the mentioned layers involved several iterations: feedback was given, and new versions were produced. Quality assurance requires the available time and effort of all participants, and in this MOOC we have committed ourselves to both of them. The quality assurance process has been beneficial for the ESRs in their training as researcher guaranteeing in their future research fairness and quality policies.

5. Experience

After the MOOC was uploaded to *edX*, we carried out a beta-testing process, in order to find possible deficiencies. The aim was to guarantee the desired quality in contents and learning activities before launching the MOOC. A total of 2 weeks was allocated to this process. The work was divided among the beta-testers, with at least three beta testers (two ESRs and one supervisor) per module, to ensure enough people to review each module. After feedback information was provided, any identified issues were corrected.

5.1 Publicising

The MOOC has been broadcast in two editions, specifically in February and September 2022. In both editions, a strong publicising campaign started 3 months before the broadcast. The advertising was mainly conducted using the social networks of TeamUp5G. Moreover, the particular networks of every researcher of the project were also used to advertise the MOOC. Specialised mailing lists, such as that of the IEEE Communications Society, were used to announce the broadcast date. The MOOC was advertised in each outreach event where the TeamUp5G members participated. To illustrate the effort on dissemination, after the first edition, the experience gained in the creation and production of the MOOC was shared in the 31st Annual Conference of the European Association for Education in Electrical and Information Engineering (EAEIE) [19] held at the end of June 2022. Other researchers that participated in the conference were interested in the work done and offered themselves to publicise the MOOC to their students at their respective universities. As an example, the second edition has been also announced by colleagues at the Technical University in Prague in the Techpedia repository [20].

5.2 Enrolment

The enrolment started 3 months before the broadcast in parallel with the communication campaign. **Figure 5** illustrates the evolution of the enrolment process for the first edition of the MOOC. A total of 144 students was enrolled at the start date of the first broadcast. After 6 weeks of the course broadcast, on April 2022, 232 students were enrolled. Yet, a verified certificate for the completion of the course was requested by 12 students. These latter students had to take an extra exam in order to obtain their certificates. The remaining participants are considered as listeners although they can benefit from all the course materials and can take the tests of each module. It must be

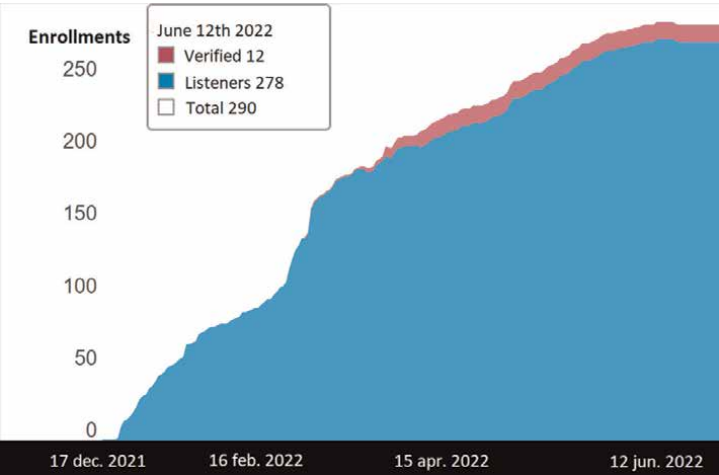


Figure 5.
Daily enrolment in the first edition of the MOOC.

pointed out that it is common for massive online courses to have a high percentage of students that attend as simple listeners for the sake of acquiring knowledge.

Since at the end of the broadcast all materials remain available, more students continued to enrol until the middle of June. The only limitation to the students that were enrolled towards the end of the broadcast period is that they were no longer eligible for an official course certificate. Finally, a total of 290 students was enrolled on 12th June 2022.

The broadcast of the second edition of the MOOC started on 13th September 2022, and currently continues. At the start of the second broadcast, 102 students were enrolled. This number has increased to 125 students a month later. It should be noted that the enrolment of this edition exhibits a similar behaviour than the first one.

Figure 6 shows the education level of the enrolled students of the first edition. It can be noted that 35% holds a university bachelor's degree while 54% has a higher

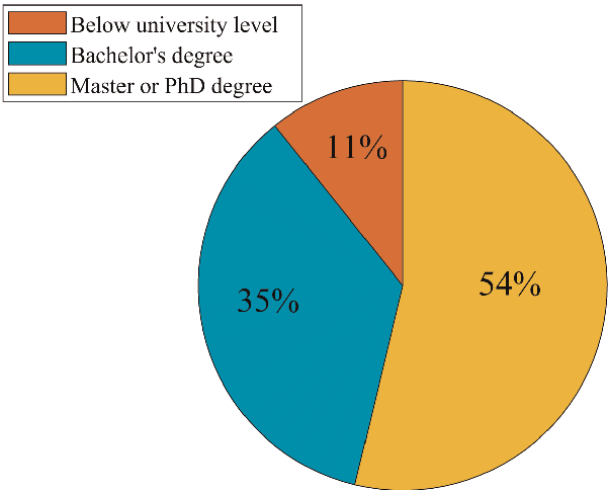


Figure 6.
Level of education of the enrolled students in the first edition of the MOOC.

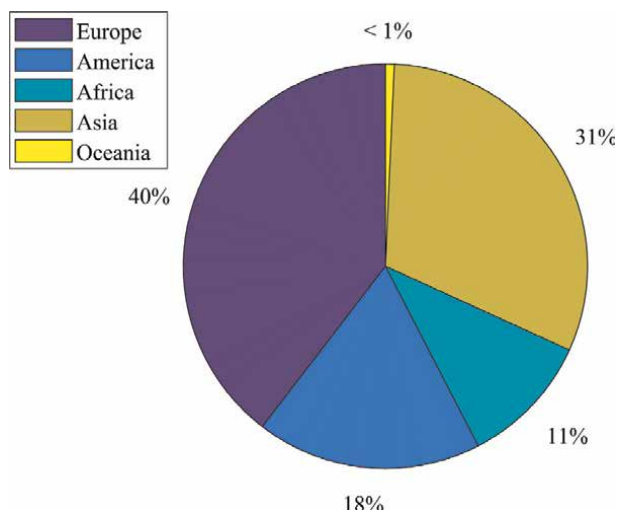


Figure 7.
 Geographic distribution of the enrolled students in the first edition of the MOOC.

university degree which includes students who have finalised the master or PhD degrees. Inside this percentage of 54%, the most representative figure, with 40% of the total, corresponds with students who have completed a master's degree and are probably pursuing their PhD now. This figure shows that the audience of the course requires a high level of academic education. In the case of the second edition, a similar behaviour is found, where 45% holds a master or PhD degree. These results match with the target audience foreseen during the preparation of the MOOC.

On the students' region of origin, the first edition of the MOOC reached a wide geographic distribution. More than 65 countries had at least one student enrolled in the course. In particular, Spain is the country with the highest number of students enrolled with a 15.6% of the total. **Figure 7** shows the geographic distribution divided by continents. We noted that the most representative continent is Europe with 40%, where the countries with more participants are Spain, Portugal (5.7%), United Kingdom (3.9%), Germany (3.9%) and France (2.8%). In Asia, the country with the highest number of enrolments is India, with 8.5% of the total, followed by Pakistan (3.9%). With respect to America, the United States represents the country with the highest participation, with 8.5% of the total (same as India), followed by Brazil and Canada (3.2% each).

5.3 Interactive discussion

To ensure extra support for the learning activities, a discussion forum where students could share their concerns was set up. Two ESRs were actively involved in the forum to answer questions and ensure that no inappropriate messages were posted. An active participation among students was achieved and supported by the two above-mentioned ESRs, with positive feedback. We observed that two main types of questions were posted. First, administrative questions mainly related to how a valid course certificate could be obtained. Also, two students expressed their concerns with a specific video. Their main comments were associated with the fact that the content amount was high, and it was difficult for them to understand the explanations.

Therefore, this video has been corrected for the second edition of the MOOC in accordance with the student's comments. The second type of question is associated with more technical issues. Students expressed interest in learning more about MIMO systems, which are one of the enabling technologies for 5G. Besides, systems operating on millimetre waves aroused a lot of interest. The two ERSs in charge cleared all the doubts and also suggested additional bibliographic material where the students could expand their knowledge.

6. Challenges and Leassons learned

The primary challenge for MOOC is avoiding the lack of continuous engagement, exemplified by cases of high dropout rate [21]. To understand why the dropout happens, it is vital to understand who is using the MOOC and their purpose. Do the ones who are signing up do really they realise what is their objective? Or do they have doubts? The research specifies that most students join MOOCs for four important reasons: address personal challenges, gain qualifications, develop/advance their knowledge in the specific area of interest and curiosity about MOOCs. Data from [21, 22], which correspond to the Harvard and MIT's first 16 *edX* MOOCs, show that the dropout rate in the first week happens to be 50%. Among them, most of the students are male with median 24 years old. The main factor about dropping is either external pressures, such as life events, or internal factors. Additionally, the dropping contribution factor is directly dependent on the quality of MOOCs, complex content from the level of the students and lack of direct personal support to the students.

MOOC planning is also a crucial task. From the beginning, it is challenging to have a well-defined structure for the content (e.g. main technological innovations and new 5G mobile networks applications that arise from the TeamUp5G MSCA ITN/ETN), identification of the key learning outcomes (e.g. understanding, designing and optimising the 5G heterogeneous small cell and cell-free ultra-dense networks, whilst covering several topics mainly related to 5G phase 2) and underlying available resources for its production (e.g. in campus Audio/Video facilities of UC3M).

The deadlines for the production, detailed reviewing process and acceptance of the content, with the expected quality-check procedures, should be appropriately scheduled. Active cooperation among all authors of the MOOC is essential and periodic monitoring ensures that there are no communication issues or doubts on the producers.

One of the main problems we had was, sometimes, miscommunication between the coordinators and the content producers. Some producers felt that the indications from the coordinators were not clear or changed as the MOOC progressed. This caused that the content initially produced was not of the expected quality, which caused delays in several tasks. In addition, sometimes the performed monitoring was not incisive enough which also caused the delay in the delivery of the content.

We have learned that, in general, although many of the MOOC producers were not initially aware of the high amount of work required to create high-quality content that meets the expectations of a well-prepared audience, they all agree that it has been a rewarding learning experience.

Working with a very diverse team across Europe also brought challenges to the production organisers, due to several reasons. It was necessary to coordinate a team of more than 20 people and the involved people came from a very diverse set of backgrounds. One of the main problems found by the organisers was a weak commitment

from some producers. While some of them did not meet the deadlines, other ones did not read the indications given by the organisers, resulting in weird contributions firstly submitted by some producers, whose quality was not sufficient (and resulted in additional iterations to ensure sufficient quality).

The lessons learned are basically two-fold: the communication between the producers and the organisers should be improved to avoid possible mishaps in the production process, and the commitment from producers should be ensured from the beginning, until the end, to avoid possible inefficiencies in the production.

To meet their own individual expectations, the MOOC creators must focus on high-quality course contents, excelling in the presentation style, while timely delivering the lectures, with appropriate course content assessment. The student's satisfaction can then be achieved and encouraged for further enrolment in other courses, after completing the current course.

Finally, the COVID-19 was also a challenge because it imposed some restrictions to mobility and recording that constrained the initial planning. However, with dynamic planning and some flexibility, we managed to record every video and material properly.

7. Conclusions

The production of a MOOC involves a great amount of work, time and effort. The most complex task was not only the production of the content itself, but also the coordination of the producers and supervisors. More than 20 people from five different countries have been involved in the production of this MOOC and all the work has been carried out online. Therefore, although our project is composed of great professionals, there were some coordination and miscommunication problems between the supervisors and the content producers causing some delays. Besides, the resources to guarantee the recording quality were available at the UC3M premises in Madrid. Hence, some items were not recorded by the authors but by producers residing in Madrid. All these coordination issues implied that efforts had to be doubled to achieve a high-quality outcome.

Another important conclusion is, as drawn in this chapter, that MOOC can be used as an innovative training method providing tools and resources for the PhD students very valuable and useful in their future careers. In this sense, this experience has been quite positive. Besides, the coordination among the different parts and actors in the research in international groups or projects has been improved thanks to the production of the MOOC, thus this is another advantage of using MOOC as additional tool.

Regarding the dissemination of the research and TeamUp5G activities, the MOOC has been also very valuable. Along with the publications in journal or specialised conferences, the dissemination provided by the MOOC to a more general although technical people is important making visible the project, the institutions and the topic and solutions.

To conclude, the MOOC on 'Ultra-dense Networks for 5G and its Evolution' has been presented. We have addressed the objectives, the resources that were available, the production of the MOOC itself and its broadcast experience. Although there have been some challenges during content creation and recording, lessons have been learned and important conclusions have been drawn to improve future MOOC recordings, such as a correct content design, appropriate time scheduling, organisation of the tasks and people responsible for them or strict quality control, among others.

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Conflict of interest

The authors declare no conflict of interest.

Abbreviations

DSP	Digital Signal Processing
ESR	Early-Stage Researcher
ETN	Educational and Training Network
IoT	Internet of Things
ITN	Innovative Training Network
MSCA	Marie Skłodowska-Curie Action
MOOC	Massive Open Online Course
RADCOM	simultaneous RADar and COMmunications
SPOOC	Self-Paced Open Online Course
SPOC	Small Private Online Course
UAV	Unmanned Aerial Vehicles
UC3M	Universidad Carlos III de Madrid
VLC	Visible Light Communications

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Perspective Chapter: MOOC – A Decade Later! What Is the Current Situation in Teacher Education?

Bruno Gonçalves and Vítor Gonçalves

Abstract

The growth of distance education, even if in emergency modalities such as those compelled by the pandemic context in which we live in the last 3 years, seems to have potentiated a second massification of the use of MOOC. In this sense, it looks important to us to make research on the current status of these courses, namely, regarding their adoption in the continuing education of teachers. The study was based on a survey of the MOOCs carried out in the context of in-service teacher training in Portugal. The exploratory research focused only on the last 3 years—which involved the pandemic. The information was collected in the NAU platform, but also by searching for keywords in the search engines of MOOCs carried out in the field of teacher training. This way it will be possible to understand, in a more concrete and deeper way, the impact of this technology on teacher training in Portugal and the contribution it can make to improve the quality of the teacher training.

Keywords: continuing education, digital technologies, higher education teachers, MOOC, online learning

1. Introduction

Massive Open Online Courses (MOOC) seem to be, on the one hand, a very useful distance learning modality in the training of citizens in their different professional areas and, on the other hand, in the training and education of students in the different study cycles. In this sense, MOOCs present themselves as a useful and appropriate tool for the training of individuals or groups of learners, namely, through the development of their knowledge and skills supported by technology. One of the groups that seem to use this distance learning modality seems to be teachers, as part of their continuing education, but also as a contribution to the teaching and learning of their students. The use of MOOCs both in teacher training and in teaching must do, among others, with the ease of access to information, flexibility, use of technology and dynamization of the teaching-learning processes. On this basis, MOOCs “are a continuation of the trend in innovation, experimentation, and the use of technology initiated by distance and online education to provide massive learning opportunities” [1]. Littlejohn [2] states that a MOOC can be defined as a course

that targets large-scale, networked interactive participation. Thus, a MOOC can be considered to provide open access, based on a distance education model, promoting large-scale interactive participation [3] and can be one of the most versatile ways to provide quality education, especially for those residing in distant or disadvantaged regions [4].

MOOCs are free online courses available for anyone to enroll in that provide an affordable and flexible way to learn new content and acquire or improve new skills, advance your career, and deliver quality educational experiences at scale. In the next section, we seek to address in more depth the concepts surrounding MOOCs as a way for the reader to get a good understanding of the dynamics surrounding this online learning modality. However, before moving on to the next section, we would like to remind you that through this research we intend to conduct a survey on the current status of MOOCs in the continuing education of teachers. To do so and after explaining it in the methodological section, we will collect information from the NAU platform (an online project and platform, pioneering at the Portuguese national level, to support education and training, aimed at large audiences), but also by searching for keywords in the search engines of MOOCs carried out in the field of teacher training. In this way, we seek to understand not only the impact of this technology in education in Portugal, but also the contribution it can provide to improve the quality of the training teacher.

2. Massive open online courses: Concept review

The following section is fundamental to understanding the technological and pedagogical characteristics surrounding MOOCs. We present those that seem to be the most important for a general understanding of the dynamics of MOOCs.

2.1 Evolution of MOOC

In 2008, George Siemens and Stephen Downes published the first MOOC called Connectivism and Connectivist Knowledge as an open online course. Although the number of participants was just over 2300, Siemens was not exactly interested in scale, but in connections. The term MOOC was created in 2008 by Dave Cormier at the University of Prince Edward Island and Bryan Alexander of the National Institute for Technology in Liberal Education. Although the MOOCs appeared in 2008, it is worth mentioning that only in 2012 were multiple investments made in MOOC projects, allowing the courses to acquire scale and notoriety. Since 2012, all over the world, thousands of courses have emerged, supported by different platforms, and, currently, it is impossible to identify all existing MOOCs. In fact, there are thousands of MOOCs, distributed all over the world and promoted by different companies and educational institutions, public and private, or even by any individual citizen. They understand all areas of knowledge and languages and are open to all types of interested parties, so it would be unfeasible to attempt to carry out the respective task. However, we identified Cognitive Class, Coursera, Edx, FutureLearn, Iversity, Khan Academy, Myriad X, Udacity, Udemy, and Saylor as the best-known MOOC platforms. Each of these tools is unique, with its own characteristics and very specific functionalities. The technology varies from platform to platform. It is naturally up to each course creator and potential students to choose the platform that best serves their knowledge needs.

In Portugal, the first MOOC appeared in 2012, namely: The First MOOC in Portuguese, developed by João Mattar (Brazil) and Paulo Simões (Portugal) and launched simultaneously in Portugal and Brazil; Bullying in a school context: characterization and intervention, which was aimed at educators and teachers of non-tertiary education and was created by the ICT Competence Center of the School of Education of Santarém (Portugal).

In 2013, we highlight the initiative promoted by the European Commission, which resulted in the launch of the first pan-European university MOOC, which allowed Universidade Aberta (Portugal) to join it. However, the institution “went a step further than its partners and developed a specific pedagogical model for massive open online courses, thus becoming the first university in the world to do so—the iMOOC model” [5], which will be discussed further in this chapter. The iMOOC model: “the model is patented and is composed of a set of standardized pedagogical practices extended to the whole institution, each one dedicated to a type of study cycle or training level” ([6], p. 7). It is worth mentioning that “this initiative marks the pioneering design of the first institutional pedagogical model for MOOCs” ([6], p. 7). The MOOC promoted by Open University is designed based on the four pillars of the institution’s Virtual Pedagogical Model (VPM), namely student-centred learning, flexibility, interaction, and digital inclusion: “The model also articulates flexibility with the pace needed to help students accomplish tasks in the face of the pressure of their daily commitments” ([6], p. 7).

Currently, in Portugal, there are already several institutions offering MOOC courses, from public and private higher education institutions, namely, universities and polytechnics. In addition to these that offer MOOC courses essentially at the level of educational offerings, there are also MOOCs offered in the context of teacher training, among which are the Ministry of Education, Directorate-General of Education, ICT Competence Centers, Scientific-Pedagogical Council of Continuing Education and the Directorate-General of School Establishments. It is also important to note that organizations, namely companies, are turning to the training of their staff through online courses, including MOOCs. This position of companies seems to facilitate the continuous training of these professionals, making it more flexible, dynamic, and innovative.

Before we address the main features of this genre of courses, it is important to talk about what MOOCs are and what their main goals are in the online education market.

2.2 Concept of MOOC

Analyzing the concepts underlying the acronym MOOC: Massive—represents the scope and geographical breadth that this genre of courses has, as they allow a large number of participants to enroll. It refers to the possibility of expanding the course in terms of the number of students [7]; Open—these are courses open to any type of participant and represent the democratization of knowledge, without any kind of restriction either in economic terms or even in terms of prerequisites; Online—available in real time, 24 hours a day, as long as you have a web connection; Course—refers to the course format, which encompasses technology, pedagogy and content. In other words, they serve as knowledge platforms for any individual who anytime, anywhere wishes to learn, which makes them a powerful and emerging learning strategy with repercussions in both educational and technological areas. According to Siemens [1], MOOCs “are a continuation of the trend in innovation, experimentation, and the use of technology initiated by distance and online education to provide learning opportunities on a massive scale” ([1], p. 5). MOOCs must innovate and create new

trends such as the use of non-traditional textbooks such as graphic novels to increase students' attention levels [8]. Jansen and Schuwer [9] states that "MOOCs are courses designed for large numbers of participants, that can be accessed by anyone anywhere as long as they have an internet connection, are open to everyone without entry qualifications, and offer a full/complete course experience online for free" (p. 11). Littlejohn [2] states that a MOOC can be defined as a course that targets large-scale, networked interactive participation. Thus, a MOOC can be considered to provide open access, based on a distance education model, promoting large-scale interactive participation [3] and can be one of the most versatile ways to provide quality education, especially for those residing in distant or disadvantaged regions [4]. There are many renowned authors and experts in the field who talk about MOOC [10–30], however, although there are different positions, the literature is consensual that MOOCs are a rapidly expanding technology based on the connectivist learning theory and consist of courses, in principle open and free of charge, which allows a large number of participants to enroll. Although MOOCs have an informal nature, they seem to contribute to the free acquisition of information and to equality in knowledge, since they promote access to quality content at a reduced cost, or even free of charge, depending, of course, on the type of courses one intends to attend.

2.3 Technical-pedagogical characteristics

The literature seems to agree that there are two major typologies of MOOC proposed by Downes [31], who designates the former as cMOOC and the latter as xMOOC [32]. Although the two typologies have common features, including content divided into weeks and the high number of participants, the main differences seem to result from the role of teachers and participants in the MOOC and the way learning is carried out. cMOOCs are based on a collaborative methodology and "are structured from self-organized learning, centered on gaining meaning through community experience, using participation tools such as blogs, RSS feeds, and other decentralized methods" ([33], p. 66). They are context-centred and correspond to a connectivist perspective in which George Siemens, Stephen Downes, Jim Groom, Dave Cormier, Alan Levine, Wendy Drexler, Inge de Waard, Ray Schroeder, David Wiley, Alec Couros, among others, have been involved since 2008: The "c" represents the connectivist MOOCs. The cMOOCs were the first MOOCs that emerged. These courses place emphasis on student knowledge creation, creativity, autonomy, and social and collaborative learning ([34], p. 4). The Connectivism and Connective Knowledge course (CCK08), Personal Learning Environments Networks and Knowledge (PLENK2010), MobiMOOC, EduMOOC, Change11, Digital Storytelling (DS106) and Learning Analytics and Knowledge (LAK12) are some examples of this type of courses.

Given that this typology follows the connectivist practices of student participation and self-direction, the pedagogical practices are considered to follow more specifically Downes's [35] four principles, namely:

- **Autonomy:** students could choose where, when, how, with whom and what to learn. In other words, it is related to the freedom to choose goals and content;
- **Diversity:** it allows for a sufficiently diverse population to avoid misinformation and closed-group thinking (heterogeneous groups). There is an incentive to engage in diverse readings, discussions, and environments, which allows for a wide spectrum of opinions, tools, and content;

- Degree of openness: encompasses all levels of participation, with no barriers between what/who is in or out. Such a characteristic ensures the free flow of information through the network and encourages a culture of sharing and a focus on knowledge creation;
- Interactivity: is what makes everything possible, with knowledge emerging as a result of interactions between the various participants.

The four principles proposed by Downes [35] influence each other in the sense that the diminution of any one of them weakens the quality of the teaching-learning process and, with it, the learning network itself—connectivism. In this sense, it is crucial that all principles are at the same level for the learning process to run smoothly.

According to Figueiredo [36], the main benefits and limitations of cMOOCs are also highlighted. In the benefits, the author suggests that the technology is exploratory, disruptive, deconstructive, incubating and contextual:

- Exploratory: they follow an exploratory path, of trial-error-reflection cycles, closer to design practices than to traditional sciences. In complex and unpredictable social environments, this type of approach offers opportunities for emergence and collective creativity;
- Disruptive: an innovation is disruptive when it is born at the margins of traditional markets or social systems and asserts itself by gradually winning over customers who tolerate its initial imperfections and contribute to overcoming them;
- Deconstructive: to deconstruct is to question already installed ideas and thus conclude on whether they are still valid or whether they should be reformulated. In an environment like education, where the habit of questioning the big ideas is almost non-existent, cMOOCs have the merit of doing so;
- Incubators: they allow new practices to be developed, evolve and consolidate until they can be transposed to traditional contexts;
- Contextual: cMOOCs themselves are learning contexts, co-constructed and adapted by those who are learning. The same is not true of xMOOCs, which are predominantly content-centred.

The absence of a business model, the problematic accreditation, the reduced scalability, the difficulty in authenticating students and the high dropout rate are the main constraints of the cMOOCs [36]:

- Absence of a business model: there is no market, income and cost logic compatible with cMOOCs. Thus, for now, the sustainability of this type is based on economies of reputation;
- Problematic accreditation: the logic of complexity and large numbers that characterize the model conflicts with the reliable calculation of market value for each of the participants that complete a cMOOC. The compatibility between cMOOCs and reliable valuation is one of the model's most interesting problems;

- Reduced scalability: concerns pedagogical and assessment processes that take advantage of complex adaptive social systems, the laws of scale and, obviously, social networks to become applicable to large populations without requiring additional teaching resources;
- Difficulty in authenticating students: the eventual transposition of the cMOOC model to the market, as well as the adoption of accreditation bodies, justifies looking into reliable methods of authenticating participants;
- Dropout rate: a large number of participants who attend a cMOOC end up dropping out. However, it is important to note that even those who do not finish can derive great benefits from their participation.

The xMOOCs come from MIT/Stanford and are content-centred and more rigidly organized, limiting creativity. Thus, their activities are guided by the teacher who has the role of providing the supporting materials and directing the discussions. Participants can contribute by sharing content and ideas. xMOOCs are the most common MOOC model: “The “x” stands for commercial MOOCs, that is, those offered through commercial or semi-commercial platforms, such as Coursera, edX, and Udacity. These MOOCs are centred on viewing videos and completing short exam-type exercises ([34], p. 4).

xMOOCs follow an instructivist course design in which learning objectives are predefined by the instructor [2] and materials are designed and prepared in advance. Students watch video series (lectures), read recommended articles, and solve quizzes [37]. While Rodriguez [38, 39] considers that xMOOCs are based on cognitive-behavioral pedagogical practices, Conole [40] states that this typology mainly adopts a behaviorist learning approach. It is of interest to note that this model has received much criticism from connectivist authors Parr [41]. EdX, Coursera, Udacity and FutureLearn are some of the examples of xMOOC platforms [42, 43] that the following points are characterized.

In short, cMOOCs emphasize creation, creativity, autonomy, and social networked learning, emphasizing participation among their members. xMOOCs emphasize a more conventional learning approach through video presentations and short exercises and tests, with the teacher continuing to take a leading role. In cMOOCs, there is no rigid assessment process as is known in conventional institutions [44], as participants are encouraged to assess their progress and understanding through interaction among all. In xMOOCs, assessment follows instructional practices, relying on completing various questionnaires and completing projects.

Besides cMOOC and xMOOC there are other proposals for categorizing MOOCs in the literature, which are presented below.

- Network-based MOOCs are considered the original ones, that is, those taught by Alec Couros, George Siemens, Stephen Downes, and Dave Cormier. In this type of MOOC, “the goal is not so much content and skill acquisition, but dialogue, socially constructed knowledge, and exposure to the open web learning environment using distributed media” ([45], p. 35). The pedagogy of network-based MOOCs is grounded in connectivist methods.
- Task-based ones “emphasize skills by requiring the student to complete certain types of work” ([45], p. 35). Community is crucial, especially in terms of examples

and assistance, yet it is a secondary goal. The pedagogy of this type of MOOC, unlike network-based ones, is “task-supported and tends to be a mix of instructivism and constructivism, and traditional assessment is also difficult” ([45], p. 36).

- Content-based ones, supported by instructionalist pedagogy, have a high number “of enrollments, commercial prospects, renowned university professors, automated testing, and exposure in the popular press” ([45], p. 36). In this type of course, the acquisition of the content is fundamental, and the network or the completion of the activities are considered secondary aspects.

In addition to the previous MOOC categories, Clark [46] proposes a taxonomy based on the pedagogy adopted, namely ([46], pp. 6379–6380):

- TransferMOOC: are derived from other courses provided on virtual platforms, such as Coursera;
- MadeMOOC: consists of courses oriented towards innovation, problem-solving, work and peer review. An example of a platform that offers this type of course is Udacity;
- SynchMOOC: these have fixed start and end dates and have delimited certain periods of time either for the completion and presentation of work or for the evaluation of the same, such as, for example, Coursera and Udacity;
- AsynchMOOC: they can be attended anytime, anywhere and work best in different time zones. Coursera is an example of a platform that provides this type of courses;
- AdaptiveMOOC: based on dynamic assessment, these are courses geared towards personalized learning, such as Gogbooks;
- GroupMOOC: this type of course starts with a very small group of trainees, who are selected based on a set of criteria such as their previous skills. One example is the NovoEd platform;
- ConnectivistMOOC: these are courses inspired by the work of George Siemens and Stephen Downes and are supported by the connections established in the network. The autonomy of the participants is fostered through the sharing of knowledge. An example of this type of course is the Connectivism and Connective Knowledge Online Course (CCK08);
- MiniMOOC: short, very intensive courses with very clear and concrete objectives, such as Open Badges.

There are also other categories such as BOOC (Big Open Online Course), COOC (Community Open Online Course), DOCC (Distributed Online Collaborative Course), MOOR (Massive Open Online Research), POOC (Personalized Open Online Course), SMOC (Synchronous Massive Online Course), SPOC (Self-Paced Online Course), SPOC (Small Private Online Course), and MOOOC (Massive Online Open Ongoing Courses), among many others.

Naturally, each type of MOOC has its own characteristics, such as the type of content to be made available, the number of participants expected, the communication strategy adopted among peers and, especially, the pedagogical and technological model of each MOOC. In this sense, it is the responsibility of each educational institution, or each promoter, to choose the most appropriate model for each specific teaching-learning process.

2.4 MOOC planning and development

Based on the researchers' experience in creating courses in the MOOC modality, it is easily understood that the planning of an online course is always a fundamental factor that must involve a multidisciplinary team (with different specialities), especially in three central areas: technology, pedagogy, and content production. In the technological area, it is necessary to define the platform where the MOOC will be developed, as well as the tools that will be made available considering the digital skills of the target audience. In the area of pedagogy, it is important to define pedagogical strategies and methodologies suitable for implementing the teaching-learning process, which also involves planning and developing activities that are useful for boosting and innovating learning. In the area of content, it is necessary to consider the design and production of diversified and quality content (text, video, images, sound, among others) that contribute to the progress of students in the most diverse subjects.

According to Read and Covadonga [47], the planning of a MOOC should take into account:

- The acquisition of basic skills to use the necessary platforms or tools, by teachers and students;
- Reflection on how the contents and activities of the MOOC differ from the materials used in face-to-face courses;
- The large-scale interactions that MOOCs may require, as teachers will play a key role in course development;
- The analytical mechanisms are available for the analysis of learning and, preferably, the support combined with questionnaires for obtaining data and assessments.

Blanco et al. [48], Read and Covadonga [47] and Riedo et al. [49] summarize the aspects to be considered in the development of a MOOC, namely:

- Being aware of the responsibility of distributing training on a topic as specific as possible to a broad and differentiated audience;
- Highlight that the centre of learning is the learner and the teacher has the role of making content available, adapted to the MOOC format, and monitoring, guiding and interacting through discussion forums or other social tools
- Establish a duration generally between 25 and 125 hours;
- Take into account the different prerequisites and motivations;

- Structure the MOOC into four to eight modules, each with four to eight videos and other materials that motivate and challenge students;
- Avoid videos longer than 12 minutes, with the same topic having more than one;
- Offer content and other support materials in different formats;
- Prepare varied activities at different levels;
- Clarify which activities and tasks are mandatory and appropriately value those that allow validation of achievement;
- Be prepared to integrate different technologies suited to the specificities of the contents or the profile of the users.

According to Costa et al. [50], the team responsible for developing a MOOC course is responsible for the following tasks:

- Defines the target audience/audience for which the course is intended (general characteristics of the profile or profiles of the participants);
- Defines general learning goals;
- Lists and organizes the topics that will be worked on in the course;
- Clarifies the existence of prerequisites in terms of previous knowledge and/or skills;
- Explains the selected strategies and ways of organizing work;
- Explains the modalities of interaction, communication and collaboration;
- Explains the objectives and methods of evaluation chosen.

There is no single model for planning and developing a MOOC. However, from the authors' experience in designing this kind of course and supported by the literature, MOOC promoters should take into consideration the three major dimensions mentioned at the beginning of this section: technology, pedagogy, and content. Each of these dimensions is absolutely central in the planning and development processes of a MOOC, since the teaching-learning process nowadays can only be achieved through these three dimensions.

2.5 MOOC platforms

In this section, we present the six main existing MOOC platforms, taking into account the principles of the impact they have on education, but also the quality of the service provided to their users.

Coursera: Is one of the most popular MOOC platforms that offers hundreds of online courses taught by recognized educational institutions, in several languages. It offers many free courses, but also has paid classes or MOOCs that, although free,

require payment for official certification. Coursera partners with over 275 leading universities and companies to bring flexible online learning to individuals and organizations around the world. It also has more than 113 million students.

Udemy: This is a platform created by Eren Bali. This platform has more than 44 million students, 65,000 instructors, 183,000 courses, 594 million course enrollments, 75 languages, and 8600 corporate clients. Course content is quite varied and ranges from music theory and pet care to programming (from basic to advanced), data analysis, design, sales, and more. Some courses are free and others are paid, with or without certificates of completion. It is one of the solutions more available for any type of user who wants to offer a MOOC.

FutureLearn: With a wide range of paid and free online courses, FutureLearn stands out as one of the platforms with the largest offer of accredited diplomas. FutureLearn is based in the UK and owned by The Open University, a UK-based distance learning university. It has over 40 years of experience in distance and online university education.

Saylor: Uses accredited teachers to create free courses and use open educational resources in over 15 categories. Upon passing the final exam, participants can download a certificate of completion.

edX: with over 2500 online courses, edX covers over 30 academic fields, from medicine to design. Founded in 2012 by Harvard University and the Massachusetts Institute of Technology, this non-profit organization partner with top establishments around the world.

Khan Academy: is a non-profit organization founded by Salman Khan and has a mission to provide free, high-quality education for everyone, everywhere. It offers a free collection of videos on math, medicine and health, economics and finance, physics, chemistry, biology, computer science, and other subjects.

Each of the identified platforms has its own characteristics, namely principles and values, functionalities, and tools, among others. It is therefore up to each entity promoting a course or each trainee or student to choose the platform that is best suited, on the one hand, to the production and implementation of a course and, on the other hand, to the acquisition of knowledge and skills in the area of interest of those who sign up. Whatever the promoters' or students' decision, they must always consider three principles that seem central to us: (i) Knowledge of the greatest possible number of platforms through the exploration of their functionalities; (ii) The topics addressed in the course; (iii) The architecture of the course in the digital and pedagogical aspects. Knowing how to select the MOOC platform is half the battle for the success of the course and learning.

2.6 Process of evaluation, certification and accreditation of MOOCs

The process of student assessment in MOOC courses is not consensual in the literature and indeed should not be since each learning context is obviously unique. The platform created or adopted for the implementation of the MOOC, the digital tools used for communication, interaction and collaboration among peers and among teachers, the pedagogy adopted, the type of activities proposed, the type of content produced, the MOOC recipients, the social and economic context, the topics addressed, the type of training, the promoter, the objectives to be achieved with the implementation of the MOOC, among others, are absolutely central aspects that determine the evaluation model of MOOC. It is also important to mention that MOOCs are difficult to evaluate because there are no established evaluation criteria,

completion rates are low, there are many instructors and there are accessibility problems. Regarding specifically the dropout rate in MOOCs, “most students who enroll in a MOOC have no intention of completing the course, their intention is to explore, find out something about the content and immediately do something else” [51]. In this follow-up, Cairo [52] considers that the rate of participants who complete a MOOC is between 10% and 15%. Also [51] points out that the percentage of students who complete a MOOC is around 10%. Cisel and Bruillard [53], on the other hand, state that less than 10% of enrollees typically complete a course. In general, dropouts in MOOCs are associated with difficulties regarding the “level of autonomy required, the ability to deal with the technological environment adopted, as well as the persistent feeling, in some cases, about the absence of the physical presence of teachers and classmates” ([54], p. 3). Obviously, the dropout and the difficulty to control the inputs and outputs in a MOOC also conditions the evaluation process.

According to Explorance [55], there are four ways to evaluate a MOOC:

- By the process perspective: proposed by Stephen Downes this method to evaluate a MOOC is referred to as the ‘process perspective’ whereby the MOOC is evaluated by the criteria of successful networks (autonomy, diversity, openness, interactivity);
- Via the outcomes perspective: the second method that Downes proposes is the ‘outcomes perspective’. In this approach, MOOCs are evaluated as knowing systems; as entities which learn as a whole. MOOC effectiveness is then based on the system’s success and not on individual participant outcomes. Both of Downes’ approaches are very interesting and deserve more thought and exploration.
- By self-assessment:
- Some MOOCs are experimenting in using self-assessment to evaluate student progress. However, this type of evaluation only examines participant learning and not the quality of the course or the teaching approach. With MOOCs not establishing learning goals and with students creating their own, the evaluation process becomes even more complex. Another factor to consider is that relying solely on self-assessment can lead to inaccurate and unreliable results.

Clark [46] identifies a set of MOOC certification models (pp. 6380–6381):

- Absence of certification: no document is issued to certify attendance; participants attended only to acquire learning experience;
- Attendance and completion certificate: is awarded to all participants who complete the MOOC, in order to recognize their attendance in the respective course, however, no official accreditation is granted to them. In addition to Coursera, which awards this type of certificate, the ECOiMOOC model of the Open University (Portugal) stands out, in which the certification process involves the existence of a summative assessment, aimed at participants who wish to obtain a course completion certificate. However, participants must submit for evaluation at least two of the artifacts produced. In addition to this type of certificates, some MOOCs offer verified certificates [56, 57];

- **Certificate of mastery:** this type of certificate presents a grade, however, it is not considered as an official credit. One example is the courses promoted by EdX.
- **Distinction certificates:** institutions that want to assess the knowledge acquired by their students while attending their courses are provided, at a reduced cost, with sets of tests, as is the case with Udacity.
- **University credits:** an example of the accreditation process is also the ECOiMOOC, which offers the possibility for participants to request, after completing their learning, a formal accreditation by paying a certain amount. In this MOOC model, credits (ECTS) will be awarded after an evaluation.

Bergeron and Klinsky [58] warn of the complexity of MOOC accreditation, as does Auyeung [42], who states that MOOC providers fail in the accreditation process. Thus, there is still a low applicability rate on the part of Portuguese educational institutions, except for the Open University (Portugal) which, as previously mentioned, grants the accreditation of its MOOCs upon payment of a certain amount. Currently, there are already several platforms such as, for example, Coursera and NAU that offer courses with a certificate of completion. However, some courses have as prerequisites either the payment of a certain amount or a minimum grade to obtain them. Regarding accreditation, most courses are not accredited by the Scientific-Pedagogical Council for Continuous Training in Portugal. There is, therefore, a long way to go in these two matters—certification and accreditation, but especially in the latter. If MOOCs are accredited, they will certainly have more teacher participation and, consequently, greater digital training for teachers to improve their practices and innovate in the teaching-learning process. But many MOOCs have been used with considerable weight and importance in various continuing education courses or short courses.

3. Methodology

This section identifies and explains the main methodological options focusing on the research objectives, the characterization of the NAU platform, the data collection instruments, and the processes of processing and analysis of the data collected.

3.1 Research objectives and methodology adopted

This study is supported by exploratory and descriptive research. Exploratory insofar as researchers, supported by a set of pre-defined criteria, look for the MOOCs that have been carried out in the last 3 years within the scope of teacher training. Descriptive research because it allowed describing a phenomenon in its context, that is, understanding the recipients of each course, the objectives, the curricular structure, the evaluation, and the certification process, among other relevant aspects.

The research has three objectives:

1. Identify the MOOCs carried out in the last 3 years in the context of teacher training.
2. Determine the impact of MOOCs on teacher education in Portugal.

3. Understand the contribution of MOOCs to improving the quality of teacher education.

The first objective was achieved through a search for MOOCs on the NAU platform (www.nau.edu.pt/pt/) but also through a web search for the following set of keywords: MOOCs in the context of teacher training; MOOC courses for teachers; MOOC in the professional development of teachers. The search for keywords was carried out according to the following criteria:

- Type of websites: platforms offering MOOCs;
- Recipients: all teachers of all educational levels in Portugal, with the exception of higher education;
- Language: Portuguese.
- Time range: May 2019 to December 2022.

The research was carried out through the usual search engines, but also on the six main platforms promoting MOOC courses that were identified in the literature. Platforms like www.my-mooc.com and www.mooc-list.com that offer a list of MOOCs and free online courses were not ignored, and we tried to follow their news about these types of courses. The European Multiple MOOC Aggregator, called EMMA for short, was also used. It aims to setting excellence in innovative teaching methodologies and learning approaches through the large-scale piloting of MOOCs on different subjects.

3.2 Characterization of the NAU platform

The NAU platform (Online Teaching and Training for Large Audiences) is an online project and platform to support teaching and training, aimed at large audiences. It is a service developed and managed by the FCCN Unit of the Foundation for Science and Technology (FCT) that allows the creation of courses in MOOC format produced by recognized and relevant entities in society. One of these entities is the General Directorate of Education (GDE) which is a central service of the direct administration of the State responsible for implementing policies related to the pedagogical and didactic components of preschool education, basic and secondary education, and extra-curricular education.

It should be noted that NAU is part of the cross-cutting actions of the Portugal INCoDe.2030 initiative by promoting digital development, inclusion and digital literacy, education, and qualification of the active population.

NAU offers courses in several areas, such as exact sciences and technologies, training and education, health and life sciences, communication and marketing, economics and management, natural sciences and environment, social sciences, law, arts and culture and human and political. On the platform, MOOCs are categorized into three levels, namely: initial, intermediate, and advanced and are taught in Portuguese and English only. Most courses created are aimed at teachers—from preschool to secondary education—without excluding all other professionals working in schools, and all human resources in Education.

The courses are promoted by the following institutions: Directorate-General for Education, INA—National Institute of Administration, I.P, INCoDe.2030, MetaRed, CENJOR—Protocol Center for Professional Training for Journalists, Directorate-General for Health, National Center for Cybersecurity, Polytechnic Institute of Lisbon, General Secretariat for Education and Science and University of Évora. Any institution can apply for collaboration with the NAU and to do so must contact the respective entity. The process of producing a course on this platform is quick and simple and will always have the support of the NAU team.

3.3 Collection, processing and analysis of data

Data collection was based on participant observation, which allowed the identification of a set of MOOC courses within the scope of continuing teacher education. Data collection was carried out on the NAU platform but also on other MOOC platforms supported by a set of criteria previously established and presented earlier. Data were recorded in the investigator's diary according to previously defined parameters.

Data were recorded, processed and analyzed in Microsoft Excel through a set of previously established categories, namely: digital platform, promoting entity, course designation, target audience, number of hours and date of completion. While the quantitative analysis only sought to identify the existing MOOCs between 2019 and 2022 in the context of teacher training, the qualitative analysis (content analysis) sought to identify the themes of the MOOCs, learn about the certification process for these courses and determine the format of the course.

4. Discussion of results and conclusions

This section presents the results of research on the current status of these courses in continuing teacher education in Portugal. Based on the results, a reflection is made on the themes and the importance of greater use of this type of course in teacher training is also pointed out.

At the time of selecting this topic for carrying out this investigation, we immediately thought that, due to the pandemic, there would be many courses in MOOC modality aimed at the continuous training of teachers. And if there were not many, at least there would be a significant growth of MOOCs in teacher education. However, we are completely wrong, unfortunately! In fact, during the pandemic, there was a huge growth in the offer of online courses, some in e-learning format and others in MOOC format. However, the courses that were offered in the e-learning modality were more oriented towards teacher training and those that were offered in the MOOC typology were oriented towards all those interested in learning online. That is, during this investigation, it became clear that MOOCs were not the modality adopted for teacher training. Even after the pandemic, the market for online courses continues to grow, whether in e-learning, b-learning or MOOC, but there are still very few MOOCs for teacher training. It is difficult to understand the reasons why teacher training only takes place mainly in face-to-face, b-learning or e-learning. Incidentally, understanding these motives would certainly make a good research question for another study. The fact is that MOOCs are not the main modality of support for teacher training.

In Portugal, in addition to some higher education institutions and a few other entities that have already offered and still offer some MOOC courses within the scope of

teacher training, only NAU assumes the responsibility of offering this type of course. In the area of education and training, NAU partners with the Directorate-General for Education, the University Institute of Lisbon, the Foundation for Science and Technology, the Institute for Employment and Vocational Training, the University of Algarve, the University of Trás-os-Montes and Alto Douro, University of Évora, Porto Nursing School, Polytechnic Institute of Tomar, Open University, Polytechnic Institute of Leiria, Polytechnic Institute of Lisbon, Gaia Nascente—Training Center of Association of Schools, New University of Lisbon and the School Superior of Nursing in Lisbon. It should be noted that each of these partners offers, through the NAU platform, MOOC courses on various topics that were identified in the methodology section.

During the research, 16 MOOCs were found on the NAU platform. Some of these courses have 1 edition, others have 2 and still, others have 3 editions. In this sense, the total editions of the courses are 26, that is, 26 courses were promoted, between 30 May 2019 and 30 December 2022. levels of education (public and private), school directors, teacher training centre directors, librarian teachers, professional teaching teachers, among other professionals in the area of education and training, and also all those who are interested in the topics covered in each one of the MOOCs. It should be noted that the 16 courses available on the NAU platform were promoted by a single entity, in this case, the General Directorate of Education. Then, the MOOCs identified in the survey are highlighted: “E@d in Schools”—15 h (1 edition); “Collaborative Work with eTwinning: First Steps”—3 h (3 editions); “Prevention of online addictions in children and young people”—15 h (1st edition); “Bullying and Cyberbullying: Prevent & Act”—25 h (3 editions); “Technologies for Inclusion and Accessibility”—5 h (2 editions); “Will Artificial Intelligence Transform School?”—25 h (2 editions); “Collaborative work with eTwinning: Next Level”—15 h (1 edition); “Learning and School Communities”—25 h (1 edition); “Education for Sustainability”—39 hours (3 editions); “Inclusive Education”—25 h (2 editions); “Active Learning Scenarios”—25 h (2 editions); “Autonomy and Curriculum Flexibility”—30 h (1 edition); “CyberSecurity in Schools”—15 h (1 edition); “eTwinning MOOC”—3 h (1 edition); “Cooperative Learning Communities, Inclusion and Digital Environments”—25 h (1 edition); “Safeguard and protect children and young people in sport”—4 h (1 edition). As can be seen in the designation of each course, each one of them addresses a different theme. Each of these courses presents information about what will be learned, description of the course, format in which it will be taught, the necessary prerequisites to attend the MOOC, the evaluation and certification process and also the general plan of the course that, normally, appears divided by modules.

5. Impact of MOOC on teacher training

Throughout the development of this research, we were faced with a few surprises. One of them was clearly thinking that the pandemic and all the facts associated with it (confinements, social isolation, emergence of online education, technological evolution, among others) would clearly and unequivocally bring out the growth of MOOCs in education, especially in the context of continuing education of teachers. It seems that we were wrong! Online teaching has indeed grown a lot, obviously in quantity with the transposition of face-to-face teaching to online teaching, but also in quality. Quality because it was necessary to improve the technological infrastructure of

educational institutions, it was necessary to rethink pedagogical models for effective practice with technologies in online environments and to produce quality activities and digital content for students to assimilate the various knowledge. However, this increase in quality and quantity in online education does not seem, at least in the Portuguese case, to have occurred in MOOCs. In general, the teaching-learning processes took place through videoconferencing tools such as Zoom, Microsoft Teams, Google Hangouts, and Google Meet, among others. Thus, it is verified that the use of MOOCs before the pandemic period in education was not an option for the educational institutions, as it was during the pandemic period. Currently, according to the research and observations we had the opportunity to perform, they are still not an option for schools in the teaching-learning process. Although some may have used it, mainly to improve their knowledge and skills, there is no statistical significance in such a large universe of Portuguese educational institutions.

However, in the context of continuing teacher education, there seems to have been an evolution in the adoption of MOOCs. The investigation confirmed that the Directorate-General for Education, through the NAU platform, promoted 26 MOOC courses aimed at teacher training in the last 3 years. It is true that since 2017 the General Directorate of Education has been producing MOOCs, but it was only since mid-2019 that the NAU platform emerged having a proactive role in Portugal, which came to give a new look to the offer of MOOCs for teacher training. This shows that there is beginning to be an interest and perhaps an attraction for this type of distance learning modality on the part of institutions and teachers. However, there is still a long way to go, since most training continues to be offered in e-learning and/or b-learning modality, without support for any MOOC platform.

6. Contribution of MOOC in improving the quality of the training teacher

MOOCs also seem to make a rather important contribution to the realization of continuing teacher education. The results seem to indicate that this contribution is categorized on several levels that articulate and are indispensable to the implementation of useful training to improve teachers' practices: innovate in training, modernize and digitally empower teachers, enhance teachers' autonomy in carrying out tasks, promote flexibility in learning, democratize access to information, enhance the creation of learning communities, promote online socialization, involvement, sharing and collaboration among peers, encourage the design and production of digital content and innovate in the evaluation model of training. Teachers will be enriched if MOOCs are adopted as a support modality for the implementation of teacher training. In addition to the themes that teachers reflect, discuss and learn in online training, they also have the opportunity to acquire digital skills of various levels that will be useful not only for the implementation of MOOC training but also for digital innovation in the teaching-learning process and thus boost the process and motivate students to learn.

The technologies in teacher training and in the teaching-learning process are currently indispensable contribution and their role will always be to help in the planning, development and dissemination of knowledge and never the opposite.

Some institutions in Portugal, like the Polytechnic Institute of Bragança, are joining Learning Programs on Coursera to offer as soon as possible MOOCs to enhance curricula with world-class content and hands-on experiences; improve career readiness and prepare graduates with job-based learning; enable faculty with


supplementary content and promote blended learning; increase student capacity without increasing infrastructure costs; and attract new students with a stronger global reputation. Later these experiments may be replicated for teachers in non-higher education as well. If will result as a strategy, we must wait a couple of semesters to see if we feel changes and evaluate this new possible scenario.

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Perspective Chapter: MOOCS at Higher Education – Current State and Future Trends

Abdullah M. Mutawa

Abstract

MOOCs, which stands for “massive open online courses,” are a kind of distance learning that gives students from all over the world the opportunity to have access to education and training of a high standard even when they are not physically present in a classroom setting. They have the ability to challenge the paradigms that are currently used in education, therefore changing the roles that students, instructors, and institutions play in the process. They provide a technique of presenting educational content to a large number of learners that is both efficient and economical; they may be expanded to accommodate a large number of students, and they may be of assistance to teachers in the process of expanding their knowledge and abilities. In addition, massive open online courses (MOOCs) might assist institutions in expanding their student bodies and their global footprint. In this chapter, we will discuss the origins and development of massive open online courses (MOOCs), as well as the primary MOOC platforms, emerging MOOC trends, potential pitfalls, the future of MOOCs, and the integration of artificial intelligence (AI) into MOOCs.

Keywords: MOOCs, higher education, AI, MOOC growth, pandemic effect, personalized instructions, 4IR, XIR

1. Introduction

Massive Open Online Courses (MOOCs) are a kind of distance learning in which students from all over the globe may attend online courses from authorized universities and other educational organizations. MOOCs were started in 2008 and have since grown in popularity. MOOCs enable students to access high-quality education and training without physically attending a classroom. They are accessible to anybody with an internet connection, allowing students to study without regard for geography or cost.

MOOCs have transformed the way we learn and access information. These courses, provided by major colleges and educational institutions, have provided learners all over the globe with many educational options. Consequently, MOOCs can potentially disrupt established education paradigms while transforming the roles of students, teachers, and institutions.

MOOCs provide a cost-effective method for delivering high-quality educational information to many students. MOOCs may be scaled up to accommodate vast

numbers of learners without requiring a considerable increase in teachers since they do not need physical classrooms. One of the primary advantages of MOOCs is their scalability since students may access course content from anywhere in the globe and at any time. Furthermore, MOOCs enable learners to get information from experts and professionals worldwide, delivering a more holistic learning experience.

However, educators were concerned about the scalability of MOOCs, fearing that they might replace or disrupt the conventional paradigm of learning in a classroom environment. Fortunately, this concern has proved unjustified since MOOCs may be utilized to supplement and strengthen classroom learning. MOOCs may assist teachers in providing a more engaging learning experience for their students while also enabling them to concentrate on the more interactive components of teaching.

Furthermore, using MOOCs may aid in transforming faculty members' roles in higher education. MOOCs can make faculty members more effective by providing access to the most up-to-date educational material and technology. Furthermore, MOOCs may assist faculty members in developing their skills and expertise, enabling them to become more confident and engaging lecturers. MOOCs may also aid in transforming institutions' roles in higher education. MOOCs may assist universities to attract more students and create a worldwide presence by giving access to high-quality educational material and technology. Furthermore, MOOCs may help universities stay competitive by giving students access to cutting-edge instructional material and resources.

MOOCs have the ability to transform the way we access and learn. MOOCs may assist in altering the roles of students, faculty members, and institutions by providing learners with access to high-quality educational information from anywhere globally. As the usage of MOOCs grows, probably, the influence of these courses on higher education will only rise in the coming years.

In this chapter, we will look at the history and evolution of MOOCs, the leading MOOC platforms, developing MOOC trends, especially in light of the COVID-19 epidemic, drawbacks and the future of MOOCs, and the use of artificial intelligence (AI) in MOOCs.

2. Background

The notion of MOOCs began in 2008, with the introduction of an online course named "The Introduction to Artificial Intelligence" by Stanford University. This course was meant to be free and available to anybody with an internet connection. The course was a significant success, enrolling over 160,000 students from 190 countries. This sparked a surge of interest in the notion of MOOCs, and other colleges quickly started to offer their courses [1].

MOOCs have grown in popularity since then [2], with more colleges providing them and more students taking advantage of them. According to the Open Education Database [3], there are presently over 16,500 MOOCs accessible from over 950 institutions worldwide, providing over 20,000 courses. The bulk of these courses is available via a few large MOOC sites, such as Coursera, edX, and Udacity. **Figure 1** displays the pace of increase in course offerings during the last decade [4].

The advantages of MOOCs in augmenting traditional learning methods are numerous. For one thing, they offer access to quality education for those who lack financial resources or geographic access to a physical campus. This can include students in rural areas or from disadvantaged backgrounds who may not otherwise



Figure 1.
Number of courses offered by MOOCs [4].

have the opportunity to receive an education of the same quality as their urban counterparts.

Another benefit is that MOOCs are sometimes free or inexpensive compared to conventional college courses. This makes it easier for students to enroll in non-required courses at a cheap price and with greater flexibility than traditional courses provide. MOOCs enable students to learn at their speed and acquire skills without physically attending class if they want not to. This gives individuals greater choice over how they go through course material and makes it easier for them to accommodate other obligations, such as employment or family, than attending classes on campus would.

After a decade, it is evident that despite initial concerns that MOOCs would replace more traditional forms of education, these concerns have been substantially allayed by evidence indicating that these online courses supplement rather than replace existing methods of teaching and learning. While some educational institutions may still be hesitant to use this new technology, it is evident that for many others, it has become a vital asset for providing quality education at an accessible cost and on terms tailored to the needs of each student.

There has been a lot of work done on MOOCs in the literature in the last three years, Deng et al. [5] evaluate recent literature on MOOCs to identify critical learning and teaching characteristics from the learners' and instructors' perspectives. Using Biggs' 3P model as an organizing principle, they evaluate the evidence for the correlations between these variables.

Another recent publication was by Badali et al. [6]. The objective of this research was to discover motivational elements and theories that influence participant retention in MOOCs and to explain how motivation facilitates MOOC completion. Six primary motivational elements, split into need-based and interest-based categories, were discovered, with academic motivations playing the largest impact on retention. Self-determination theory was the most influential motivating theory for participants.

Were Julia et al. [7] analyzed 50 MOOCs to determine scalable best practices for giving formative feedback and interactivity to large numbers of students. Several formats, such as quizzes, peer feedback, and simulations, can be employed to give scalable feedback and interactivity, as revealed by the analysis. During knowledge transmission activities, the majority of MOOCs permit student-content interaction. The study identifies potential best practices for educational scalability in online education and indicates the need for more complex interactions and feedback in MOOCs to increase their quality.

Other researchers concentrated on the learner perspective [8]. This study created and validated a MOOC learner engagement scale (MES) with four components (behavioral, cognitive, emotional, and social). The scale was created via a modified procedure that included focus groups, surveys, expert reviews, item purification, and construct validation research. The MES can be used to evaluate engagement patterns and examine the relationship between student engagement and other crucial MOOC teaching and learning aspects.

3. Methodology

Our methodology of selecting Massive Open Online Courses (MOOCs) platforms in this study is based on some published benchmarks. The MOOC must be part of a consortium of respected accredited educational institutions and have over one million registered users with no less than five thousand online courses available on the platform. MOOCs will be evaluated based on their posted statistics and feedback from student surveys. The chapter will focus on the most popular MOOCs, and it will analyze how they stand during the pandemic drawbacks and weaknesses, and identify opportunities for improvement. Additionally, this chapter will explore the potential of using artificial intelligence (AI) tools in modern and future MOOCs to increase access to education and reduce educational costs.

4. Major MOOCs platforms

Coursera [9] is the most prominent MOOC platform, with over 3200 courses from 275 universities. The platform website claims it has over 113 million registered members from over 190 countries. Coursera specializes in giving lessons in a wide range of subjects, including business, computer science, data science, and others.

EdX [10] is the second biggest MOOC portal, with over 2000 courses from 140 schools. edX has approximately 50 million registered users from over 190 countries, according to the company's website. EdX specializes in giving lessons in a wide range of subjects, including the humanities, sciences, and engineering.

Udacity [11] is the third biggest MOOC platform, with over 1400 courses from over 100 universities now available. The company's website claims it has over 16.9 million registered members from over 240 countries. Udacity offers courses in several subjects, including programming, data science, artificial intelligence, and others. The growth rates of these three platforms are shown in **Table 1** from 2016 to 2021.

Aside from these large platforms, several smaller MOOC platforms provide courses in specific disciplines. For example, Khan Academy [12] provides courses in mathematics and physics, while Future Learn [13] focuses on courses in the humanities and social sciences, and there are other localized MOOCs in other areas, see for example our published article entitled "It is time to MOOC and SPOC in the Gulf region" [14].

4.1 Growth of MOOCs

Overall, the MOOCs environment is evolving, and it is getting more popular as more colleges offer courses and more students take advantage of them. The number of MOOCs offered has more than quadrupled since 2015, according to the Open

Year	Coursera Students (Million)	edX Students (Million)	Udacity Students (Million)
2016	23	10	4
2017	30	14	8
2018	37	18	10
2019	45	24	11.5
2020	76	35	14.5
2021	97	42	16.95

Table 1.
The total number of enrolled students (million) in the three major MOOCs from the year 2016 to 2021.

Education Database statistics, and the number of registered users is expected to exceed 1 billion in the next four to five years. As indicated in **Table 2**, this trend will likely continue in the coming years as MOOCs grow more popular and more colleges and students use them.

Figure 2 depicts the increased rate of the number of MOOC courses provided. However, compared to the growth rate of students shown in **Figure 3**, the course growth rate is linear, but the student growth rate is exponential. **Figure 4** shows both plots at various scales. This would condense the population in future online courses, which might present issues in the future unless controlled by automation and AI, as detailed later in the chapter (**Figure 5**).

If current growth rates continue, the number of registered learners is likely to reach 1 billion by 2016–2017. As we shall see in the latter half of this chapter, reaching this number would alter the future of education.

4.2 MOOCs and the pandemic

The 2020 coronavirus pandemic has significantly influenced higher education institutions and how they teach their courses [15]. With universities and colleges throughout the globe forced to shut their physical campuses as a result of the epidemic, many have had to swiftly adjust to the new reality and switch to offering their courses online. This has resulted in significant growth in the usage of MOOC platforms, which provide universities with a simple, cost-effective, and scalable option to offer online courses [16].

MOOCs have been for a while, but the epidemic has dramatically expanded online education’s acceptability. This is because they enable students to access course

Year	Students (Million)	Courses (Thousands)	Universities
2021	220	19.4	950
2020	180	16.3	950
2019	120	13.5	900
2018	101	11.4	900
2017	81	9.4	800
2016	58	6.85	700

Table 2.
Total number of students, number of offered courses, and number of institutions involved in MOOC education.

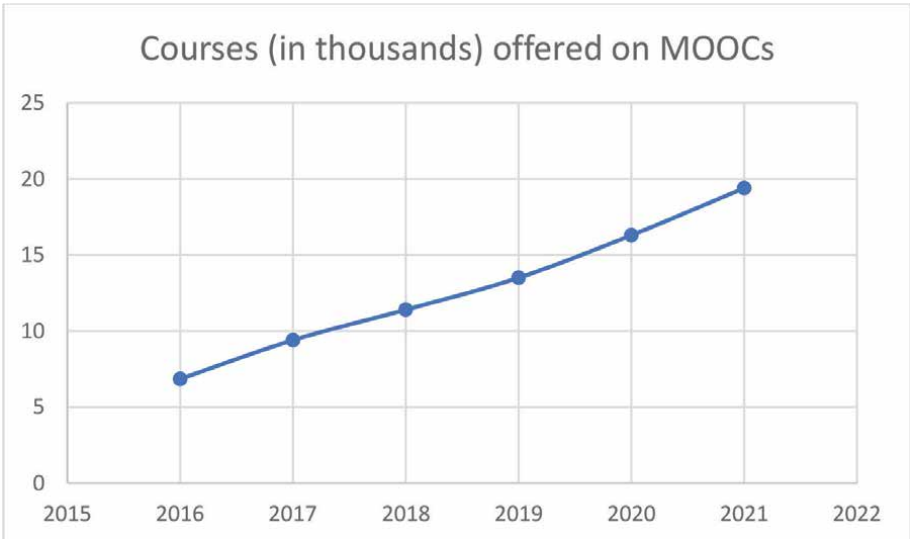


Figure 2.
Number of courses (thousand) in all MOOCs.

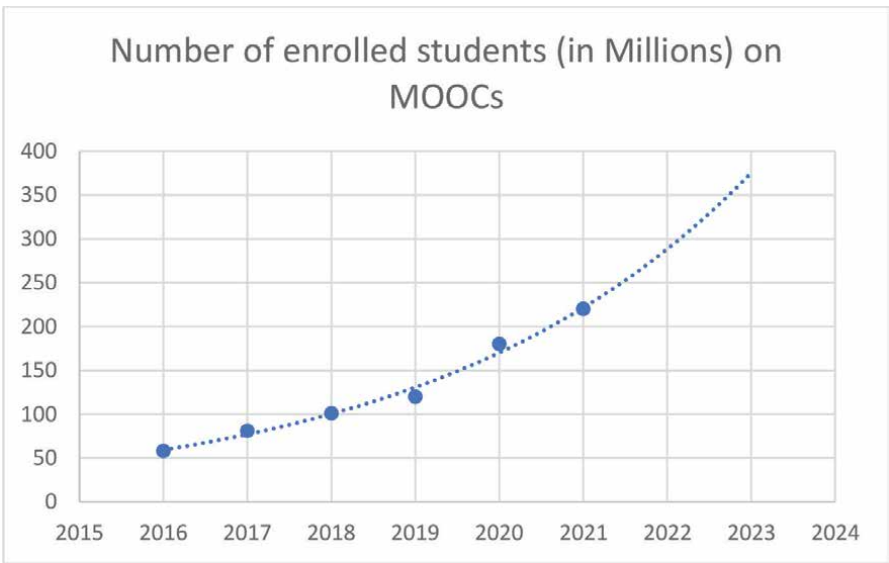


Figure 3.
The total number of enrolled students (in million) in all MOOCs.

information from any place, at any time, and on any device with an internet connection. This makes them especially useful during a pandemic when students cannot attend in-person sessions. MOOCs are also less expensive than regular courses since they need less physical infrastructure and resources [17]. Furthermore, since they are not constrained by geographical borders, they may reach a far bigger audience for course material.

MOOCs' rising acceptability has resulted in remarkable growth in their utilization throughout higher education institutions. MOOCs are being used by many

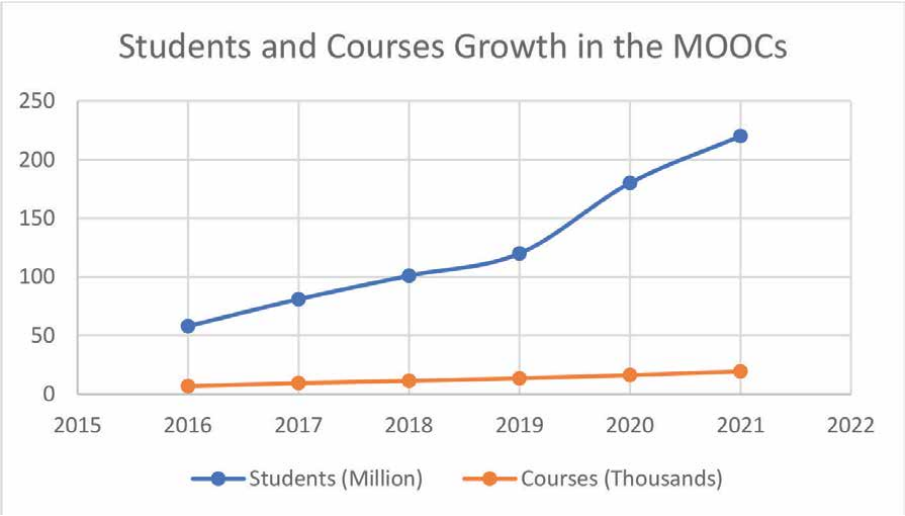


Figure 4.
The growth comparison between number of registered students (million) and number of offered courses (thousand).

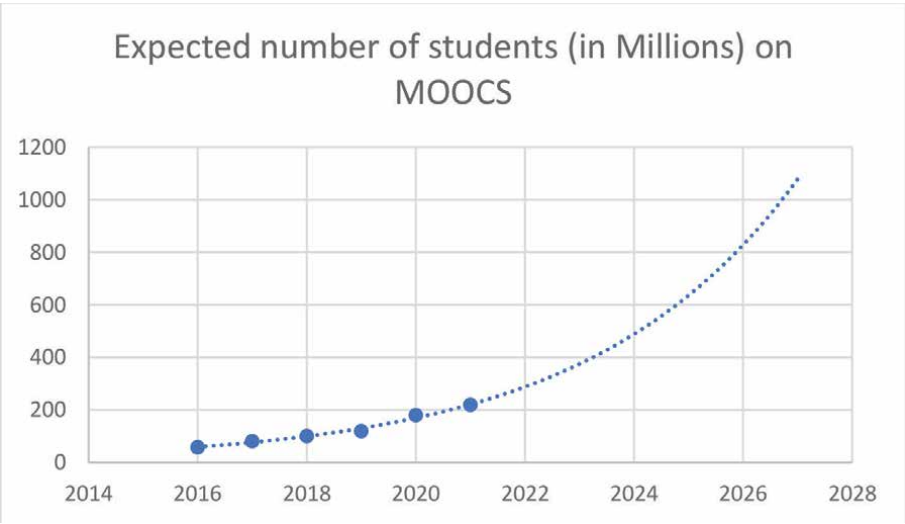


Figure 5.
The expected number of students (million) enrolled in all MOOCs.

universities and colleges to teach courses ranging from the introductory level to the doctoral level. This has enabled them to continue teaching their courses despite the epidemic, and several universities' enrollments have increased as a result.

Simultaneously, MOOCs have enabled colleges to reach a broader spectrum of students. MOOCs can give access to courses to students who may not be able to attend classes in person by utilizing the power of the internet. This is especially useful for students who live in remote areas or have limited access to physical infrastructure. Furthermore, this has created chances for non-traditional students, such as those who are unable to attend courses owing to employment or family obligations.

MOOCs have allowed higher education institutions to improve the quality of their courses in addition to extending access to them. Instructors may give more interesting information by leveraging MOOCs, such as interactive video lectures, podcasts, and discussion boards. They may also utilize social media to communicate with their students and offer fast feedback on tasks. This has enabled educators to provide their students with a more individualized learning experience and better prepare them for the real world [18].

Overall, the epidemic has considerably raised the acceptance of distance education, especially MOOCs. MOOCs have enabled higher education institutions to continue teaching their courses despite the epidemic by offering access to courses to a wider variety of students and allowing teachers to generate more exciting material. This has enabled them to stay competitive in the current educational scene and provide their pupils the finest education possible.

The COVID-19 pandemic increase has now diminished, but the influence remains. Many individuals continue to utilize online courses to develop new skills and information as online learning has grown in popularity. This is particularly true for people who lack the time or financial means to attend a regular institution.

The 2020 pandemic altered the globe in numerous ways, one of which was the abrupt emergence of online learning. It has become a viable and accessible method of learning, and although the pandemic surge has since gone, it has made its imprint and will be a significant component of the learning landscape for years to future.

In conclusion, the COVID-19 epidemic has had a tremendous influence on the education industry, with many higher education institutions increasingly resorting to MOOCs to provide their courses. MOOCs have become a feasible choice for students who are unable to attend regular courses as a result of this growing acceptance and usage of remote learning. Furthermore, as more individuals aspire to gain new skills and information, the epidemic has increased the number of students enrolling in MOOCs.

5. Drawbacks and weaknesses of the MOOC education

MOOCs have grown in popularity in recent years because they provide a greater variety of educational options cheaper than conventional forms of education. However, despite the potential advantages of MOOCs, there are certain downsides to be aware of [19].

One of the most significant disadvantages of MOOC education is the absence of personal connection. MOOCs, as opposed to regular classes, are entirely online, which means there is no direct connection between the student and the teacher. This might be difficult for some students who are unable to ask questions or participate in conversations with their classmates. Furthermore, the absence of physical presence might make it difficult for pupils to completely comprehend and appreciate the subject being taught [20].

Procrastination is another issue with MOOCs. Because the courses are self-paced and there is no defined timetable, some students may be tempted to procrastinate until the last minute. This might result in a loss of motivation and a reduction in the quality of their job. Furthermore, some students may struggle to remain focused and on track without the framework of a typical classroom [21–23].

MOOCs also lack the physical abilities required for specific kinds of courses. Courses that need students to engage with actual equipment or instruments, for

example, cannot be recreated online. Furthermore, certain subjects may need hands-on laboratory activities to completely comprehend the content.

Courses that concentrate on theoretical areas such as mathematics, economics, and computer programming are often well-suited for an online setting. Because these courses do not involve any connection, they may readily be taught online. Additionally, classes focusing on areas such as language and literature might be suitable candidates for MOOCs if the teachers can offer a range of materials and activities to interest the students [24].

MOOCs are not appropriate for courses requiring physical contacts, such as engineering, medicine, and art. Students must engage with physical equipment or materials to properly comprehend the subject taught in these courses. Furthermore, laboratory experimentation and fieldwork courses cannot be reproduced online.

In conclusion, although MOOCs may provide a broad variety of educational possibilities, there are certain negatives to be aware of. MOOCs might be challenging for some students due to a lack of human connection and the potential for procrastination. Furthermore, many subjects, such as those requiring physical abilities, are not appropriate for MOOCs. Conversely, MOOCs may be an excellent choice for students who do not have access to conventional forms of education in subjects such as mathematics, economics, and other theoretical areas.

6. Using artificial intelligence in MOOCs education

Artificial intelligence (AI) is rapidly being used in Massive Open Online Courses (MOOCs) to assist instructors in answering students' queries, grading assignments and examinations, and following up with students. AI may enhance students' learning experiences, from automatic feedback on assignments and tests to answering students' queries in real time. Instructors may create more engaging and individualized learning experiences for their students using AI in MOOCs [25].

One use of AI in MOOCs is to give automatic feedback on assignments and examinations [26]. AI algorithms may assess student replies, offering feedback on what was accurate and where improvements should be made. This form of feedback may be highly beneficial for students having difficulty learning the topic. AI algorithms may also give each student individualized advice and assistance, allowing them to learn more successfully [27].

Another method AI may be utilized in MOOCs is to assist students in answering questions in real-time. AI algorithms may be used to assess student queries and give responses or recommendations to assist students in better comprehending the content. This form of AI-powered support may be very beneficial for students with difficulty learning the topic [28].

Finally, AI may be used to contact students who have finished a MOOC. Artificial intelligence (AI) algorithms may be used to monitor student performance and give individualized comments and suggestions. This follow-up form is perfect for pupils who have difficulty learning the topic. AI may also monitor student progress and provide individualized recommendations for more education [29–31].

In general, AI is becoming more popular for usage in MOOCs. AI may offer automatic feedback on assignments and tests, assist in real-time answering student queries, and follow up with students after they have finished a course. Instructors may create more engaging and individualized learning experiences for their students using AI in MOOCs [32, 33].

To summarize, the application of AI in MOOCs has grown in popularity in recent years. AI offers students tailored coaching and feedback, answers student inquiries, and grades assignments and examinations. AI may also be used to track student progress and provide reminders to help pupils stay motivated. AI is also being utilized to create adaptive learning systems that can change course material and sequencing depending on the requirements of each individual learner. The application of AI in MOOCs has the potential to enhance students' learning experiences and assist them in achieving their educational objectives.

7. The future of MOOCs education

Based on current patterns, we predict the future of MOOC education in this section. There are several angles to approach this topic. Still, we confine our discussion to mobile education and the next industrial revolution.

7.1 Future MOOCs and mobile education

MOOCs have enabled the creation of more tailored learning experiences. MOOCs allow instructors to personalize course content to the specific requirements of each student [34]. Students may study at their own speed and in their own style [35]. MOOCs also enable the creation of interactive learning experiences. Students, for example, may participate in virtual forums and online exercises and view movies that teach a subject. This motivates pupils to think critically about the issue and engages them in learning. Simultaneously, smartphones have transformed the learning experience into a much deeper relationship; future phones may be smart companions. Students may now access classes from anywhere, enabling them to study independently and at their own pace [36]. Furthermore, mobile and distant learning technologies provide a more individualized learning experience. Students, for example, may receive customized information targeted to their specific requirements, such as practice exams and tutorials [37].

MOOCs, mobile learning, and distant learning technologies will continue to play an essential role in shaping the direction of education in the future. These technologies will provide more tailored learning experiences, more accessible educational opportunities, and more access to excellent education for a broader group of students. Furthermore, these technologies will enable instructors to reach a larger audience of students, allowing them to give more specialized and personalized courses.

Overall, MOOCs, mobile learning, and remote learning technologies have transformed education and will continue to play an essential role in shaping the future of education. These technologies have allowed students to attend classes from anywhere, allowing for more individualized learning experiences. Furthermore, these technologies have qualified instructors to reach a broader student base and give more specialized and personalized courses. These technologies will be used to provide more accessible and individualized educational possibilities.

7.2 Future MOOCs and the next industrial revolution

The fourth industrial revolution, or 4IR, is quickly changing the educational landscape. As technology improves, educational institutions must adapt to suit the

requirements of the contemporary workforce. MOOCs have grown in popularity and have influenced the educational scene in recent years. MOOCs provide students with access to high-quality courses regardless of their geographic location or financial status.

Automation, artificial intelligence, machine learning, metaverse, digital twins, internet of things (IoT), blockchain, cloud computing, big data, and robots are increasingly used in the 4IR. Some literature also expresses the fifth industrial revolution (5IR) as a layer on top of 4IR, driven by society's values [38, 39]. This technological revolution has generated a new and ever-changing learning environment. As technology evolves, so do the contemporary workforce's expectations. MOOCs are particularly positioned to address these expectations because they provide students access to high-quality, low-cost educational resources, enabling them to remain ahead of the curve in terms of upskilling and professional growth.

MOOCs' future in the next industrial revolution (XIR) will usher in a more individualized approach to learning. MOOCs will be able to personalize course content to each student's particular requirements and capabilities by using machine learning and AI. This will enable students to concentrate on the specific skills and technology required for their profession's future. Furthermore, with this personalized approach to learning, students will be able to create macro-diplomas that will testify to the abilities they have gained during their studies. This will provide companies with important information about prospective hires' capabilities and guarantee that the workforce is prepared for the XIR.

Finally, MOOCs have shown to be a great tool in the XIR. MOOCs will be able to give students with individualized learning experiences that fit their unique needs and skills thanks to the usage of machine learning and AI. This will allow learners to create macro-diplomas that testify to their learned abilities and exhibit their capacity to operate in the XIR. As a result, MOOCs will continue to play an essential part in education's future.

8. Conclusion

Massive Open Online Courses (MOOCs) have grown in popularity over the last decade and were extensively used by higher education institutions during the COVID-19 epidemic. The use of artificial intelligence (AI) in MOOCs has also grown in popularity since it may assist students in getting individualized advice and feedback. As more colleges and educational institutions resort to distant learning to deliver excellent education and training to students from all over the globe, AI will probably continue to play a critical role in MOOCs. MOOCs have been shown to give education to regions that would not otherwise have access to such high-quality education; it promotes sustainability and equality and closely adheres to the United Nations Sustainable Development Goals (UN-SDGs) for education. MOOCs will play a significant role in the future and will transform the notion of higher education if they continue to expand at the current exponential pace.

Conflict of interest

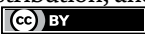
The author declares no conflict of interest.

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Perspective Chapter: MOOCs to Bridge the Multilevel Digital Divide

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Abstract

Massive open online courses (MOOCs) play a significant role in proliferating universal online education regardless of learners' limitations and backgrounds. Regrettably, the MOOC movement has been challenged by the inequality in accessing essential digital technologies, known as the digital divide. Research has identified multiple forms of digital divide beyond the binary access difference. The evolving forms of the digital divide have been induced in MOOCs due to the access, skill, and outcomes gap, which drives a digital divide cycle. The concept of the multilevel digital divide in MOOCs is a rising concern that demands thoughtful actions by MOOCs stakeholders. This book chapter discusses the intertwined multilevel digital divide and MOOCs and proposes potential solutions to break the digital divide cycle and bridge the gap. Additionally, current MOOCs platforms have digital accessibility issues that hinder learners with disabilities from participating and can result in further inequalities. In order to address the accessibility issues, this chapter describes the application of web content accessibility guidelines and universal design for learning concepts that may assist associated people with MOOCs to bridge the digital divide and promote equitable MOOCs.

Keywords: digital divide, multilevel divide, bridging divide, MOOCs, educational equality, E-learning

1. Introduction

1.1 Equitable learning and MOOCs

The Massive Open Online Courses (MOOC) movement has the potential to bridge the global knowledge divide [1]. MOOCs have revolutionised the notion of accessing education through a wide range of open and distance (ODL) learning approaches [2]. Unlike typical institutional course enrolment, a large number of participants can access MOOCs basis on their demand for knowledge without strict entry requirements, which enables just-in-time knowledge opportunity and promote educational equality [2]. Educational equality has been an integral part of sustainable development that contributes to creating a civilisation that acknowledges social inclusion [3]. United Nations (UN) sustainable development goals (SDGs) incorporated education

as a priority objective defined in SDG goal 4, which aims to “ensure inclusive, equitable, and quality education and promote lifelong learning opportunities for all” (SDG-4). According to Sustainable Development Goal 2030, education is linked to socioeconomic mobility, which can play a crucial role in overcoming poverty [4]. Access to education enhances individuals’ ability to escape from poverty. Since their origination, MOOCs have exhibited rapid growth and facilitated universal access to education for anyone from anywhere, regardless of their background [3]. Therefore, individuals can acquire the necessary knowledge and skill through MOOCs, resulting in economic mobility. Particularly, MOOCs widen educational access for all, including individuals with no prior access to education. Overall, MOOCs scaffold the efforts to achieve SDG-4, thus promoting gender equality, social inclusion, and special needs education [5].

1.2 Flexible and open learning opportunities

The core concept of MOOCs is to provide open access to education for all, which emerged from the open educational research (OER) movement [6]. MOOCs are developed adhering to a few fundamental characteristics, which are open, participatory, and distributed [7]. Access to MOOCs is often free of cost and open to individuals who can access the learning contents accommodating necessary devices and the Internet. Participation in MOOCs allows bidirectional interaction for learners to contribute and participate in learning and knowledge sharing. Due to the connective nature of MOOCs, knowledge is shared among the participants in a network. Participants can engage in the learning interaction and access course materials conveniently from anywhere [7]. The flexible characteristics and openness made MOOCs increasingly popular. As a result, MOOCs have grown exponentially in recent years. About a decade ago, more than 160 K registered learners were enrolled in three free Stanford courses, which was the Kickstarter of the modern MOOC movement [8]. According to recent census data, more than 220 million (excluding China) learners are enrolled in 3100 courses and 500 micro-credentials [8].

1.3 Growth of MOOCs

In recent days, many universities have adopted MOOCs, and several unicorn EdTech (Educational Technology) organisations (e.g. Edx, Coursera) revealed themselves with extensive online courses. Looking at the current proliferation of MOOCs may seem that this progress has a long history; however, the transformation of MOOCs happened in the last decade. In 2008, Dave Cormier from the University of Prince Edward Island and Bryan Alexander from the National Institute for Technology in Liberal Education coined the term massive open online course (MOOC) in response to an open online course designed and led by George Siemens of Athabasca University and Stephen Downes of The National Research Council [9]. Afterwards, in 2011, a few interactive teaching videos were created by Stanford University academics and disseminated through open Internet-based platforms supported by cost-free online resources [7]. The MOOCs explosion was initiated in 2011, and Stanford University played a significant role. Later in 2012, Coursera debuted as a commercial MOOCs platform. In the same year, separate non-profit organisations such as Udacity (founded by Sebastian Thrun) and Udemy were founded. MIT and Harvard subsequently combined their MITx platform into EdX [7]. They were followed by the European-based platforms Futurelearn and Iversity.

Within a decade, more than 900 universities have launched free online courses worldwide since Stanford's inception. Many national governments throughout the globe have developed their country-specific MOOC platforms in addition to the more prominent global MOOC platforms (Coursera, edX, FutureLearn), including India, Italy, Israel, Mexico, and Thailand [10]. Consequently, MOOCs opened the opportunity for everyone to choose from a wide range of courses that can contribute to global upskilling and the development of human resources.

1.4 MOOCs for upskilling

MOOCs can play a crucial role in upskilling human resources globally to address the global rise of enhanced employability demand. The world is experiencing high-paced digitalisation where job and career development needs are continuously transforming and require incessant upskilling for individuals to sustain the job market [11]. Due to the immense application of A.I., automation, and robotics, most of the existing workforce has to confront either migration of profession or acquiring new skills to accommodate the contemporary technological ecosystem. The employability characteristics in the workplace are shifting due to the ongoing change in technology, services, and markets, as well as demographic changes in the globe that demand lifelong skill development opportunities [11, 12]. Empirical evidence suggests that the opportunity for skill development influences employability improvement and career sustainability [11]. U.S. labour statistics shed light on this by demonstrating the strong relationship between skill-based education opportunities, employability, and career development [13].

Examples throughout the world demonstrate the need for upskilling to meet current employability requirements, particularly the need for technological skills. For instance, in 2016, there were technical skills shortages in 72% of major enterprises and 49% of Small and Medium Enterprises (SMEs) in the United Kingdom [14]. A similar tendency was also evident in other regions of the globe in a recent survey by the Manpower Group, which found that companies in India (83%), Japan (74%), Taiwan (88%), Hong Kong (83%), and Singapore (84%) were unable to acquire the necessary skilled manpower [15]. According to the survey, digital technology-relevant skills are the most required among the top five demanded job sectors (IT and Data, Sales and Marketing, Operation and Logistics, Manufacturing and Production, Customer service). Similar phenomena have been observed in Europe, a total of 26% of E.U. adult workers lacked the necessary job abilities in 2017, and by 2025, 49% of all job opportunities in the E.U. will need high-level qualifications [16]. Long-term unemployment was observed due to skills shortages and talent mismatch in Australia, which has been a rising concern [11]. In relation to the gap between upskilling and employment, tertiary educational institutions have limitations in adopting the changes swiftly and synchronising with the global economic climate and connecting industry demands [11]. The inadequacy of providing flexible and contemporary skill training can be overcome through MOOCs. According to the available evidence, MOOCs may be an effective way to upskill the workforce [11]. MOOCs can provide a simple, scalable, flexible, and cost-effective method for people and companies to acquire or update skills.

1.5 Equitable access debate in MOOCs

With the increasing Internet penetration and diffusion of information and communication technology (ICT) infrastructure, MOOCs are becoming worldwide

popular among people to participate in open education. Likewise, global evidence indicates that many organisations will widely adopt MOOCs as an applied educational framework [2]. Nonetheless, while being open and free, MOOCs tend to introduce hurdles to potential learners since they may not be available to everyone. In the early stage of the MOOC movement, access to ICT was a significant concern as MOOCs require access to the device and/or the Internet. There is always a concern that certain groups of people will not be able to attend MOOCs due to the access or skill gap.

Although physical access to ICT has significantly improved globally and nations are prioritising bridging the access gap, there is still a controversy that MOOCs are adopted mainly by educated people [5]. This phenomenon can be understood by the Knowledge Gap Theory [17], which suggests that the population with higher socio-economic status tend to access newly infused mass media and information faster than the lower-status group. Those with better educational attainment and adequate digital skills will naturally be ahead in taking advantage of MOOCs. A large number of individuals still need to acquire the fundamental digital competencies required to take advantage of this educational opportunity. Despite having access to ICT, they cannot take advantage of MOOCs or any other digital learning opportunity. Consequently, they cannot convert their digital/online capital to offline capital, which submerges them in a vicious cycle of the digital divide. Research has shown that delivering digital literacy training with the help of MOOCs can bridge the multilevel digital divide and unleash the potential of MOOCs to help the learner acquire the necessary skills for economic mobility [18].

Based on the information above, this chapter describes the challenges of the multilevel digital divide and digital accessibility associated with MOOCs. The chapter also synthesises a wide range of theoretical frameworks to shed light on the multilevel digital divide issues underpinned by MOOCs. In this technological realm, equity challenges in MOOCs cannot be addressed by the dichotomous digital divide concept; instead, MOOCs are emerging with a complex multilevel digital divide. This chapter provides a comprehensive understanding of the multilevel digital divide intertwined with MOOCs and devises how careful design of MOOCs can be used to overcome the multilevel digital divide. Additionally, the current chapter provides a brief guideline to design accessible MOOCs, which are crucial for inclusive practice.

2. Methodology

The methodology employed in this book chapter was a narrative compilation of credible qualitative and quantitative data, along with a comparison of well-established theoretical frameworks within the field of digital divide and MOOCs research. To ensure the credibility and accuracy of the information presented, multiple sources were consulted, including academic journals, government reports, and online databases. The sources were carefully evaluated for their relevance and reliability. The data from the selected sources were then analysed and synthesised, with a focus on identifying common themes and trends. The results of the analysis were used to form the basis of the narrative in this chapter, and the information was presented in a clear and concise manner, with appropriate references and citations provided for each piece of data. To validate the findings, the results were reviewed and checked by independent experts in the relevant field. The findings were then integrated into the narrative of the chapter. This method of data synthesis and integration was chosen to provide a comprehensive and in-depth analysis of the subject while maintaining the narrative structure of the chapter.

3. Challenges in MOOC

Although the proliferation of MOOCs is growing rapidly across the world, many challenges hinder participation in MOOCs based on learners' characteristics and their socioeconomic background [19]. The unavailability of sufficient resources and infrastructure has been seen as a significant barrier to MOOCs for learners from developing countries and least-developed countries (LDCs), as access to devices and the Internet is the mandatory prerequisite to access MOOCs. In developed countries, while Internet coverage has become almost universal to people, developing and least-developed countries are yet striving [20]. At the same time, maintaining quality Internet connection remains a challenge in developing countries and LDCs [21]. Incorporating rich interactive content with high-definition (HD) audiovisual in MOOCs has stressed the need for high-speed Internet connection and requires devices with adequate processing power. However, recent data shows that less than 25% of Internet users from LDCs have access to high-speed broadband Internet [21]. The access gap still seems a significant obstacle for participants from developing and least-developed countries. Nevertheless, there has been a linear increment in global Internet penetration over the past decade, with an average of 60% of the world's population now having access to the Internet and growing rapidly (see **Figure 1**).

When the access gap is closing, new tensions have been raised in the MOOC movement. Several studies claimed that the MOOC movement is challenged by the lack of financial and human resource support from stakeholders [23, 24]. Additionally, the open and cost-free characteristics demotivate stakeholders' intentions from a commercial lens and could induce fear of losing revenue. Due to the public benefit aspect of MOOCs, institutions anticipate income loss if prospective students choose MOOCs. Among many challenges, scholars and experts in this area identified the low completion rate of MOOCs as the notorious factor that strengthens the efficiency debate of MOOCs. The completion rate indicates the percentage of participants who

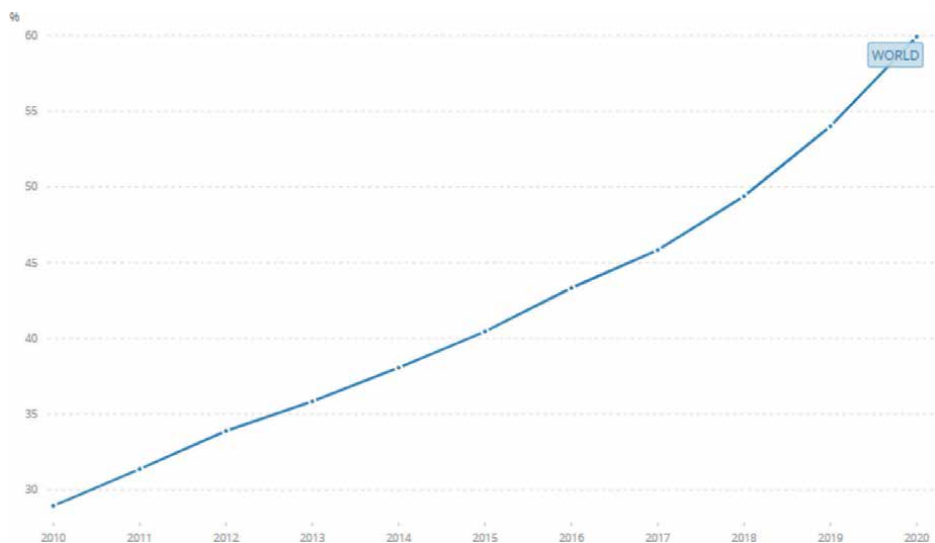


Figure 1.
Progress of internet penetration at the individual (% of the world population) level in the last decade. Source: Illustration from World Bank and ITU data [22].

satisfied the evaluation criteria of a specific course in order to be eligible for certification. Still, MOOCs have a significant dropout rate, with current completion rates ranging from 7 to 13%, depending on the platform [25]. However, scholars argue that considering completion rates as the indicator of MOOCs' overall success might not be an appropriate metric [26]. These completion rates may not take into account the diverse learning objectives of a variety of participants. For example, some participants may need to complete the course to acquire specific required knowledge from certain modules/content.

Before addressing any obstacles in the MOOC movement, it is crucial to address digital access challenges since access to the Internet and a device is a prerequisite for reaping the advantages of MOOCs, which is portrayed as the digital divide. Therefore, associated bodies with MOOCs development should comprehend the digital divide challenges at the outset of developing MOOCs.

4. The concept of a multilevel digital divide

Since the early 1990s, when Internet access and the usage of personal computers began rising, the “Digital Divide” has been a subject of attention, and it has continued to develop ever [27]. The most widespread definition of the digital divide is the gap between those who have access to and use digital technology (e.g. Internet, Devices) and those who do not [28]. Hilbert's descriptive framework describes the divide by differentiating how a person or organisation/community with distinct characteristics utilises various kinds of technology, how they access these technologies using different abilities, and how they achieve different results [29]. The term “Digital Divide” may seem like a technical issue; however, it is a social problem pertaining to the access and usage disparity in ICT, similar to other social inequality. The digital divide phenomena are far more complex and diversified than general dichotomous digital exclusion/inclusion [30]. In the twenty-first century, the digital divide notion is not limited to those with and without access to ICT. Multiple degrees of digital inequalities are extensively known and have been discovered through decades of intensive research [30–35].

Initially, the digital divide was studied as a binary difference between those connected to the Internet and those who were not [27]. This form of the digital divide is currently known as the first-level digital divide. Subsequently, Hargittai [36] emphasised that a distinction should be made between an Internet access gap and a skill divide, reflecting distinctions across groups of individuals in terms of the abilities required to utilise the Internet successfully. This idea also deviated from the deterministic notion that access to technology would inevitably bring all of its advantages. Several academics have highlighted concern about the approach to the digital divide that focuses only on differences in Internet access [37, 38]. Since the percentage of the population with an Internet connection is substantial in most Western nations, having an Internet connection is no longer regarded as the primary or sole barrier to benefiting from the Internet. When broadband Internet access and digital devices were more ubiquitous, the significance of an Internet access-based digital divide began to be questioned. Consequently, the focus of the digital divide discourse switched to the digital skills gap, which is the second-level digital divide [36], which also encompasses usage inequalities [38]. Several academics have proposed that digital disparities should be addressed more comprehensively, considering Internet access, skills, and the outcomes of Internet use [37, 38]. Consequently, the digital divide debate has

changed from binary Internet access to skills and usage of the Internet to an emphasis on the gain of Internet use, identified as the third-level digital divide in 2011 [39].

According to Robinson et al. [34], the legacy digital divide remains across various groups because of economic class, educational attainment, disability, and geographic location. They argue that emerging technologies of the fourth industrial revolution introduce more complex and growing digital divides. Consequently, there is the potential for a digital gap in various aspects. In addition, researchers found algorithm-driven inequalities in the intelligent algorithm-based smart environment [40]. In the information era, algorithms are the backbone of emerging technologies such as AI (Artificial Intelligence), IoT (Internet of Things), and Big data, which support the virtual labour market and virtual society. However, the algorithm-driven virtual world is forming a digital underclass and widening the digital gap unprecedentedly [34, 35]. Ragnedda [41] identifies “New Digital Inequalities” resulting from the algorithm-dependent virtual society. The notion of “New Digital Inequalities” encompasses three degrees of algorithm-based inequality: 1. Inequality in Knowledge, 2. Inequality in the Database, 3. Inequality in Treatment. Algorithms may acquire bias from their developers, resulting in “Inequalities in Knowledge” [41], if algorithms are trained using inaccurate reference data, referred to as “Inequalities in Database” [42]. As a result, algorithms may treat users differently depending on their gender or other attributes, resulting in “Inequalities of Treatment” owing to several deliberate or unintended shortcomings [43].

All associated bodies with MOOCs development need to comprehend the multi-level digital divides and the emerging forms of digital inequalities. Hence, they can develop strategies to reduce the impact of the digital divide. Otherwise, the MOOC movement may deviate from its originating characteristics of open and equitable learning for all.

5. Progress in access to ICT across the globe

Information and communication technologies (ICTs) provide a new framework and numerous opportunities for achieving social, economic, and political development goals. Over the decades, ICTs have become an increasingly important tool for development; their adoption can spur productivity, trade, and economic development. During the United Nations Conference on Sustainable Development, Rio + 20, Governments recognised the significance of ICTs facilitating the information flow between governments and the public, which is essential to bridge the digital divide and international corporations for providing equitable access to technologies. ICTs have completely revolutionised how people live, work, and communicate and have played an essential role in fulfilling the United Nations’ Sustainable Development Goals (SDGs).

In 2015, Internet penetration grew from 6 to 43% of the world’s population compared to 2000, according to International Telecommunication Union (ITU) 2015 ICTs figures [44]. Today there are more than 7 billion mobile subscriptions worldwide, significantly increasing from 738 million in 2000. Globally, around 3.2 billion people are using the Internet, of which 2 billion are from developing countries. Over the last decade, mobile broadband has enabled more areas to connect by overcoming infrastructure challenges worldwide. **Figure 2** shows global mobile network coverage covering most of the population in all regions. The share of the population lacking coverage does not exceed 7%, except for in Sub-Saharan Africa.

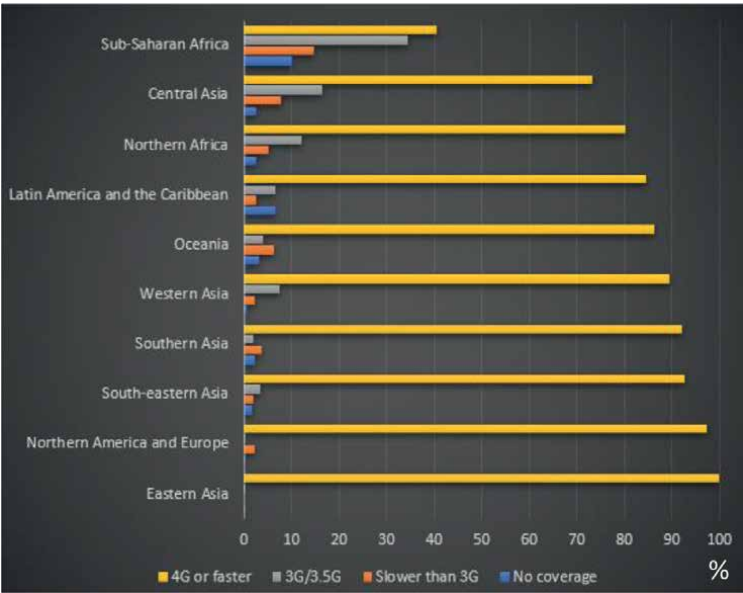


Figure 2.
Distribution of population by mobile network coverage, by technology, 2021 (source: UNCTAD calculations based on ITU [45]).

Currently, 4G or newer wireless systems are the dominant technology in use around the world. Nevertheless, more than one-in-five people in Central Asia and Northern Africa have yet to gain 4G coverage.

Fixed-line technologies also play a crucial role in delivering Internet connectivity in many countries. These special connections are of the highest speeds, such as fibre broadband connections. As specified in SDG indicator 17.6.1, **Figure 3** presents the fixed broadband subscriptions relative to the population, disaggregated by speed. It is understood that Northern America, Europe, Oceania, and Eastern Asia are mostly enjoying high-speed fixed broadband, while other regions have much lower subscription rates. For instance, in 2021, Southern Asian countries had around two subscriptions per 100 inhabitants on average, whereas Sub-Saharan African countries had only one subscription. Network availability, access to electricity (e.g. for charging), and affordability in terms of network services and the devices needed to use them

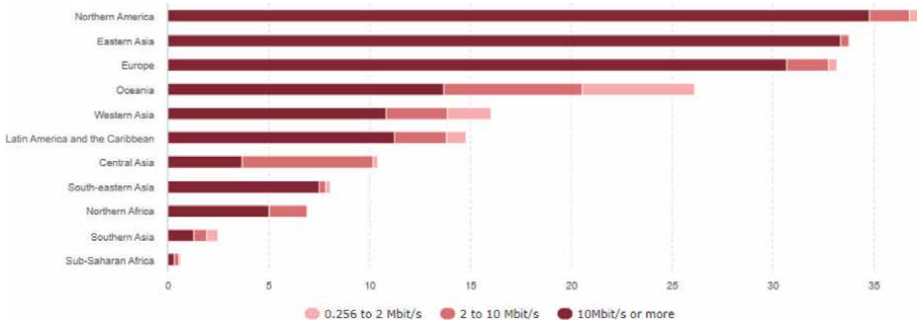


Figure 3.
Fixed broadband subscriptions by speed, calculations (source: UNCTAD calculations based on ITU [45]).

are the critical reasons for varying uptake across countries. Therefore, high-speed Internet access remains a luxury for most people in the least-developed countries. However, fixed-line or mobile networks are a pivotal fundamental requirement for Internet access.

6. Second-level digital divide challenges in MOOCs

While overall access to ICT is increasing around the globe, the adoption of MOOCs is hampered by the lack of ICT skills [1], as participants require minimum ICT skills to participate in MOOCs. Studies found that major beneficiaries of MOOCs hold prior ICT skills and have higher educational attainment [46, 47]. Therefore, people with affluent socioeconomic capital are likely to gain more benefits from MOOCs [5]. In contrast, the ICT skill gap and lack of elementary knowledge of MOOCs challenge disadvantaged groups to take part and reap the benefits of MOOCs. Empirical evidence indicates that people with higher educational status and ICT skills use MOOCs more, regardless of the course providers (University/Other Platforms) [5]. These common phenomena are derived from the MOOC platform that requires ICT skills and the design of the courses which offer content developed targeting educated participants, which are linked to the multilevel digital divide theories. The concept of the multilevel digital divide has identified the ICT skill gap as the second-level digital divide [30]. Therefore, despite having access to the Internet and devices, people can experience challenges in participating in MOOCs due to inadequate ICT skills.

When physical access is rapidly growing, and MOOCs are becoming increasingly popular, the lack of ICT skills is a significant challenge limiting the universal access and objective of MOOCs, which emerged from the multilevel digital divide. On the other hand, this will result in a further third-level digital divide. However, MOOCs can be carefully designed to reduce the skill gap, promote ICT skill training, and eventually scaffolds the needs of initial skill to reap the benefits from MOOCs.

7. Bridging second-level digital divide through MOOCs

Although the second-level digital divide or skill gap is considered as a barrier to participation in MOOCs, on the other hand, MOOCs have the potential to bridge the digital skills gap. Different types of competencies, such as “technical competence,” “information literacy,” “information navigation skill,” “social skill,” and “creative skill,” have been highlighted by academics as necessary for closing the digital skills gap [48, 49]. Mossberger et al. [49] distinguished between technical competence, or “the skills required to operate hardware and software, such as typing, using a mouse, and instructing the computer to type records in a particular way”, and information literacy, or “the ability to recognise when information can solve a problem or fulfil a need and to efficiently use information resources”. Van Deursen et al. [48] categorised technical competence as “operational skills”, or the fundamental Internet-use abilities. In addition, they identified ‘information navigation skills’ (the ability to identify, select, and evaluate sources of information on the Internet), ‘social skills’ (the ability to use online interactions and communication to understand and exchange meaning, as well as acquire social capital), and ‘creative skills’ (needed to create different types of quality content and to publish or share this with others on the Internet).

Studies found that the purposive application of MOOC can bridge the second-level digital divide (skill gap) [18, 50]. For example, in response to the European Commission's desire for more training options in digital competence, a MOOC on Basic Digital Competencies was launched in 2013 to assist bridge the digital skills gap in Spain by UNED (National Distance Education University; <http://www.uned.es>) in the Dominican Republic's UAPA (Open University for Adults; <http://www.uapa.edu.do>), and Spain's CSEV (Centre for Virtual Education; <http://www.csev.org>) [18]. This initiative, established in 2010 and included in the "Ibero-American Summit of Heads of State and Government", aims to promote social inclusion by enhancing remote education in Ibero-American nations. One of its primary goals is the development of abilities for distance education, including fundamental digital skills for instructors and students as well as the broader population.

The key aim of this MOOC represents an innovative recommendation that seeks to equip learners with the fundamental digital skills required to access the opportunities provided by the Knowledge Society and, in particular, to benefit from the new global effort based on social and open learning. The course included eight modules and 75 learning hours, leading to the awarding of badges and a final certificate upon completion. Each module had a wide variety of video material, supplemental materials, and links. Some were preparatory explanations, while others were video lectures filmed in a studio and by individual teachers. They were available for TV, polymedia, and screencast recordings, all open on YouTube. In response to the initial invitation issued by the Universia Miradax MOOC platform, over a thousand students were enrolled in the course. When the project's outcome was evaluated, the overall experience in MOOCs and the content were highly valued by learners [51]. The evaluation of this project identified a high level of learners' interest. However, the success and sustainability of such digital skill development MOOCs are linked with the participant-oriented design approach and matching learners' needs. The mentioned project depicts how MOOCs can be utilised to improve digital skills, which contribute to bridging the second-level digital divide.

Educated people are generally considered to have the fundamental digital skills to keep pace with the information era. However, people with higher educational attainment may require acquiring new digital skills or updating existing skill sets. For instance, university professors may require skill updates to cope with the gradual change in teaching and learning methods [50]. Basantes-Andrade et al. [50] studied the implementation of nano-MOOCs to improve the digital skills of university professors, who are the protagonists of their learning experience to innovate and apply teaching-learning techno-pedagogical proposals in the educational environment, in which technology is an integral part of teachers' professional activities. They employed a comparative quasi-experimental study (pre-test and post-test) with a sample of 297 university faculty members. The sampled faculty members exhibited optimal skill sets such as information literacy, problem-solving, and communication; however, they needed more content creation and digital security skills. Based on the pre-test result, a nano-MOOC was developed and implemented with faculty members. The post-test results revealed that online training through the nano-MOOC format is an effective option for university faculty training, and 83.84% of the participants increased their required digital competencies. These findings indicate that effective and individualised training may be accomplished in less time and tailored to the learners' requirements and characteristics.

The studies discussed above illustrate how MOOCs can be utilised to bridge the digital skill gap regardless of participants' educational attainment. However, to

address the lack of prior skill shortage, MOOC developers must be concerned with target participants' circumstances, understand their needs to navigate the course content, and apply strategies to retain participants until completion. Built-in course navigation guidelines, simplistic user experience (UX) design, multi-language support, and learner assistant system are some best practices to enhance MOOCs' success. Preplanned and comprehensive MOOCs design can help learners to acquire digital skills. Consequently, the escalation of digital skills will bridge the second-level digital divide and allow individuals to unleash the enormous potential of MOOCs and convert digital capital to offline capital.

8. MOOCs to ignite capital conversion cycle

The ownership of digital devices and access to the Internet does not ensure that individuals will gain equal outcomes and convert their online capital (i.e. digital assets) to offline capital. The degree of benefit from digital assets relies on the level of "technical competence", "information literacy", "information navigation skill", "social skill", and "creative skill". Possession of digital skill sets enables individuals to convert digital capital to offline capital.

The digital divide concept is intertwined with digital capital, described as a cumulative form of economic, social, and cultural capital [52]. However, Ragnedda and Laura [53] conceived digital capital as a specific isolatable capital instead of a mere subset of other capitals based on the Bourdieusian capital concept. They asserted that digital capital consists of two components: Digital Access (Equipment, Connectivity, Time spent, Support, and Training) and Digital Competencies (Information & Literacy, Communication, and Collaboration, Digital Content Creating, Safety, Problem Solving). Gómez [52] claimed that people with more offline capital (Social, Economic, and Cultural) are more likely to possess more digital capital, and people with sufficient digital capital can properly reap the advantages of their offline capital in the digital world and gain more offline capital. Conversely, people with less offline capital will possess less digital capital, consequently gaining less offline capital using digital capital. Gómez [52] explained this phenomenon as the bidirectional conversion of economic, social, and cultural capital to digital capital.

Initially, possession of material resources and income was identified as the key driver of the digital divide. However, contemporary studies conceptualised the ICT-related materialistic (device, Internet) and non-materialistic (motivation, skills) as the digital capital, which is the primary driver of the digital divide [53]. As explained earlier, individuals cannot benefit from digital capital without digital skill sets. Consequently, they cannot ignite the capital conversion cycle, which also sticks individuals in a digital divide cycle.

The MOOC movement can scaffold the upskilling process and ignite the capital conversion cycle, as illustrated in **Figure 4**. Individuals with access to ICT may leverage the advantage of ICT when they can overcome digital skill barriers. Consequently, individuals can transform their online capital into offline capital, enabling a self-reinforcing process and allowing them to gain more materialistic access and sophisticated skill sets. This cycle has the potential to bridge the multilevel digital divide. When individuals gain access to ICT, it does not ensure that the multiple forms of the digital divide would not impact them. Without ICT skills, individuals with rich materialistic access are subjected to stick in the first-level digital divide. Thus, MOOCs can assist in overcoming the divide. MOOCs intervention can reinforce both access to materialistic

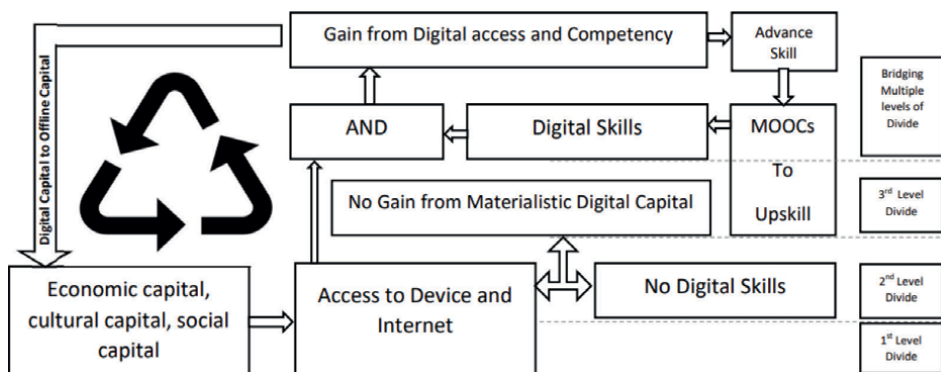


Figure 4.

MOOCs to convert digital capital to offline capital and bridge the multilevel digital divide. Source: Authors' elaboration using Gómez and Ragnedda & Laura Ruiu [52, 53].

access by converting online capital to offline capital. Also, MOOCs can enable the opportunity to overcome the second-level divide and exponentially enhance skills.

9. Digital accessibility challenges in MOOCs

Disability affects approximately 16% of the world's population, of which 2–4% have severe difficulty in functioning [54]. The worldwide prevalence of disability is increasing because of the ageing of the population, the fast spread of chronic illnesses, and advancements in the methodology used to quantify impairment [54]. Nevertheless, people with disabilities (PWD) are entitled to equal protection under the law and access to human rights [55]. Likewise, PWDs should have equal access to lifelong learning opportunities to enhance their living experience. MOOCs can provide online learning opportunities to all and allow and empower those who might be excluded due to disability.

The significant advantage of MOOCs is that they are accessible online to everyone. Nonetheless, this raises the question of the accessibility of MOOCs for PWD. Given that certain MOOCs depend largely on multimedia material, accessibility must be considered. Everyone must have access to videos, presentations, audio lectures, and rich content. Videos should have captioning to guarantee that all participants can interact with the topic. Accessibility issues and variable information literacy among students can raise challenges when participating in MOOCs. If participants cannot access, comprehend, or interact with course material, it will be impossible to evaluate their learning will result in social exclusion of PWD. Accessibility is a crucial dimension of the MOOC movement to accommodate people with different types of disabilities to open learning opportunities for PWD [56]. However, empirical evidence indicates that little progress has been made too far in generating universally accessible MOOCs or customising MOOCs to fit the requirements of PWD [57]. It is perceived that PWD can get equal benefits from MOOCs; hence, MOOCs should be utterly accessible to participants with disabilities [57]. There is a general consensus that the issues with MOOCs and PWD are not adequately monitored and understood. Along with that, the capacity of MOOCs providers to design completely accessible UX and develop accessibility policies has not matured [57]. Low stakeholder commitment and capacity levels might lead to difficulties for PWD that result in exclusion.

10. Web content accessibility guidelines for inclusive MOOCs

MOOCs are often delivered through websites where learning materials are presented to participants using web content. Therefore, inclusive MOOCs design should address the accessibility features of the broadcasting website. A website is accessible if its content is accessible to a wide variety of persons with disabilities, including those with visual impairment, hearing impairment, speech difficulties, restricted mobility, learning and cognitive limitation, photosensitivity, and various types of disability. Tim Berners-Lee, the World Wide Web inventor and director of the World Wide Web Consortium (W3C), states, “The power of the Web is in its universality. Access by everyone regardless of disability is an essential aspect” [58]. In order to ensure accessible MOOCs, the web content associated with the MOOCs should be developed following the Web Content Accessibility Guidelines. The Web Content Accessibility Guidelines (WCAG) are guidelines issued by the Web Accessibility Initiative (WAI) of the World Wide Web Consortium (W3C), the leading body for developing world-wide Internet standards [59]. WCAG is a collection of guidelines for making Web content more accessible for individuals with disabilities [59].

The WCAG is evaluated based on three conformance levels, ranging from A to AA and AAA. According to the guidelines, for users with disabilities, web content must be “Perceivable” & “Understandable” (covering necessary requirements for images (i.e. alternative text), audio, and visual design), “Operable” (outlining crucial practicalities like keyboard use and task completion time), and “Robust” (e.g. regarding cross-browser compatibility) [60]. Several versions of WCAG guidelines have been revealed over time, including WCAG 2.0 that was released in December 2008 and became an

Check point	WCAG 2.1 criteria
Skip links	WCAG 2.1-2.4.1
Alternative navigation	WCAG 2.1-2.4.5
Focus is visible	WCAG 2.1.-2.4.7
Keyboard operable	WCAG 2.1.-2.1.1,2.1.2,2.4.3
Page structure	WCAG 2.1.-1.3.1,1.3.2,2.4.6
Reflow and magnification	WCAG 2.1.-1.3.2., 1.4.4, 1.4.5, 1.4.10
Page titles	WCAG 2.1-2.4.2
Consistent navigation	WCAG 2.1-3.2.3
Consistent icons and labelling	WCAG 2.1-1.3.1, 3.2.4, 4.1.2
Image alternatives	WCAG 2.1-1.1.1
Link text	WCAG 2.1-2.4.4
Colour contrast and meaning	WCAG 2.1.-1.4.1,1.4.3.,1.4.11
Form field labels	WCAG 1.3.1,3.3.2
Error messages	WCAG 3.3.1,3.3.2
Alternative media	WCAG 1.2.2,1.2.3,1.2.5
Pause or stop motion	WCAG 2.1.-2.2.2

Table 1.
Essential WCAG 2.1 checklist to ensure web-based MOOCs accessibility, source: Authors’ compilation following WCAG 2.1 [62].

ISO standard (ISO/IEC 40500:2012) in October 2012 [59]. In June 2018, W3C published WCAG 2.1; in December 2021, a draft of the extended guideline was published as WCAG 3.0, a successor to WCAG 2.2 and earlier versions [61]. However, it does not deprecate them. Before launching MOOCs, it is strongly recommended to at least check for the following 16 WCAG 2.1 criteria (see **Table 1**) and publish the contents for participants once they pass the evaluation [62]. Otherwise, inaccessible MOOCs can result in digital divides for PWD. In contrast, accessible MOOCs can work towards bridging digital inequalities by enabling access for every user across every device.

11. Following universal Design of Learning for MOOCs

Course designers and educators have adopted the Universal Design for Learning (UDL) concept for designing and delivering online courses from the perspective of meeting the requirements of diverse learner groups via purposeful planning [63]. UDL is a collection of concepts to develop learning curricula that provide equal learning opportunities for all participants [63]. UDL facilitates the development of accessible learning outcomes, resources, and evaluations. This method enhances the learning experience for all participants, including participants with disabilities [63]. With an emphasis on digital equality that transcends beyond enabling access to devices and reliable Internet, UDL provides principles to help learners via personalisation that acknowledges each learner's needs and skills. When using UDL in designing MOOCs, it is highly recommended to adhere to the following three key concepts (see **Figure 5**), which provide more flexibility to accommodate individual requirements, particularly PWD [64].



Figure 5.
Universal design for learning guidelines version 2.2 source: [64].

- **Multiple modes of student engagement** that engage learners' interests, suitably challenge them, and inspire them to learn.
- **Multiple methods of representation** that provide several approaches for students to obtain information and construct knowledge.
- **Multiple means of student action and expression** that provide alternative ways for learners to demonstrate what they have learnt.

When MOOCs are created utilising UDL, it implies that learners are given priority above educators' and providers' preferences, and institutional decisions reflect learners' circumstances and objectives. UDL also contributes to ensuring digital equality for all learners, including those with disabilities, by providing platforms and resources which are accessible and compatible with the software and hardware that is offered to students, such as assistive devices.

12. Conclusion

Massive open online courses are compelling, but stakeholders must consider their application thoughtfully. MOOCs have been criticised for their poor completion rates, limited teacher involvement, and inadequate evaluation methods. Remarkably, the access inequality phenomena have been raising concerns while MOOCs are being rapidly adopted. Nevertheless, the first level of the digital divide (access gap to ICT) has been found frequently discussed in the MOOC movement. However, the evolving nature of the digital divide concept suggests that MOOCs are challenged by multiple forms of digital divides. Therefore, mass adoption of MOOCs tends to develop a digital underclass and limit the opportunity to gain offline benefits from digital access and MOOCs. This chapter discusses the underlying multilevel digital divide concept linked with MOOCs. Also, the current chapter synthesises empirical evidence devising strategies to utilise MOOCs as a self-reinforcement tool to bridge the multilevel digital divide. Apart from multiple digital access inadequacies, PWDs are experiencing hurdles in accessing web-based MOOCs resulting in digital divides for learners with disabilities. This chapter discusses the strategies (i.e. WCAG, UDL) that may aid MOOC administrators in incorporating accessible MOOCs into existing learning programmes or developing new courses by carefully identifying the learners' needs using UDL and following WCAG.

The MOOC movement set off its journey acknowledging free and open education for all. Empirical evidence found that multiple forms of the digital divide and inaccessible MOOCs to diverse learner groups may deviate the MOOC movement from its pursuit. However, careful design and development approaches can overcome the digital divide challenges in MOOCs and foster digital equality in the digital learning paradigm.

Conflict of interest

The authors declare no conflict of interest.

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Perspective Chapter: University of Everywhere and Online Collaborative Learning Environment

Foziah Gazzawe

Abstract

In this chapter, the focus will be on how modern technology has changed the concept and ideas of education in colleges and universities, how technology has been adapted to education, and the benefit of using it to facilitate the educational process by both lecturers and students. This research is important as it will demonstrate the effect e-learning has on educational methods, and the relationship technology has in improving the educational process. It was found that the University of Everywhere has solved the basic problems of providing one-to-one education to large numbers of people regardless of where they are located, in addition to the most important advantage of the idea of courses and education *via* the Internet and how the online collaborative learning environment allows more students to participate fully during classroom time. This chapter is useful in demonstrating to learners how they can continue to study even after they graduate from schools and universities by accessing the MOOC that is available free of charge and upon request, which helps in achieving a more participatory learning culture. This chapter also makes software recommendations for students and addresses critical features needed within the tools.

Keywords: University of Everywhere, perspective of e-learning, MOOC course, collaborative learning, online course

1. Introduction

This chapter will discuss the ways in which education currently contains different methods and tools, and the way this has changed the culture of e-learning. This has in turn changed the conceptualization of e-learning. For instance, the concept of a flipped classroom, whereby the teacher can create videos and interactive lessons, provides instructions, which can be followed remotely. This therefore demonstrates how technology can facilitate the process of learning online. The effects of this e-learning will also be discussed in regard to practical and financial constraints, and in comparison, with in-person learning. The motivation for this research is to provide

a perspective into the current e-learning techniques and what routes are available for students to consider.

1.1 E-learning

E-learning, according to Haythornthwaite and Andrews [1], “constitutes more than a specific environment or site for learning; and that something is happening to the nature of learning itself that makes it different from learning as it has been conventionally conceived” (p. 47). Thus, e-learning is not just a variant of conventional learning. While it can be compared to conventional learning, it must be seen its own and must be continually studied.

Having Internet access can be said to facilitate learning everywhere or anytime. Ubiquitous learning refers to the availability of learning anywhere in such a way that day-in-day life is synchronized with the use of the computer. It becomes a normal thing to carry on with life at all circumstances. Through conversion and continuous digitization, we can say that Internet learning is made easier and an accessible form of informal education [2]. This ubiquitous computing infrastructure is what facilitates ubiquitous learning. Moreover, it supports the retrieval, evaluation, or contribution of data, and the instruction of a large amount of data to a community with similar interests. Ubiquitous learning is achieved with the aid of the various applications that locate, consume, support, and produce knowledge [3].

E-learning therefore makes the process of learning easier. It moves learning out of the classroom making a virtual school as contemporary education is graced online. Ubiquitous learning therefore aids in the utilization of resources that would have been taken for granted. Ubiquitous learning helps in realizing which views are required in terms of the many groups or pools of the same knowledge [3].

1.2 Social-technical E-learning

As e-learning is introduced to our learning institutions we have to look into its relationship with society. The social-technical perspective of e-learning focuses on the digital technology introduced to enhance informal learning. Advancing technology has a significant impact on the learning environment and how students learn in the contemporary world. Hayashi and Baranauskas [4] argue that it is important to understand the learning setting needed in the integration of education technology [1] in modern schools. Technology can take different forms in different contexts. That is, depending on the social, institutional, or political contexts hence the need for an evaluation.

Haythornthwaite and Andrews [1] discussed more on how adopting e-learning is of more importance than choosing an ideal technology. However, it is the active process where the service of learning is continuously balanced socially and technically. Technology and its proposed context of use are therefore tested using theories and social approaches to ascertain whether it can be accepted in the subject matter, institution, student body, or societal context. E-learning is evolving to a more collaborative style of learning where students are faced with change. In this case, students need to take active responsibility for working together and sustaining a discussion, while the teacher takes the role of being their facilitator [1].

This socio-technical alignment to address efficiency is also apparent in the new technology that has made MOOCs (Massive Open Online Courses) available to students around the world. A class of thousands of students in higher education was

not conceivable years ago, but it is an increasingly common occurrence. In an article that discusses the differences in MOOC theories, González-Castro et al. [5] found there were eight major distinctions: connectivist, knowledge is generative, coherence is learner formed and instructor guided, interactions are distributed, multi-spaced, synchronization, resonance, innovation and impact focused, fostering autonomous and self-regulated learners. According to González-Castro et al. [5], “In a MOOC, learners possess different levels of knowledge.” MOOCs will be further discussed in this chapter.

Current issues with e-learning include technical difficulties such as connection issues, and audio and video issues, as well as student disengagement. Furthermore, there is an argument for e-learning content being too theoretical in nature and thereby is not as effective as in person teaching. Nonetheless, these problems can be addressed through appropriate measures. For example, providing recordings of the content for students to review in case of technological issues. Furthermore, students can be kept engaged through the design of interactive lecture content, as well through setting tests, time limits, and asking for feedback.

The next sections will delve into more detail on e-learning and the current issues and advantages it presents.

2. Research gap

Different research gaps are identified from the reviewed works of literature pointing to the need for developing more knowledge regarding online collaborative environments. Currently, there is limited knowledge on how to improve learner engagement and utilization of online resources by learners. The current design of programs to support online classes is not anchored on the specific needs of each student as learners may encounter different challenges in adapting to an online curriculum and supportive technologies. Although studies have acknowledged the need to adopt modern pedagogies for online learning, there is limited knowledge from studies that prescribe approaches and theories of learning that can be implemented in an online collaborative environment. Most of the current studies have made inquiries on online learning programs that follow the curriculum of the on-campus course where both physical and online classes occur. There is a need to analyze e-learning from the perspective of emerging online programs that are entirely online education and that learners are geographically dispersed.

3. Literature review

3.1 Cross-cultural issues

As the availability and accessibility of online learning increases, so do the number of students from around the world and the possibility of cultural differences. While the online collaborative learning environment allows more students to participate fully during classroom time, there is a multitude of cultures, styles, and institutional cultures that influence the online classroom. However, Haythornthwaite et al. [6] note that “the irony is that what is seen as a ‘global solution’ to learning may well impose upon cultures an inappropriate model of learning.” Likewise, Baker and Digiovanni [7] discuss the notion of the standardized curriculum in their article,

about the basics of teaching related to culture: personal response to the single curriculum. While the rise of online learning has ironically imposed a Western idea of learning on a global audience of students, Baker and Digiovanni [7] suggest that it is important to consider the use of multicultural education. They argue that the current educational reform comes from a framework that excludes the opinion of teachers and students. Schools will benefit when the curriculum expands to provide different options so that students become knowledgeable enough and find opportunities for self-interaction [8]. They found that by being flexible with their curriculums, teachers can adapt to the changing needs of their student population. They believed that the student use of narratives allows students obtain a greater understanding of the curriculum as well as find ways to increase the culture of applying the curriculum to current and prior knowledge [9]. Again, it is the responsibility of educators to understand the possibility of their students' cultural differences as they design their curriculum.

The creation of a curriculum in e-learning must be developed with regard to the students they are serving. For example, the City College of New York used Culture Quest, a professional development program considered to train teachers to essentially lead learners through inquiry-based examinations of different civilizations [10]. This program helped give educators a better understanding of classrooms with international students. In addition to teaching them about the technology used in blended classrooms, Culture Quest also taught them about cultural differences and cross-cultural issues. With the accessibility of MOOCs, the student population is now drawn from throughout the world. It is a more diverse and culturally aware online classroom today and professional development like Culture Quest is necessary.

3.2 Researching E-learning

E-learning is a fast-changing and ever-evolving field of study. Just as the exclusion and inclusion of different segments of students occur due to technological advances, current theories of e-learning must be re-evaluated. According to Haythornthwaite and Andrews [1], e-learning needs a new theory of learning, as this new theory applies to all disciplines and different fields of e-learning. In his blog "Don't follow the crowd," Beasley [11] believes that historically black colleges need a new theory of learning in the digital age. The author discusses the differences at the colleges, which include different student populations. Beasley [11] states that online programs are a very developed part of an increasingly evolving area of e-learning and are usually known as "disruptive." This description represents the advancements that have not been adopted by organizations. The continued research of e-learning in universities in America and internationally, along with today's evolving technologies, has contributed to a new type of global curriculum and a more participatory culture of learning. As stated by Haythornthwaite and Andrews [1], "e-learning needs to use traditional theories of learning and work on developing them using modern dimensions that apply to the principles and practices of e-learning (learning as an effect of communities and the navigation of their interconnections by learners), transformation, and emergence."

In Ref. [12] case study of the Blackboard system, a conceptual model was created to determine student satisfaction with e-learning. The study found that learners' characteristics will affect learners' perceived fulfillment and perceived usefulness of a product. The study also showed that multimedia instruction and other interactive learning activities influenced the students' perceived satisfaction. As the e-learning

field continues to evolve, researchers must work with these data to create more effective online courses. From the university to the teacher to the student, e-learning research must be done on every level in order to generate a more effective curriculum and, eventually, better learning opportunities.

3.3 Physical campus and classrooms

Due to the contributions of Harvard, MIT, and other institutions to the field of online education, more learners around the world are able to attend these universities for free. This was not possible years ago, but as technology has changed the way people are educated, it has also changed the accessibility of this education. As noted in a previous sub-entry, the economics of higher education are changing the field. Student debt has risen, but with the advent of online education, this can stop the increased debt. Students are not required to pay thousands of dollars to attend one class at a physical campus. For example, they can now attend a class at Stanford University from their home in India. The physical campus and classrooms of a university are not necessary for the international student to attend and to participate in a course.

However, the physical campus and classrooms are not being eliminated. According to Blumenstyk [13], even those that are not as architecturally or artistically lauded still hold significant value, offering not just the classroom and laboratories of official education but the opportunity for students to cooperate more informally with their lecturers [14]. There is still value in the physical campus because most universities use the facility grounds for recruiting purposes. Students want to see where the classrooms are and feel like they are part of a college environment.

3.4 Software recommendations

The online courses and universities continue to grow so software that is capable of handling bigger workloads is needed to manage in the higher education institution. There are now many software programs and websites that claim to do this task. This type of software is crucial to the survival and growth of online education. According to Carey, one of the basic principles of effective online instructional design is the continuous assessment of how students are learning, their progress, and their knowledge acquisition [15]. Teachers must diligently assess their students' progress and likewise, administrators must constantly assess the need to upgrade or replace computer software and hardware. Tools such as Software PhD can help tremendously when performing these tasks.

One software design that the author thought could be useful for higher education is a tool for assessing university credentials for awarding degrees. For example, my software design would assist the university with monitoring a student's grades and proficiency before awarding a degree. This is similar to Blackboard and other online tools, but the current tool would be more advanced and it would be able to test students more accurately in their knowledge and skill level.

With the current software design, it would help universities counter what Carey [16] wrote in Chapter 9: Time-based degrees reinforce and augment the strength of rare and expensive institutions, and academic degrees show little about what was learned [17]. Traditional universities were the only institutions that students believed they could earn their degrees. The hybrid universities have changed this perception and the current software design would continue to develop the institution's ability to

award meaningful degrees. It would not be just an accumulation of course units or a grade point average, but it would be an assessment of a student's ability to utilize their acquired knowledge. They would use the software to complete tasks that were relevant to their field of study. The software would manage their grades and the course resources like Blackboard, but it would go beyond these functions and transform the way a student would earn a degree.

3.5 Disruptive technologies

Disruptive technologies are described as “Innovations that create an entirely new market through the introduction of a new kind of product or service, which is initially judged to be worse on the basis of the performance metrics that mainstream customers value” [18]. The disruptive technologies of today have enabled the hybrid and online universities to continue to grow in influence and stature. In chapter 8 of Carey's book [16], he looks at how Harvard and MIT have used technology to open up its virtual doors to learners who want to experience higher education at two of the top schools in the world. According to Wing [19], the emergence of technology and its use to obtain courses *via* the Internet have the greatest impact on changing the methods of education and that Harvard and MIT acknowledge the influence that technology is having on education.

Likewise, according to Carey [16], the research by MIT continues to build on Moore's law and is said to be the reason for the Silicon Valley business model and the higher-education technology revolution. Institutions such as MIT contribute by developing the technology as well as implementing into their own business models. The disruptive technologies have changed the accessibility and cost of attending classes at these top schools. Additionally, the quality of these courses can be analyzed more closely [16]. The value of individual courses is often overtaken by an institution's good repute and standing. It is not always the case that these individual classes maintain or live up to that expectation and standard. Increasing accessibility also increases the visibility of the online courses; thus, the university itself is under more intense scrutiny.

With this scrutiny, online higher education can improve and offer students a better learning experience. As Haythornthwaite et al. [6] writes, The technology ultimately exceeds the performance of prior products and develops to the level that it satisfies the majority market. Firms that support the disruptive technology “displace incumbent firms that supported the prior technology.” These new technologies can offer a more student-centered learning experience. For example, there can be more student-generated content and collaboration on blogs and discussion boards. Students can also access course resources at their convenience and repeat lessons online as necessary. These features can be utilized at a lower cost for students, even as the visibility of these online courses increases.

3.6 Online collaborative learning environment

As more learners take advantage of the free online courses, their influence is being felt. Students from around the world participate in these courses and teachers have included them, thus creating a more participatory culture of learning. Much like DuoLingo and other educational applications, MOOCS has been more student-centric than courses in the past.

The online collaborative learning environment allows more students to participate fully during classroom time. Just as the exclusion and inclusion of different segments of students occur due to technological advances, current theories of e-learning must be re-evaluated to incorporate the influence of cultures and contributions from around the world. This collaborative learning environment was apparent in the case of [20], a Mongolian teenage learner who earned a perfect score in an MIT MOOC. After earning his score, he was offered a job at MIT, where he helped improve the school's MOOCs. The school learned that even though he did not take any of the prerequisite courses, he was able to find free resources on the Internet and taught himself the necessary skills to complete the MIT course. After he started working at the company, MIT produced an online course entitled "tutorials for some key concepts that students might not know" [20].

The promise of free online education for all may not be possible. According to the study MOOCs: Expectations and Reality, the costs of MOOCs are significant, and generally, the indication suggests that MOOCs are currently falling far short of "democratizing" education and may, for now, be doing more to rise gaps in access to education than to reduce them [21]. Likewise, in the journal *Inside Higher Education*, Straumsheim [22] noted that Coursera, a MOOC provider, is trying to find a working business model. The website still offers most college courses for free, but has started to charge for certain classes and certificates because financial reasons are behind its decision to custody some students up front. There must be the revenue generated at some point; thus, certain MOOC providers offer a paid option to receive academic credit for completed courses.

In addition to the feasibility of free online education is the issue of effective online learning. In a blog about learning through a MOOC, Hao [23] noted that to take benefit of resources like MOOCs effectively, a learner has to be able to think critically, understand clearly the knowledge structure of a subject and his/her own abilities, constantly detect learning issues, search online for additional learning material, and seek support through an individual studying network. Is the standard university student ready for this type of education? [23]. Current research must continue to analyze the effectiveness of online learning. As Blumenstyk [13], writes in *American Higher Education in Crisis?*, investigation by the community college research center have found that community college students, who are more likely to be low-income and less-prepared educationally, extract from virtual courses at a upper rate compared with face-to-face courses [24]. Although students have access to more technology than before, they may not be ready for the demands of online learning. This e-exclusion will continue to grow if educators and learners do not have the technical skills necessary to teach and learn in an online environment.

As shown in these examples, the democratization of higher education is not as clear-cut and positive as many portrayals of them have been. Further research is needed on online learning and its effectiveness as more universities continue to add MOOCs to their catalogs. The global curriculum and increased online collaboration have helped create more learning opportunities for students around the world, but we must ask ourselves if it is effective. As Carey [16] noted, the creation of the modern university system in America could be coming to an end because of the rise of MOOCs, but we must be determined not to repeat the mistakes of the past: "It is a deeply flawed, irrational institution designed to be bad at the most important thing it does: educate people" [25].

3.7 Summary of literature review

The main issues addressed in the literature review include a multicultural dimension of online education, re-evaluation of research theories of e-learning, accessibility of physical educational facilities, e-learning software, disruptive technologies in online education, and the effectiveness of MOOCs. Designing an online education curriculum should consider the cultural differences of online learners to adapt to their needs better. While studying the models of learning in an online environment, previous studies have pointed to the need for incorporating new theories that apply to the principles and concepts of e-learning. Using modern theories in the research of e-learning would facilitate the development of better curriculums for online courses. Apart from the re-evaluation of theories, various works of literature have pointed to the need for physical campus facilities such as laboratories and classrooms to support student cooperation and integration.

Software like Blackboard is an interactive learning management system that has continuous assessments of students' learning progress and knowledge acquisition. Software like Blackboard can effectively track a student's grades and proficiency to enable the school in awarding degrees and certificates. The main challenges with learning software like Blackboard and Moodle are the complexity of navigating through tasks and the limited capability of assessing learners' knowledge acquisition. An important element of an e-learning software system is to effectively assess the knowledge and skills learners acquire throughout the course rather than grading based on point average. Similarly, various works of literature have mentioned the role of disruptive technologies in promoting better learning experiences in online classrooms. A notable contribution of disruptive technologies relates to the shifting of accessibility and cost of attending higher education.

On the other hand, there are some shortcomings relating to the reviewed literature. Most of the reviewed studies have not documented the effectiveness and feasibility of fully online learning as a substitute for physical classes. There is still a knowledge gap on how to effectively utilize the learning management systems in an online class, especially with regard to students' motivation to utilize the vast resources in the system. Learners may face different challenges in fulfilling the demands of online classes; thus, more research is needed to evaluate the strategies for developing teachers' and learners' technical skills needed in navigating an online environment. Although online classes proved to be effective in the democratization of higher education, very little is known concerning the challenges that may face by those requiring practical lessons like lab tests. More research is needed to devise better approaches to incorporating physical campus facilities like laboratories into online lessons without impacting technical skill development. Due to these reasons, my research intends to prescribe the effective learning management for massive open online courses (MOOC) that promotes the democratization of higher education; an enhanced collaboration of learners and teachers; a user-friendly and interactive environment; reliable assessment of the acquisition of knowledge and skills by learners.

4. Conclusion

The University of Everywhere continues to evolve, influence, and change the field of higher education. Learners from all over the world from many types of economic situations are now able to attain their education. As technology improves, these


online colleges can provide even more opportunities to students. Traditional colleges and universities have already integrated the use of technology into their classrooms and they are now facing the challenges of economic feasibility. The University of Everywhere will continue to grow and give opportunities to more learners while also showing the weaknesses of traditional education.

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Chapter 6

MOOCS and Micro-Credentials as Launch Pads to Further Education: Challenges and Experiences

David Parsons, Hayley Sparks, Darcy Vo and Anzel Singh

Abstract

Massive Open Online Courses (MOOCs) are often framed as providing affordable, flexible ways to deliver education on a global scale. However, opportunities for further study are often neither massive nor open. This leads to questions about how MOOCs fit within the broader landscape of online education. The particular focus of this chapter is the role of accredited micro-credentials in the evolution of MOOCs and their potential to offer a pathway from the open online course to further study that leads to credentialed and stackable higher qualifications. These reflections stem from the experience of a higher education institution in New Zealand delivering both free short courses and accredited micro-credentials on a MOOC platform. Data gathered from end-of-course surveys is used to reflect on the motivation of students to engage in further study. While the data reinforce known motivational factors for learners, they reveal limited motivation to progress to micro-credentials from shorter, free courses, despite these micro-credentials successfully recruiting from other pathways. This suggests that perhaps MOOC platforms need to make a greater effort to standardize their definitions and presentation of micro-credentials, while providers need to be aware that potential students are looking for institutional credibility, affordability, content quality, and relevant topics.

Keywords: MOOC, micro-credential, survey, New Zealand, motivation

1. Introduction

Massive open online courses (MOOCs) have transformed the global educational landscape. It is now common for learners to study online, self-paced, with international providers, picking and choosing their own learning pathways from a huge range of options. As a result, hundreds of millions of people have learned using MOOC platforms [1]. In the early days of MOOC enthusiasm, particularly around 2012, they seemed to present a major disruption to traditional models of education, but more than a decade on this does not seem to have been the case. Many MOOC courses are offered by traditional universities taking advantage of online platforms, and many learners still want recognition for their learning and structured pathways towards recognized qualifications. The MOOC has therefore found itself no more than a new niche in the online learning delivery of higher education institutions that

continue largely unaffected [2]. This is not to say that they have not had an important influence on contemporary higher education. Rather, their role has become not so much as a separate competitor to the traditional academy, but rather as a provider of new routes into and through it.

This chapter seeks to explore how MOOCs offer a launchpad to further education as an informal, self-paced, affordable, and anonymous pathway to learning for anyone with access to the internet. For many, it has provided a first step to further study and more formal qualifications. This picture has emerged slowly as institutions have responded to student demands for larger courses of study on their online platforms, and more widely recognized means of credentialing. In particular, a key evolution of MOOCs has been the development of micro-credentials. Despite a rather complex and ill-defined beginning, the micro-credential has increasingly become a significant component of the MOOC ecosystem that links it strongly to more well-established and formal academic learning pathways.

1.1 Outline of the chapter

This chapter outlines the experience of one institution in New Zealand that began offering MOOC courses on a global platform in early 2021. Some of these courses were the usual free short courses for anyone to enroll in but, taking advantage of New Zealand's global leadership in the development of micro-credentials as stackable, internationally credentialed qualifications, the institution also began to offer related postgraduate micro-credentials. These micro-credentials also offer pathways to other qualifications such as postgraduate certificates and master's degrees. This chapter is therefore based on data gathered for this institution by the MOOC platform based on end-of-course surveys that we believe offer some useful insights into the challenges of integrating both MOOCs and micro-credentials into effective learning pathways.

The chapter is structured as follows. First, reviewing the literature, the background to MOOCs is briefly outlined, followed by a discussion on what motivates learners to enroll on, and complete, MOOCs. Taking the perspective that a key motivating factor is a progression towards other formal and credentialed studies, the chapter then explores aspects of credentialing of MOOCs, and the emergence and role of micro-credentials.

The specifics of the experiences of the New Zealand institution are then explored, along with some student data related to the MOOC experience. The chapter concludes with some discussion of related work and reflections on the future role of MOOCs and micro-credentials.

2. Background: what is a MOOC?

MOOCs are Massive Open Online Courses. In order to qualify as a MOOC, a course must be a free, web-based distance learning program that is designed for large numbers of geographically dispersed students [3]. These characteristics are strengths but also weaknesses since they undermine student motivation to enroll in, and complete, MOOCs that are defined in this narrow way.

Although MOOCs first appeared around 2008, specifically with the work of Stephen Downes and George Siemens in creating the first connectivist MOOC (cMOOC), they began to emerge at scale in 2011 from Ivy League universities such as Stanford University offering a few open online versions of their on-campus courses

and making them accessible to the world, with over 100,000 people signing up to learn technical topics involving relevant modern skills such as data science [4]. Since then, the number of MOOC providers has grown significantly, with MOOCs now available from a wide range of providers including Coursera, Udemy, LinkedIn Learning, Esme Learning, and FutureLearn, among many others.

MOOCs have undoubtedly opened access to learning to a mass population who would otherwise not be able to benefit from traditional forms of learning. Being able to learn at any time, from anywhere, to fit with one's schedule and with a reduced cost has driven the uptake of this learning format remarkably. In 2021, enrolment across MOOC-based platforms totaled 220 million learners (not including China). At the same time, the number of MOOC courses reached approximately 19,400 and these were developed by 950 universities worldwide [1].

2.1 MOOCs and learner motivation

Motivations for enrolling into a MOOC can range from personal interest or curiosity to learning a specific skill set for a promotion or career pivot, or even general marketability in the modern competitive professional landscape. Student perceptions of the value of micro-credentials vary widely, from valuing the evidence of learning, or the skills developed, to building interpersonal relationships [5].

There are two main groups of people who enroll in these courses, and their socio-economic background appears to play a significant role in their intention to learn and finish a programme [6]. Those who have a higher socioeconomic position and education, and those who already have a high-skilled job, are likely to benefit most from up-skilling to improve within their current job role and gain general career benefits. Those from lower socio-economic groups and education, or who do not have a highly skilled job, are more likely to benefit from re-skilling to transition to a new job, gaining tangible career benefits. A literature review looking at the perceived value of MOOCs in Australia noted three major themes as; flexibility for learning, on-demand, lifelong learning in a rapidly changing workplace, and credentialing towards a formal qualification [7]. In the Indian context, motivating factors to complete MOOCs were enjoyment ("hedonic motivation"), habit, and the course content [8]. These various perspectives suggest that learner motivation in MOOCs can involve many factors and these may vary between contexts.

2.2 Factors in non-completion of MOOCs

Although MOOCs consistently have a significant uptake in terms of student numbers, their extremely low completion rate in comparison to the number of students enrolled brings into question the true value of the MOOC. Specifically, if so many people are signing up, why do so few end up finishing?

There may be many reasons why learners do not complete a MOOC. One limitation is they are not interactive enough - there is no one to hold learners accountable or to provide an opportunity to talk through the learning process. According to a study of recently graduated occupational therapists adopting MOOCs for their growth, a lack of synchronous learning stood out as a key criticism by these healthcare professionals, suggesting that it should be included to provide a better learning experience [9]. Other reasons for not completing MOOCs include lack of time, finding them less effective than traditional learning, technical barriers, and monotony [8].

2.3 Motivations to complete MOOCs

By making sense of why students hesitate to complete a MOOC we can begin looking at whether providing solutions to the current problems with MOOCs would lead to higher completion rates. One way in which MOOCs have been addressing this question is by integrating them with more formalized courses as pathways to accredited academic programmes. This has seen an evolution of the MOOC into something that can sit within the same framework as traditional education programmes as a cost-effective and low investment steppingstone towards pursuing a new area of study with a lower level of commitment through self-paced learning. The focus of the next section is connecting MOOCs to related programmes at academic institutions by applying meaningful credentialing frameworks.

3. Credentialing and MOOCs

When MOOCs first began, Coursera was one of the pioneers, developed by Stanford computer scientists in 2012 [5]. While their courses were modeled after the existing for-credit and on-campus courses in the university computer science programmes, it was clear that at the time, learners who completed the MOOC courses were not awarded any university credit [10]. Since then, there have been two distinct approaches to credentialing on MOOCs: one is moving further away from formal credentialing systems to offer a clear alternative, but the other is the formalization of digital credentialing. The former direction has driven the vast range of diverse topics and content of courses in an attempt to differentiate themselves from traditional institutions' accredited courses. The latter initiative means that learners can earn academic credits granted by associated institutions if they satisfactorily meet the course requirements. According to [1], the first online master's degree offered on a MOOC platform was in 2013 by Georgia Tech. Since then, more tertiary institutions around the world have continued to add a range of credentialled MOOC-based courses including master's degrees, bachelor's degrees, and micro-credentials. In addition, there has been a collaboration among universities in digital credentials. 2019 saw nine universities in Europe, the US, Canada and Mexico working together to create a standardized system for sharing and verifying academic credentials issued by participating institutions [11]. Later that year, the European MOOC Consortium developed the Common Microcredential Framework, aiming to "create a new kind of international and portable credential in the area of lifelong learning" [11].

3.1 Micro-credentials and MOOCs

In a world in which education providers and national administrations are constantly looking for new ways to meet the needs of both students and wider society, the concept of micro-credentials has been widely embraced in recent years, alongside other potentially disruptive forms of credentialing such as nano degrees, digital and open badges [12, 13]. Micro-credentials emerged from the large MOOCs established in the 2010s, along with the later moves towards digital badging, a move to credentialise collections of MOOC learning units, and subsequent interest from formal higher education [14, 15]. This somewhat untidy emergence of different terms and offerings has led to a "chaotic landscape of unbundled credentials" [16], so it is

helpful to explore the various definitions of micro-credentials and identify their key characteristics.

Micro-credentials provide learning that is smaller in scope and duration than traditional vocational or higher education qualifications, focusing on specific in-demand subject areas. Being relatively short, they can provide rapid upskilling, particularly for mature learners already in the workforce [17]. They offer more options at lower costs to combine education and job training, providing employees with better skills and the capacity to learn [18]. Unlike traditional large-scale qualifications, they can be developed quickly to adapt to changing demands [19]. What constitutes a micro-credential is something that has been evolving and becoming more diverse over time. However, the key elements are identified by the name, in the sense that 'micro' implies a small learning component and 'credential' implies that unlike, for example, a commercial training course, the qualification carries accreditation from a recognized learning provider. Beyond that, there is little consistency. For example, the length of micro-credentials varies from 1 to 15 months, with prices from around \$20 to around \$20,000, and time commitments ranging from just 1 hour per week to 40 hours [20]. This diversity makes it difficult to talk about micro-credentials generically and raises many questions about their definition and role, as discussed in the next section.

3.2 Questions relating to micro-credentials

There is still limited academic research in the field of implementing and sustaining micro-credentials in higher education [13, 21] and there remain many questions about their character in practice and their overall philosophy. Areas of debate include what levels of education they should address, how many hours of learning they should be, how much they should cost, whether or not students may be able to seek scholarship or loan support to study, and whether these qualifications could be in some way 'stackable' to become components of a larger, and perhaps more traditional, type of qualification [13, 22–24].

National policies vary. The Australian National Microcredentials Framework recommends stackability [25] while the Irish Universities Association [26] takes a less specific line that some micro-credentials may be stacked into larger credentials over time, and in Ontario, the integration of 'micro-certifications' into larger qualifications is assumed [27]. The lack of standardization makes it difficult to compare the micro-credentials from different providers [20]. In an effort to provide a set of standards, the European Union has defined 10 principles for micro-credentials, that they should provide: Quality, transparency, relevance, valid assessment, learning pathways (including stackability), recognition, and portability, and be learner-centred, authenticated, and be supported by suitable information and guidance [28].

There are many reasons why potential students might want to study micro-credentials as opposed to other types of qualifications. These include wanting to increase income, apply skills to practice, and develop professionally using a rigorous framework for learning [22]. However, there is also an expectation that the topic of a micro-credential is one that serves an identified need in the marketplace from a stakeholder (e.g., employer) perspective, rather than just from a student perspective [17]. Micro-credentials meet the need for units of learning that are (1) very thematically focused, (2) updated frequently, and (3) provide an easily shareable, informationally transparent digital object [29]. There are also design considerations such that different micro-credentials might emphasize different design elements based on their content. They might be self-directed using online materials (the instructional design

and online platform both need consideration), job-embedded, competency-based, and/or research-based, and they should not have a one-size-fits-all approach [22].

3.3 Micro-credentials and pathways

One perspective on micro-credentials is that they can bridge the gap between MOOCs and full online accredited programmes [30]. However, according to [20], who analyzed 450 micro-credentials, the range of courses on offer means that not all of them provide pathways to other academic credits. The main thing that differentiates MOOC micro-credentials that lead to other academic programmes is the hours of work required to complete them. In an attempt to provide a broad definition of such qualifications, [31] refers to ‘mesocredentials’ as certifications that provide academic credit for MOOC achievement from a recognized academic institution, with academic degree programmes being ‘macrocredentials’. In this model, ‘microcredentials’ are MOOC courses that just provide badges and certificates of completion. It is therefore important to note that this chapter focuses on micro-credentials that meet the EU criteria of stackability, recognition, and authentication [28].

3.4 Academic micro-credentials in New Zealand

Although micro-credentials did not originate in New Zealand, the New Zealand Ministry of Education has taken a lead in addressing alternative credentials in their policies [32], and was an early adopter of micro-credentials bearing academic credit. New Zealand micro-credentials must be approved by the New Zealand Qualifications Authority (NZQA) and are therefore subject to the same requirements as other accredited training programs. They must be between 5 and 40 credits in size (one credit is 10 hours of study), meet a demonstrated need from employers, industry and/or community, not duplicate any learning already approved by NZQA and be reviewed annually to confirm they are meeting their purpose [33]. New Zealand’s definition of micro-credential is relatively broad, including both the definition widely used in the United States, of alternative credentials that consist of more than a single course but are less than a full degree, and the European Higher Education Area (EHEA) definition of a micro-credential as a sub-unit of a larger credential with specified minimum credits [32].

The first pilot courses were offered in 2017. Despite initial resistance to micro-credentials being able to count towards other qualifications by New Zealand universities [34], they have since become stackable into larger qualifications such as certificates, diplomas and master’s degrees. However, most of the micro-credentials approved by the New Zealand Qualifications Authority at the time of writing are offered at low levels of the qualifications framework (sub-degree) and mostly provide only a small number of credits. Currently, only a handful of institutions offer micro-credentials at the postgraduate level, but their potential to stack to larger postgraduate qualifications offers an opportunity for research that may inform future developments in this area.

4. Context of the study

The study context described in this chapter is a private graduate school in New Zealand that was established in 2014, initially in partnership with a publicly funded

Polytechnic but, since 2018, operating as a private training establishment. The institution offers a range of qualifications, primarily at the postgraduate level, and consisting of postgraduate certificates and master's degrees alongside a range of other courses that include those offered on MOOC platforms, which include free short courses alongside longer accredited micro-credentials, and these micro-credentials are stackable to larger qualifications. These micro-credentials are compatible with the European MOOC Consortium's Common Microcredential Framework, with a total study time of 150 hours and equivalent to level 6 or 7 in the European Qualification Framework [32].

When the institution initially began offering micro-credentials in early 2020, these were at the undergraduate level, not stackable, and not offered on MOOC platforms, so only available to domestic students. However, conversations with a global MOOC platform led to a move towards offering free courses on that platform, as well as micro-credentials that were both postgraduate level and stackable. The free courses were designed as pathways into the micro-credentials, while the micro-credentials were also pathways into other studies.

In June 2021, the institution offered three short courses (open, and online) on the MOOC platform, aiming to provide learners with an introduction to future-focused thinking and practices in education, technology, and leadership in sustainability. The number of students taking these courses reached more than 1500 in each. The courses are free to enroll and learners have the option to receive a certificate from the MOOC platform provider when completing the end-of-course quiz and paying a small fee.

5. Study results and discussion

End-of-course surveys disseminated by the platform provider make some data available to gauge the value of the courses for learners and address some of the questions raised in this chapter about motivation and the role of credentialing in MOOCs.

The number of responses across the three courses so far varies, with the education course having 88 responses, the leadership in sustainability course 97, and the technologies course 197 responses. This course also had the highest number of joiners (more than 1900).

In terms of the value the courses bring to learners, more than 90% of the responses across the three courses found the course met their expectations or beyond. In particular, 94% of the respondents agreed that they gained new knowledge or skills and more than 50% indicated that they had applied what they had learned since starting the course.

Open-ended question responses also supported the quantitative data. For example, respondents considered the courses' content and learning tasks were relevant to their practice and expanded their knowledge: "It's very well-structured with interesting/valuable contents, the practical tasks helped me to apply immediately what I've learnt and this is awesome." Learners also recognized that they had gained specific skills - "Best course, not only does it teach us the new way of learning, it also gives us the opportunity to enhance our skills and way of imparting education to the learners." Learners were also in many cases inspired to continue related work after completing their courses - "this course was really informative and got me thinking about future renewable projects." These responses suggest that the MOOC courses are meeting several of the motivating factors previously identified in the literature, including course content [8], lifelong learning in a rapidly changing workplace [7] and valuing the skills developed [5].

Open-ended questions also provided insights into learners' motivation to continue learning. Respondents expressed that they would like to expand their knowledge and dig deeper into the different topics introduced in the courses, for example, a "Deep dive in gathering information regarding rules and regulation that apply and are upcoming". This links to the motivation to develop professionally using a rigorous framework for learning [22]. Additionally, being able to interact and collaborate within a community of learning drives their desire to learn more "... I'd love to be part of an international learning environment"; "I want to learn more activities that will relate to this topic and more collaboration with other students here", "Hope there's a chance to meet you again and interact online with you". These comments suggest that students have the desire to build interpersonal relationships [5], something that is hard to do in large-scale MOOCs but is more realistic in micro-credentials that often have specific cohorts moving through their study at the same pace.

Credentialing is also a theme that emerges from the open-ended survey questions. Several respondents clearly value some form of certification that they have completed the courses. "Certificates should be available to all that complete the course"; "I answered one question wrong and did fail the certification? That is very unfair after I spent the time for the whole course...". However, there is a financial barrier since several respondents indicated a lack of willingness to pay anything for certification. "I was expecting to be able to undertake a test and receive a token bit of recognition but getting to the end to find that to do this I need to spend money!", and "I wish we could take the tests and get the certificates for free, paying online is a hassle."

A key question in this chapter is to what extent completing a free MOOC course might motivate learners to enroll in a micro-credential. Many of the respondents identified topics that they wanted to study further, but these were typically focused areas of knowledge such as the circular economy, designing image-based materials, specific applications of the Internet of Things, and cloud computing. Suggestions like these indicate that our MOOC students tend to think of their next MOOC course as being highly topic based like the free samplers they had already experienced, and were not thinking about larger, certified courses. Broader concerns that might suit the scale of a micro-credential, with a few exceptions such as global sustainability and twenty first century pedagogy, were rarely mentioned. Only one respondent specifically expressed an intention to sign up for a micro-credential. "Build on this knowledge base by signing up for the Micro-Credential course. Excellent tutors - well done one and all!"

6. Related work

There is some related work that has looked at some aspects of MOOCs and micro-credentials and addressed similar questions about how learners see the role of micro-credentials as part of their education journey, particularly those who start from a MOOC context. As in our study, an unwillingness to pay was a significant barrier to credentialing. One survey indicated that fewer than half of the respondents indicated that they would be willing to pay for a certificate [1]. Factors that impact on the willingness to pay include course topics and the institution affiliation - learners are more willing to pay if the micro-credentials are offered by highly regarded institutions [32]. Of course, ability to pay is also a notable factor [35]. On the positive side, micro-credentials were seen as a helpful route into larger qualifications [36]. However, the pathway between MOOCs and these other qualifications is not one that

is widely understood. Micro-credentials are still in a “persuasion” phase, where both the benefits and challenges are still being considered [37]. Our study noted that the quality of the course was a factor in students wishing to move on to further study, a factor noted in other recent studies [36].

7. Summary and conclusions

This chapter has briefly introduced the background to, and current status of, MOOCs, with a focus on what motivates learners to enroll in, and complete, MOOC courses. It then considered the emergence and potential role of micro-credentials in providing a pathway from traditional free, open MOOC courses to more substantial qualifications (in terms of hours and recognized credits) that are certified and may be stackable into other formal qualifications.

To explore student motivation in the context of MOOCs and micro-credential qualifications in a specific context, the chapter analyzed some data gathered by a New Zealand higher education institution that has offered both short open courses and micro-credentials on a global MOOC platform. Using anonymised student end-of-course survey data gathered by the MOOC platform, some specific issues identified in the literature related to learner motivation to enroll in, and complete, MOOCs have been reinforced by this data, in particular, the quality of the course content [8], finding value in the skills developed [5], the ability to apply lifelong learning in a rapidly changing workplace [7], developing professionally [22] and building interpersonal relationships [5].

However, while these factors may cause many learners to consider further study, few were considering micro-credentials or other larger-scale qualifications. Certification did not appear to be a significant factor, since even though learners seemed to value certification in principle, as a recognition of their work, they seemed reluctant to pay for it. There was no evidence from the data available that any of the respondents had considered stackability as a motivating factor in further study (though it should be noted that no specific questions were asked about this in the end-of-course survey). A further element to consider is that the institution involved in this study offers a range of micro-credentials that, since 2020, have recruited several hundred students. However, the number of these who have come via the MOOC pathway is very small indeed, suggesting that micro-credentials do offer a valuable learning opportunity to many students but then even though they have grown out of the MOOC context, there is currently a limited demand for micro-credentials as pathways for learners enrolled in short, free courses on MOOCs.

Although the data set available for this study was limited, it appears to suggest that despite the global move towards micro-credential certification as being an available progression from other MOOC courses, the level of interest and/or awareness from learners on MOOC platforms seems to be limited. This may be a factor of micro-credentials being a relatively recent innovation in education and one that suffers from vague definitions and many variations in implementation, coupled with other related terms being used in different contexts such as nano degrees, micro-certifications, alternative credentials, and mesocredentials. It would appear that MOOC platforms need to consider new ways of encouraging those enrolled in their courses to enroll in micro-credentials, perhaps by making learning pathways, including stackability, clearer. Ensuring that all micro-credentials have consistent terminology and approaches could perhaps assist here, perhaps by adopting the European Union's

criteria, the European MOOC Consortium's Common Microcredential Framework, or a similar unified vision of what constitutes a micro-credential, and why a learner might choose to enroll in one. In addition, institutional providers cannot lose sight of the themes that consistently emerge from the literature, that potential students are looking for institutional credibility, affordability, content quality, and relevant topics in any progression from free MOOC courses to micro-credentials or other paid, credentialled programmes.

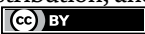
Overall, the results of our study reinforce findings from related work that an effective pathway from MOOCs to micro-credentials to higher qualifications relies on a range of factors including course quality, topic scope and relevance, institutional reputation, affordability, and awareness.

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Perspective Chapter: iPEAR-MOOC

Iris Wunder and Ruth Maloszek

Abstract

Augmented Reality (AR) has been developing rapidly in the past years, and the acceptance of this technology is growing amongst the users of smartphones and tablets. Educational applications and resources that use AR technology are also growing in both number and quality. However, most educators lack sufficient digital skills and are unaware of the pedagogical approaches necessary to use the available digital tools to advance their teaching practices and their professional development. An international team of researchers from the Friedrich-Alexander-Universität Erlangen-Nürnberg (Germany), NTNU (Norway), AETMALab (Greece), Akto (Greece) and Eucen (Spain) started an EU-funded project to explore the possibilities of engaging higher education students by combining AR and peer learning. As part of the project, a MOOC started in October 2022 (<https://imoox.at/course/ipear>) to share the iPEAR approach created by the project group. In this 4-week course, students learn about AR tools, peer learning, and how to implement the combination of both into their seminars. Participants work in peer groups to create a first augmentation and provide a pedagogical background for their projects. The chapter will describe the experiences with and results from the MOOC.

Keywords: MOOC, augmented reality, peer learning, technology enhanced learning, higher education

1. Introduction

In September 2020, the Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), together with their partners NTNU (Norway), AETMALab (Greece), Akto (Greece), and Eucen (Spain), successfully applied for funding of the project “Inclusive Peer Learning with Augmented Reality (iPEAR)” in the Erasmus+ programme of the European Union.

The project started in September 2020 and will finish at the end of August 2023. The aims of these Erasmus+ projects in the cooperation partnership strand are the development of projects with European partners to, amongst others, include sustainability, inclusion, digitalization, and innovation in higher education. These projects are not entirely research ones but include a practical approach to ensure their findings have a long-term impact.

As part of its activities, the project created a MOOC used for dissemination of the iPEAR approach, to create interest in the use of AR and peer learning in higher education and to provide a safe space to try out AR initially.

1.1 Literature review

As stated earlier, the project started in 2020 with the aim to carry out a new approach to use Augmented Reality in higher education by combining it with peer learning. At the start of the project, a literature review was carried out which identified that a wide range of literature existed on the usage of Augmented Reality in higher education.

Already in 2013, Chang et al. [1] identified the potential of AR technologies but stated that research was needed on the pedagogical issues of using AR. As Garzón et al. [2] point out in their meta-analysis of 46 empirical studies, Augmented Reality is becoming popular due to its positive effects on teaching and learning.

Kaur et al. [3] stated that Augmented Reality could fulfill the goal of visualizing interactive course content and thus enhance student motivation.

In an attempt to research how images can support learning about the past, Topouzova [4] investigates the use of AR and digital storytelling.

Yeh et al. [5], explore the usage of various multimodal modes in communication with the usage of Augmented Reality.

Furthermore, various authors have researched the impact of peer learning in higher education.

As early as 1997, Mazur [6] viewed peer instruction as a means of educational innovation and provided a manual for using it. Amongst, others, Bunting [7] identifies key elements of high-quality peer learning, such as “frequent, timely, and constructive feedback” (p. 3).

Crouch and Mazur [8] gave some evidence that peer-to-peer instruction enhances students’ conceptual understanding of science and Crouch et al. [9] state that it increases course satisfaction and comprehension. Sakulwichitsintu et al. [10] even provide a framework for peer learning to enhance the online experiences of students.

However, at that moment in time, a gap was identified in the literature on combining Augmented Reality with peer learning in higher education.

2. Background

2.1 Background of the iPEAR-project

Research has shown that “learning friends” make a difference. Students and educators, especially in the remote setting of the recent pandemic, have chosen the inclusive visual language of the internet using all forms of visuals: emoji, videos, 3D animation, QR codes, and Augmented Reality whenever possible. Visual reading and thinking are inclusive for two reasons: It helps students facing learning challenges [11] and it conveys meaning by providing a concise and memorable micro-learning experience.

Relating to the gap in the literature stated earlier, the iPEAR team wanted to carry out research on how to use Augmented Reality in the combination with peer learning and to find out how this approach will enhance student motivation and engagement.

For this purpose, 22 interviews with educators from Greece, Norway, and Germany and 214 survey data from students were collected in 2020 and 2021.

The UN Goal 4 on Quality education [12] emphasizes inclusive and equitable education by defining it as a process of systemic reform embodying changes and

modifications in content, teaching methods, approaches, structures, and strategies in education to overcome barriers with a vision serving to provide all students of the relevant age range with an equitable and participatory learning experience and environment that best corresponds to their requirements and preferences.

The iPEAR pedagogy does exactly that: it aims to support student's needs and their individual learning approaches by emphasizing the benefits of peer learning combined with visual learning in the form of Augmented Reality.

The preliminary findings of the iPEAR-project give evidence that the educational intervention can serve its purpose.

The research report will be published as a compendium of best practices, which will be presented at a conference in Athens in June 2023.

2.2 Background of the iPEAR-MOOC

As stated earlier, the MOOC is included in the dissemination of the project iPEAR. The motivation to create the MOOC was to give students and educators an incentive to try out the iPEAR-approach in a guided and safe environment so that ideas would be created to include it into their own teaching and learning.

As neither the FAU nor the partner universities were able to provide a platform for the planned MOOC with the means available, research was carried out to find the best provider for the project.

After careful consideration, iMooX was chosen, which is an Austrian platform, approved by the Austrian Federal Ministry of Education, Science and Research in January 2020. (originally offered by the TU Graz together with the University of Vienna). iMooX was welcomed by the European MOOC Consortium (EMC), the leading platform for MOOCs in Europe, in 2021 and as of January 2023 offers 120 online courses at the university level with approximately 86.649 students enrolled.

In contrast to US competitors, all contents on iMooX are not only accessible free of charge but also freely reusable. iMooX uses Creative Commons licenses, which means that all content offered on iMooX can be used for one's own teaching purposes and may also be reused free of charge.

Deriving from research on MOOC participation and the experience of the authors in taking part in several MOOCs the aim was to create a MOOC that is of a high academic standard in combination with a practical feature. To avoid "the loneliness of the long-distance learner" [13] and the known practice of participants leaving MOOCs after a few weeks, the MOOC was designed to be both time-efficient for educators who work full-time whilst being looked after by the course team.

Thus, the following criteria were set for the MOOC:

1. The duration of the course is set to 4 weeks, which are resembled by four units. During these 4 weeks, the course will be supported by the course team. However, participants can choose to finish the course within 3 months but without the course team being present.
2. The workload is approximately 2 hours per week.
3. The MOOC will consist of text, pictures, videos, and documents that can be downloaded.
4. Two synchronous virtual sessions will take place *via* ZOOM.

5. The forums should be closely monitored, with a response time of 24 hours the longest.
6. Several quizzes will be included, as well as a midterm and final evaluation.
7. A final assignment in form of a small AR-project will be requested to gain the certificate at the end of the course.

The MOOC will run twice with an iterative process of learning from the first one and embedding the findings and project ideas into the second one. The first MOOC started in October 2022 and was open until January 2023. However, only the first 4 weeks were supported by the course team. Afterward, participants could still finish the course or even start it but without support.

The second MOOC will start in April 2023. The results of both MOOCs, alongside the outputs of the whole iPEAR project will be presented at a conference in Athens in June 2023.

2.3 The content of the iPEAR MOOC

As stated in the previous chapter, the total duration of the MOOC was 4 weeks, with each week resembling one unit. These units presented the main outputs of the research project iPEAR, namely the iPEAR approach, a toolkit for peer learning with Augmented Reality and the iPEAR pedagogy to enhance student motivation and engagement.

In each unit, the participants were offered a summary of the tasks expected both as text to read and to download. The content of the relevant unit was provided by a video created by the project members of the FAU, external videos and text documents. Furthermore, optional reading lists were prepared for the first three units.

2.3.1 Unit 1: Familiarize with iPEAR

The unit informed the students about the structure of the MOOC and the iPEAR project's aims of combining peer learning in higher education with the use of Augmented Reality (AR).

Furthermore, an introduction was given on how to use the MOOC and what was expected by the participants. In detail, each week the participants received a task sheet. Furthermore, it was expected that they watch a video on the topic of the unit, read a text on the topic of the unit, answer a quiz or do an activity and communicate *via* the MOOC forum. If all these tasks were marked as completed, the participants got a badge designed by the course team in advance.

The material could be read on the screen or printed out to allow different learning styles.

It was explained that the tasks and activities would develop from small in Unit 1 to “big” in Unit 4, following our systematic introduction to AR in peer learning.

It was explained that in order to complete the MOOC, the participants had to develop a small iPEAR project suggesting an AR activity for students in a peer learning setting and describing the pedagogical concept they were using. To ensure that the project was feasible in the times stated as workload for the MOOC (2 hours per week), the project could be limited to half a page of text describing the pedagogical concept

(in bullet points) and an AR experience created and uploaded to the Assignment folders in the final unit (week four).

Participants were asked to introduce themselves in the unit's forum and to find peers by posting a picture on the iPEAR padlet. Considering European data protection laws, participants were informed about their responsibilities when using websites outside the MOOC. In total 100 participants posted in the forum and another 85 used the padlet to introduce themselves and find peers to work on their assignments.

As in all four units of the MOOC, a video created by the FAU project members introduced the unit's content. In this case, the explanation of the iPEAR project and approach to using Augmented Reality and peer learning in higher education.

At the end of the week, the course team offered a live Zoom Meeting, where they introduced the course and themselves briefly and answered questions of the participants. The meeting was recorded and then implemented in the MOOC for those participants who could not take part.

A final playlist of all videos of the MOOC can be found on YouTube [14]. This playlist includes the trailer of the MOOC, the four videos produced for each week, and the recorded Zoom session at the end of the first week.

Additionally, an optional reading list was offered for participants who wanted to know more about the authors mentioned in our videos and documents (1, 2, and 3).

2.3.2 Unit 2: Tools for building educational AR experiences

In this unit, participants learned about AR tools that can be used in educational settings or that are especially designed for educational purposes. Technically, they were introduced to WebAR and mobile AR applications.

All tools that were described in the iPEAR-Toolkit can be downloaded from the iPEAR website [15]. However, for the tasks and activities of this unit, it is not necessary to download the whole toolkit, as we presented all the necessary information about two AR-tools in great detail within the MOOC.

Therefore, participants were asked to familiarize themselves with ARTutor and Scavenger. ARTutor has been developed by the AETMA-Lab of the International Hellenistic University (IHU), a partner of FAU in the iPEAR project. For both tools, several documents were provided in both English and Greek.

The participants were asked to explore those together with their peers, whom they met in Unit 1. Obviously, some participants came from the same student cohorts, which made it easier for them to find peers to work with.

As in every unit, we invited the participants to contact us *via* the Forum of Unit 2, if they had any questions or needed further information.

As a special event, we invited the students to watch a live presentation of the use of HoloLens at the Norwegian University of Science and Technology (NTNU) from their IMTELLab in Norway. The presentation was also recorded so that those participants who could not take part live would not miss the experience.

Again, a task sheet was provided in English and Greek, which could be read on screen or downloaded and used as a checklist.

2.3.3 Unit 3: iPEAR case studies

During the first 1.5 years of the project, iPEAR case studies were carried out at the partner universities, where teachers were trying out the iPEAR-approach with

their students. Amongst others, these case studies included the field of Art & Design, Christian Archaeology, Media Education, Theatre- and Media science and Arts.

In Unit 3, those case studies were presented in a video. Another video explained the pedagogical approach of using Augmented Reality and peer learning in education.

Additionally, two documents were provided to download, where the case studies and the pedagogical approach were explained in greater depth.

In this week, the participants were asked to conceptualise an AR scenario based on the iPEAR pedagogy and to discuss it with their peers. We asked the participants to include the following content in their concept:

- the subject they had in mind
- the learning situation (seminar or other)
- how many students were taking part
- the room and technical equipment they have at their disposal
- their idea
- the technical equipment needed to realize their concept
- BYOD or not?
- how they would prepare students for the task
- how they would lead students through the task if necessary

The concept was supposed to cover approximately 5 minutes of their seminar (or other lecture) or a whole session or more. We left this decision entirely up to the participants with the hope that this freedom of choice would encourage them to try the iPEAR-approach.

Furthermore, they could also choose to offer their students an AR experience that they are going to work with, or they could even give them the task to create their own AR experience in order to show or prove something to the teacher and to the whole group.

We alerted the participants that they would need this pedagogical concept in the following week and also in Unit 4 to finalize and upload their iPEAR-project as their final assignment.

Lastly, we asked the participants to think out of the box for creative strategies that could motivate, engage, and empower their students. As before, we encouraged them to post any questions and thoughts to the forum of Unit 3 in order to discuss their methodological approach.

2.3.4 Unit 4: iPEAR project presentation

In this final week, the participants were asked to use the pedagogical concepts they created in Unit 3 and to add a short AR activity to it. The concept and AR activity together formed their own iPEAR-project, which represented their final assignment. To prepare the AR activity, the participants could choose the tools they worked with in Unit 2 (AR Scavenger, ARTutor), or a different tool from the iPEAR-toolkit. As mentioned, this toolkit was available for download.

We reminded the participants that their concept could be short and precise (e.g., up to half a page and bullet points were fine). Thus, we wanted to ensure that the participants did not see this as an academic paper and would be able to carry out the task within the 2-hours workload we anticipated for each week.

Nevertheless, we asked the participants to upload both the document with their pedagogical approach and the final version of their augmentation. The participants had a choice of sending a link or QR-Code of a video or screen recording.

As we asked the participants to find peers in the beginning, we did not expect each group to have individual augmentation. However, we asked them to state the name of the group and their peers.

2.3.5 Forums

A way to minimize the already mentioned “loneliness of the long-distance student” as stated by Middleton [13] is to create an active community *via* online forums. In the MOOC, we were asking students to introduce themselves briefly in the forum of Unit 1. To emphasize our support, we answered each post with a personal note. With more than 100 students following our request, it was time intensive. Nevertheless, we are convinced that this helped build trust and kept the students engaged. As Salmon [16] already stated, weaving the posts of participants in a thread fosters active communication within a cohort.

3. Evaluation

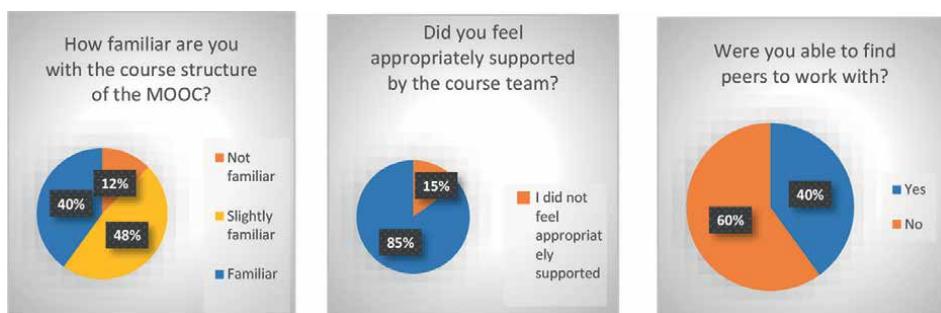
Two evaluations were carried out, one mid-term and a final evaluation at the end of week 4. The participation was anonymous.

However, in order to get a certificate for the MOOC, both evaluations had to be filled in (amongst other tasks).

In the following, the most interesting results are discussed.

3.1 Midterm evaluation

With this evaluation after 2 weeks, our main focus was set on finding out whether the participants were able to use the MOOC as intended. This means that they knew how to use the MOOC, found peers, and felt appropriately supported by the course team.



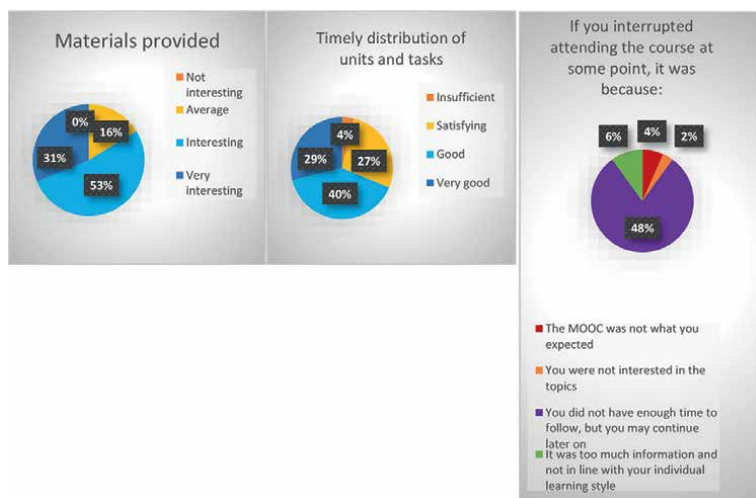
As only 12% of the participants felt not familiar with the course structure, but 40% considered themselves as familiar, it can be concluded that we need to improve

it to make it easier to understand. One idea is to have an extra overview posted at the beginning using visual aids to enhance participants' acceptance.

Regarding the support by the course team, a very high percentage of 85% was reached, which is satisfactory. However, we will take the suggestions of how to improve the guidance we received with qualitative data into consideration and apply them into our second MOOC. Nevertheless, this result shows that our efforts of informing participants of their tasks, communicating with them, and responding to questions within 24 hours were effective. We believe that the rate can be even further improved. Thus, our intent is to intensify the contact *via* the forum in Week 3, where the postings declined.

As stated beforehand, we asked the participants to find peers. To support them, we suggested using the padlet we created and the forum in Unit 1. Due to the easy way of uploading a photo or picture to the padlet, 79 participants used this option. Others were members of the same student cohort at the International Hellenistic University (IHU) and AKTO Arts and Design College.

However, only 40% of the participants stated that they were able to find peers to work with. As the iPEAR-approach, which is taught in this MOOC, uses Augmented Reality in a combination with peer learning, it is essential for participants to find peers. Thus, this number is not satisfactory and we have to find ways to improve it. For the next MOOC, we are planning to find alternative platforms where the participants feel safe to post and thus find peers.



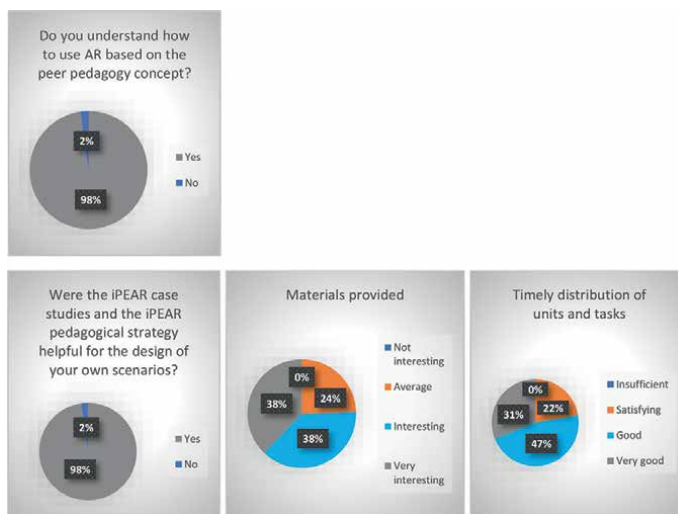
Additionally, we wanted to know if the participants found the given material interesting. The result shows room for improvement, as only 31% of the participants found the material very interesting. It is also assumed that thus, continuing the course is easier for the participants.

Regarding the timing of the tasks and units, 40% of the participants stated it as very good and 29% as good. Another 27% found it satisfying, so in total 99% could work relatively well with the given structure.

However, 48% stated in another question that they did not have enough time to follow. This seems like a contradiction and has to be explored further.

3.2 Final evaluation

In the final evaluation, we asked whether the participants actually understood how to use Augmented Reality in relation with our peer pedagogy concept. Obviously, the result of 98% meets our expectations fully.



Another 98% were reached regarding the helpfulness of the design we provided. Thus, this result is very satisfactory for the course team, as it shows that the instructions and tools offered were understandable and easy enough to be implemented within the 2 hours working load set per week. This means that we achieved our goal of creating an approach that is attractive to educators and thus will be beneficial for spreading the use of Augmented Reality in peer learning.

Interestingly, the participants found the provided material more interesting in the second part of the course, with 38% considering it interesting and 38% even very interesting. One could conclude that in the third and fourth weeks, the pedagogical approach was explained and that might have made it more interesting. Another way to interpret the results could be that by the end of the course, the participants had access to and probably read all material to finish their final assignment and thus were able to see the whole offer.

Regarding the timely distribution of the tasks, the result of the final evaluation was also better than the one of the midterm evaluation. Again, there are various ways of interpreting the improvement. It could be due to a better understanding of the tools and pedagogy of the iPEAR-approach and thus it became easier to fulfill the tasks in time. A negative interpretation would be that by this time, those participants who found it insufficient already had dropped out. Due to the anonymity of the evaluations, we can only assume the reasoning behind.

3.3 Qualitative answers

For the final evaluation, we also asked the students to give qualitative feedback. Overall, the feedback could be divided into very positive comments and

some constructive criticism. The latter is highly appreciated by the course team, as it will help us to improve the second version of the MOOC, which will start later this year.

As for the positive feedback, the participants stated that they found the subject great, interesting, and even entertaining. The comments valued the MOOC as a great experience and one comment went so far to say that everything was perfect.

The participants were satisfied how the information was given and pointed out that the care given was great, as in the course, the team was accessible. Regarding the feedback, the creation of the AR experiences was the best part for some of the participants.

However, others pointed out the innovative concept of peers caring for and helping each other as a very interesting learning method.

Lastly, the AR tools provided were considered as very interesting and the material in total as very satisfactory.

Nevertheless, constructive criticism was stated, which included the fields of accessibility, organization and structure, peer learning, material and AR tools.

Regarding the accessibility, requests were made to make inclusive seminars and to offer different languages. The course material with the instructions for using the AR-tools was offered in English and Greek. However, the course itself was presented in English.

In relation to the organization and the structure of the MOOC, participants mentioned that it was too short and should have included more interactivity. Furthermore, a greater number of synchronous meetings with the tutors was requested.

Additionally, the suggestion was made to include a chat system to help with peer-to-peer connections. This is a highly interesting feature, which we will take into consideration for the second MOOC, as one of the issues participants was not satisfied with the methods offered for peer finding (padlet and forum). As the MOOC is running on the platform iMooX, which is Moodle-based, a chat function should be possible.

Furthermore, some participants found the instructions not clear sometimes and several participants were asking for more explanatory videos.

4. Conclusion

Jordan [17] states that usually less than 10% of participants finish a MOOC. With 575 participants in this first round of the MOOC and 52 final assignments, this rate can be confirmed.

However, as the participants needed to create a project with Augmented Reality accompanied by a description of the pedagogical approach taken, the number of participants who finish the course is satisfactory.

Due to the novelty of the iPEAR approach and the diversity of the participants' backgrounds, reaching from students to photographers to teachers, the numbers are satisfactory for the course team. As already stated, One of the goals of the MOOC is to disseminate the iPEAR approach of peer learning with Augmented Reality in education.

One of the most significant request in the participants' feedback was to include more videos. Therefore, screencasts will be produced to explain the usage of the two AR-Tools better than with simple text documents. Furthermore, the participation in

the forums decreased from 199 entries in Week 1 to 14 in the third week, with a slide rise to 27 in the final week. Obviously, the number in the final week results because of questions regarding the final assignment.

However, the chosen format of facilitation with active support has proven to be successful for the project's dissemination.

Thus, the MOOC is currently adjusted to implement the findings of the evaluations of the participants and experiences of the team and will run a second time in April 2023.

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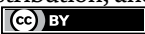
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Chapter 8

FutureLearn and Coursera: Possibilities of Communication

Irina-Ana Drobot

Abstract

The purpose of this chapter is to analyse, comparatively, the possibilities that are offered to learners by these two platforms. One of the main aspects is that learners find themselves in an international environment since they are among students from all over the world. Here we can clearly notice the advantages of English as a lingua franca, which unites such a diverse community of learners around a topic of common interest. For both platforms, audio and video, materials are available, together with the possibility of students and teachers interacting on the forums, for Coursera, or in the below video discussions, for FutureLearn. Collaborative learning is also encouraged, as some courses can ask students to use Padlet to work together or other such sites. The sense of community is built by rapport with the teachers they appear on video, through common tasks, and through peer-to-peer discussions.

Keywords: lingua franca, community, cultural awareness, FutureLearn, Coursera

1. Introduction

The term mass open online course was coined by the researcher named in Ref. [1], David Cormier, as he was writing about such a course held at the University of Manitoba, created by Siemens and Downes. According to the research mentioned in [2], over 2000 students had enrolled in the respective course, which “was delivered using various open and free to use educational resources [...] such as wikis, online forums, Google Docs, YouTube, and Facebook group.”

Mass open online courses (MOOCs) have been around before the COVID-19 pandemic crisis, an event which led to the quick development of online learning platforms that were used officially by schools and universities in order to be able to continue their activities outside the face-to-face environment. Nowadays we may associate the word “platform” used for educational purposes such as teaching or presenting research with Microsoft Teams, Google Classroom, Zoom, Webex, and others; yet, free online courses for everyone from all over the world and of all backgrounds have been opened with platforms such as FutureLearn and Coursera since 2012. FutureLearn was developed by the British (it is owned by both The Open University and SEEK Ltd.) and Coursera by the Americans (Stanford University professors Andrew Ng and Daphne Koller specializing in Computer Science). The year 2012 was the year when another MOOC platform was set up, by a group of scientists working at MIT and Harvard: edX. The two platforms, FutureLearn and

Coursera were chosen for analysis in this paper, first of all, due to the long experience of the author of the chapter with participating in courses on these platforms, and, second, due to the fact that the author of this chapter found that FutureLearn and Coursera provided more opportunities for user-friendly communication than EdX. The author of the chapter has signed up and completed courses on these platforms since 2012, with several breaks over the years, and still signs up for courses function of her subjects of interest, which are mainly related to the fields of Arts, Humanities, Political Science, Philosophy, Psychology, Linguistics, Foreign Languages and Foreign Language Teaching, due to the subjects she teaches or has taught (English and French language seminars for Engineering students, Culture and Civilization, Academic Ethics, European Union Institutions, Linguistics). While for EdX courses, the platform provides for each course a section above titled Discussion, for FutureLearn and Coursera there are more opportunities provided for interaction. FutureLearn allows for users' comments in a comments section below the video where the teachers present their lectures, and Coursera has created forums with special sections for the learners' questions, where they can interact with other learners and with the teachers. Some teachers and courses can provide more opportunities for interaction with learners than others. For instance, the course on Modern and Contemporary American Poetry taught by a professor with his teaching assistants from a university in the USA, beginning in 2012, on Coursera, can be seen as an example of high interaction between teacher and teaching staff and learners. Learners' questions on the forums were always answered by the teaching staff, learners were always encouraged to express their own interpretations of the poems in the syllabus, discussions were set up with participants entering the conversation live via phone, learners were given a virtual tour of the space dedicated to poetry discussions at their university, an anthology of poetry created by some participants was initiated, a mug dedicated to the course was created and could be shipped to participants, and, last but not least, the course ran again throughout time, including an alternative syllabus for those taking the course again. The reaction of the participants was unanimous, as the American poetry professor managed to establish a very close relationship with an audience formed by people of all backgrounds and from all over the world. This could be regarded as a friendly, equal-to-equal type of rapport, which is considered specific to countries that are low power distance, where teachers and students, bosses and staff, can establish a relationship of equality and where the students' and staff's creativity and proposals are encouraged. While in some countries, during school before university, literature and poetry were considered hard to understand and not relate to the present generations' experience, since these were titles selected from the history of literature and mostly from the past, the Modern and Contemporary American poetry professor made poetry seem close to anyone due to the sharing of similar experiences and finding common ground with modern and contemporary poets. For him, poetry is an everyday life experience, not related to obscure meanings and certainly not accessible only to the elites. At the same time, the feeling that this type of poetry is so accessible could also have to do with the fact that modern and contemporary poet remains open to interpretation and offers opportunities for anyone to relate to it and establish various meanings due to the authors' leaving the interpretation open to each of his/her readers.

Forums and comments below the videos can offer the opportunity for learners to also interact among themselves. When essays were given for courses such as the one on Modern and Contemporary Poetry as tasks, learners were presented with the method of peer-to-peer correction. Each learner has to correct a compulsory number

of essays, then have their own corrected, and, if they wanted, they could read and comment upon more essays. Such a method is explainable due to the large number of participants from all over the world. Source [3] mentions that some of the MOOC courses “have had hundreds of thousands of students enrolled.” At the same time, as has been commented on numerous times on the courses’ forums on Coursera, the feedback may be subjective or not accurate. The course on Modern and Contemporary Poetry tried to address this issue by allowing users to complain about the wrong feedback and having their grades fixed after the teaching staff checked their grades again. The staff also tried to fix all technical issues and allow all participants wishing for a diploma for finishing the course to get one, especially since it had acquired a sentimental value, due to the enjoyment of the course. The enjoyment of the course had mostly to do with the way they interacted with the professor and teaching staff. At some point, the way a teacher relates to and interacts with his/her students can have a great influence on their reaction towards the respective subject. While such an experience could be dismissed as emotional, subjective and immature, being mostly associated with young learners, it does matter even later in age, even for adult learners. After the first course was held, there was a very emotional goodbye video, where the teaching staff took into account the opinions of the participants willing to voice their opinions and give feedback for the course.

One of the downsides of communication via forums or comments under the videos could be that it can happen that some learners’ questions can remain unanswered. The number of comments and participants can make it a time-consuming task for the teacher or teaching staff team to reply to every single question. Some learners may also never comment and discuss, as they are simply interested in watching the videos and taking the time to understand the subject of the course for themselves. What is more, due to the time limit placed on how long the free content of the course is available, then the learners may feel rushed and not take the time to respond to other learners or even ask questions themselves. Having these issues in mind, communication may become ineffective if, during some of the courses at least, students may feel difficulty in connecting to others and in becoming engaged in the interactivity of the course. At the same time, some of the comments on the forums or in the comments section may not be very deep, or very well-thought. It also depends on how learners are, generally, from the point of view of their personality: extroverted, thus willing to communicate, or introverted, meaning not being so willing to communicate with others. Another issue is that, after all, students in online courses can see their teacher if they choose to film themselves while presenting the lectures in video format, while the teacher and teaching staff never see the faces of all of their students. Students themselves cannot visually see the other students they could interact with, which makes socialization even more difficult. Yet, if someone has difficulties socializing in real life, he/she can feel more relaxed while studying online and not so anxious about having to interact with colleagues they are seeing and meeting for the first time in the respective classroom setting. In spite of all this, some students may post more often than others, and those active students can notice who posts interesting and reflective topics on the forums or in the comments section. In the meantime, sorting out through comments can take time for other students as well, and they may skip this step and just go on with their course and tasks set up by their teachers. Peer-to-peer tasks such as essay corrections are done anonymously. It is an experience that is very much different from the pair or group work, students can be assigned to class in a face-to-face setting, allowing them to get to know better other colleagues they have not interacted with often otherwise.

Otherwise, communication with students on MOOC platforms such as FutureLearn and Coursera is done by using artificial intelligence. Most likely it is a robot that selects the recommendations for every user of course subjects related to previous courses the user has registered for and based on the interests that the user has listed in his/her profile. Messages related to upcoming deadlines for tasks, as well as a course content on the sidebar, are present with both Coursera and FutureLearn. This can help the student organize the learning material and keep an eye on the progress done up to a certain point. For Coursera platform courses, the learner has the option of choosing the pace of study, from one day a week to five days a week. The recommended pace is also mentioned, automatically. The student is told that he/she will be more motivated to finish the course if he/she sets up a learning pace. This could be a substitute for feeling competitive, as can be done in certain classrooms in cultures oriented towards achievement of the individual. For learners belonging to such backgrounds, having such freedom with self-organizing the pace for their course could have no effect on their performance, as they can apply the pattern of behaviour towards studying, they have been used to, or they could relax and eventually not even finish the course. Motivation is mostly individually based for such courses, as most often students register for courses for their own personal development and out of their own free will. It depends on their interest in the subject, but also on other factors such as time organization since there are also other activities to be done. Another trace of artificial intelligence can be seen in the quizzes, where, after completion, the learners can find the results and the right answer immediately.

Communication may not be a focus in such mass open online courses, yet, at various points, it could be helpful to determine the success of a course and the rate of those that finish it. However, since the introduction of the system of payment for verified certificates to be received at the end of the course, the motivation may be related to the fact that the student has paid for the course and could feel determined to feel that the payment has not been in vain.

Most of the courses on these platforms are held in the English language. This could be due to the wish of the teachers to have students sign up from all over the world. The English language is an international one, and by using it, all the teachers seem to throw out an invitation for everyone, regardless of nationality and background, to join their courses. The degree of interactivity is, therefore, first of all, ensured by the possibility of having a large audience due to their ability to understand and use the language in which the course is being taught. The accessibility of the course material is furthermore ensured by allowing students to watch the videos and complete the tasks within the limits of their everyday life, face-to-face schedule. The videos are not scheduled for live watching and they can also be watched all over again if there is something that is not clear. The latter aspect offers compensation for the possible lack of personal interaction between teachers and students due to a large number of students and limited time due to the teachers' schedules. Even in the face-to-face classroom, the teacher may not have the time to discuss with each student individually what his/ her issues with the subject are. Therefore, the teacher resorts to addressing all students as a group, and, if conditions allow, the teacher may reserve time to provide individual feedback on certain tasks each student solves, individually or in pairs or group work. Sometimes, peer-to-peer discussions on the forums or in the comments section can help, just as discussions among colleagues in the face-to-face classroom can help. Feedback can come also from a colleague, not necessarily from the teacher, in both face-to-face and online mediums.

Having such a huge class before them with mass open online courses can be a strange experience for teachers as well, not only for students. The number of seats in an online course is unlimited, and the teacher cannot have an overall view of each and every student. This lack of real-time communication can be compensated by providing access at any time within the limit allowed for completing the course and by offering the possibility for students to go through the material over and over again until the subject becomes clear. Moreover, once someone asks on the forums or in the comments section a question that is similar to another student's question, there is the possibility to do a search using keywords and to find out the answer anyone is looking for.

One advantage regarding communication among teachers and students on mass online platforms is related to the possibilities offered by the online medium in doing away with the need for searching for a physical space for an adequate classroom, with technological equipment adapted to the number of students, as well as by the teachers' doing away with issues regarding students' discipline. During courses of lectures and seminars, students may disturb the teacher by talking among themselves about other topics, or they may not be attentive. With MOOC courses, however, this is dealt with personally by every student. They can simply take a break whenever they feel like doing so and afterwards resume watching the lecture. Besides, the factor of enrolling in a course by personal choice can be decisive for showing interest in subject matter and tasks.

2. Literature review

How does communication occur between teachers and students, as well as among students, in MOOCs? What are the difficulties, challenges and solutions that can be found?

Among the difficulties regarding MOOC communication, we could mention the confusion, which requires a bit of organization for students, as well as motivation to actively participate.

Source [3] mentions that, during their first weeks enrolled in a MOOC, students feel confused. A newsletter was the solution proposed by the teacher, sent daily for their information regarding communication-related to the course. Source [4] mentions the course CCK08, on Moodle platform, where only 14% of the students showed active participation. This source mentions that 86% of the students had either given up the course or were "lurking", due to the following reasons: they simply enjoyed the "free ride", or they felt that, as "novices", they should "lurk" until they felt the necessary confidence to voice their opinions in public.

What is more, according to Ref. [4], if there is the possibility of connectivity, this does not necessarily mean that there is interaction. As a result, one of the participants in the CCK08 course mentioned that they connected to communication via email, blog, as well as forums, and they enjoyed communicating with the "temporary connections" with other users. Issues regarding communication were related to patronizing behaviour of various participants in the course or not meaningful communication related to the course material. Students' autonomy should be encouraged in MOOCs since the possibilities of communication between students and instructors are rather reduced, and instead, the focus should be on interaction among students. Another issue draws on the connection between establishing interconnectedness and trust: "sharing for many people requires trust, and the more connectedness there is, the more time-consuming and hazardous it may be to build trust." At the same

time, autonomy can mean a lack of help, and being alone with no support for certain learners: “Autonomy was equated to lack of support by some participants, particularly those enrolled for credit with associated assessments.” However, even while in a physical classroom, some students may still feel that they lack support, as the teacher may not have the time to answer all questions, the students may be too shy to ask for help from both colleagues and teachers. Alternatively, for mass open online courses, some students enrolled may rely on the support of friends or other acquaintances for further discussions.

The reason for the instructors’ motivation for starting MOOCs [5] could be the following [6]: providing the opportunity to learn through democratic access to quality courses of lectures, ensuring the instructor’s university promotion, ensuring the possibility of having students enroll in the respective university for courses, establishing collaborations with other universities and ensuring the “potential for research and development in online education”, as well as, eventually, “Transforming traditional teaching and learning approaches.”

Source [7] focuses on communication “in a global, semi-synchronous classroom” on Coursera platform as it happens on the forums, with application to a “business strategy MOOC” from spring 2013, with about 90,000 registered students. Regarding the number of students engaged in the discussions on the forum, about 4500 students created “over 15,600 posts or comments”, and “Over 15,000 learners viewed at least one discussion thread in both instances, contributing to 181,911 total discussion thread views.” The research focused on five dimensions: “the extent to which knowledge construction occurred through discussions”, “communicative intent” (“argumentative, responsive, informative, elicitative and imperative” [8, 9]), emotional impact of the posts (“positive/ negative activating, positive/negative deactivating, and neutral” [10]), topic (for instance quizzes, members’ introductions and members organizing meetings in real life) and relevance of the post in its thread or category. The research creates, based on engagement, learners’ profiles, such as in the cases subforum: those members that constantly engage with others’ posts, those members that initiate discussions, those members called “strategists”, who “had a greater proportion of argumentative statements (55%) and rarely had posts that reflected no learning (1.6%)”, and individualists, who “were highly distinctive in their large proportion of argumentative statements (85%)”; in the final project sub-forum: those members seeking help; those members strategically looking for information regarding the project; those members more interested in the exchange of ideas; those members called “focused achievers”, concentrating on peer review and certificates and those members “seeking support and opportunities for collaboration on the final project”. Cultural differences have been noticed, for instance in the cases sub-forum, the “discussion initiators” were mainly from Asia, and in the final projects sub-forum, the “project support seekers” were mainly from South America.

Source [11] mentions a problem with discussion forums irrelevant conversations to understanding the material covered and the tasks, in which some students can engage.

Research mentioned in Ref. [12] highlights the importance of discussions based on the course material, with learners collaborating with one another. Collaboration can be beneficial since the students “have a diverse range of backgrounds and motivations for taking the courses”. One issue with communication on MOOC platforms is that the space is a “non-formal” one [13], with “few rules”, and thus “learners are free to pick and choose how and if they interact”. Another issue identified is the lack of control from the instructors: “The overall governance structure is relatively weak, set primarily by the educators’ questions/assignments for the forums, the technical design of

the forums (e.g., the division of forums into specific topics) and the roles participants themselves take on during the course (typically eight weeks).” By leaving everything to the decision of the learners, the outcomes of the courses can be risky. However, the function of the way that students have the time and the interest to interact and the function of the way the instructor motivates them, there can be very productive discussions. Individual and group levels of interaction have been studied [14–16]. According to Ref. [12, 17], group interaction on forums is the basis for learning to happen. Indeed, considering how asking questions can help clarify various issues in any classroom, face-to-face included, group discussions can help both to point out various issues and to seek solutions to them. This can only be done in groups.

While the materials are provided, in all formats, both written and video, a topic covered by the professor’s materials is never enough. The main issue is to start asking yourself, as a student, various questions and to voice various dilemmas. This is how future research can occur, based on fresh perspectives and questions. This is how something new can be learnt and better understood. Only the information regarding the topic is never enough in an academic course of lectures.

3. Materials and methods

The methodology for the present chapter will be based on the author’s participatory observations in MOOC courses on FutureLearn and Coursera platforms.

Previous literature on the topic worth mentioning includes the research mentioned in Ref. [18]. This research underlines the particular way in which FutureLearn’s discussions are organized by “each course step” and located “right below or beside the course content”. FutureLearn provides, therefore, an organized and focused environment for communication, based on precisely the video material or reading material: “Learners are encouraged to share their experience, contribute their reflection, discuss issues raised in the course step, and interact with others”.

We could conclude that, at least in the perception of the author of the chapter, such an organization of interaction among users discussing the question addressed by the teacher reminds us of the posts on social media. For instance, on Facebook groups, or on a Facebook page devoted to a certain topic, we have a main post offering a bit of information, pictures, or even a video material. Then, the person posting can address a question to the users and prompt them to discuss and also to interact with one another. On FutureLearn platform courses, users can also give each other likes and various reactions just as on Facebook, and also interact by replying to other students’ posts. This resemblance offers students a familiar type of environment, which is created according to the way they are used to interacting generally on social media on a variety of topics. This is likely expected to provide a relaxed environment for studying and for communication among students. At the same time, the conversations are not expected to be carried off in a very formal way, but in a relaxed, conversational, everyday life manner, with everyone feeling equal. Since learners are expected to share knowledge of English as an international language to communicate, it is also expected that they can differ in cultural background and means of interaction. However, since they can be familiar with American English culture, they may associate the use of this language with equality with teachers and freedom to express themselves in an almost conversational manner during class. Expressing their opinions and suggestions is encouraged, as in any low-power distance classroom [19, 20]. A difference is made in communicating someone’s opinion in the comments section in

FutureLearn courses and in the language used for writing essays, which are associated with academic writing and the use of formal English. The teachers are also expressing themselves freely in the video material, which is not even as long as face-to-face lectures. The format of the video material reminds me of the brief videos shown on social media in order to be watched. Our current world believes that social media has shaped the way digital natives can focus on watching a video or reading a book. They prefer short material. Therefore, the video material on FutureLearn and Coursera platforms is short, not allowing the learner to have to watch a long video in one sitting. The courses are, therefore, especially on FutureLearn platform, interactive ones, focusing on making the learner actively participate, not just to passively listen to the lecture. At the end of the video, if the course is about learning a foreign language, the students could be asked to post in the comments section their own answers to questions such as what their name and surname are and where they are from. Such an example is a course centred on learning the Mandarin language in Taiwan course, held in January 2023, on FutureLearn platform.

One of the sections in the course is based on the question “What’s your name?”, where the course instructors explain the sentence structure and what each word means, and then there is a portion of the comments from users. FutureLearn does not use any forums for communication, which is done in the manner of social media platforms, with comments under the main sections of the course, including video and reading materials. The connection among users is not visible, as some comments are still very recent during this session of the course at the moment of writing the present paper. Under the first videos of the course, we cannot see much activity, even if comments from previous sessions of the course are also present there. We cannot see interaction at the level of likes or at the level of offering feedback. At the same time, the answer is quite clear after watching the video and there is nothing to debate. Instead, all students have to do is solve this exercise, which resembles a drill type of exercise. The social media aspect of the platform FutureLearn is visible, especially since there is the option to even share the video using social media platforms such as Facebook and Twitter. The usual type of online communication using social media is encouraged to continue regarding these types of courses. This can make them seem relevant to the preoccupations of the users of social media and as a means to create their social media image as intellectuals. At the same time, sharing by users on social media can help increase the popularity of this course, which is designed to be accessible to anyone. The level is beginner, so it should be accessible to anyone willing to start learning Mandarin.

The social media interface used for learning and teaching is not restricted to FutureLearn or other MOOC platforms. Facebook pages and groups have been used by various foreign language teachers to post videos of themselves explaining an issue related to German, French, Turkish, Japanese and other languages and then learners could comment under the video, give likes and share it with their friends.

The familiarity of the environment can show how FutureLearn platform has adapted to the way potential registered learners usually communicate. This is an equivalent of teachers trying to understand an age group and their interests, together with their preferred way of interaction, or a group of professionals, for example engineering students learning English, and their particular needs from the English language seminars related to using it in their future profession. Definitely, the students of FutureLearn platform are familiar with the online environment, with forums, sites and social media; therefore, they should find the medium for courses intuitive and easy to use.

On Coursera platform, the course about Korean Philosophy and Culture is also organized as an intuitive setting to which students are used to, as users of forums, discussion boards and Facebook group files, as well as e-books.

What reminds of an e-book is the contents that are organized very clearly and can be used in an interactive manner between artificial intelligence and student. The student can scroll up and down and also see personal progress information. On the left sidebar, there is a discussion forums section, where the students can discuss the topics related to the course. Further on, the discussion forums have a section called posts for you, which includes tasks that the students still have to do. In the case of this course, there is information regarding peer correction of essays written by other students.

We can also notice how the forums are grouped allowing socializing opportunities based on discussing ideas about the course, while first of all students can introduce themselves, each and every week. The discussions are well-grouped and organized so that the interactions are based on discussing and having a plan in mind. It is not just simple socializing as in the case among students in face-to-face classrooms, which goes further beyond the topic of courses and seminars. The introductions are based on discussing what made us students choose the respective course, in this case, the course introducing students to Korean Philosophy and Culture. Here we can discuss previous knowledge and expectations regarding the course, as well as detail our interest in Asian cultures, for example. Such a discussion topic can also help teachers to know what students expect and what their background is, in case they further wish to develop their course. In this way, the course material can be adapted better to students' needs and the function of the current students' feedback if teachers have, in view, another session of holding this course in the future.

Interactions among students are based on common ground and on precise topics for discussion prompts, so that they are not just random, socializing talk as we can see on entertainment discussion forums based on hobbies and various interests. Based on these discussion forum prompts, a sense of community can be created, reminding of life as student at university, to some extent. However, no personal relations can form too easily, as students do not further socialize in small groups after the classes are over. Therefore, the platform needs to find various ways of compensating for what differs or what can be regarded as being lost in the process of online communication. Part of this attempt to compensate for various losses can be the opportunity given by the discussion forums' prompts. These prompts are related to communication in an academic setting, such as during a seminar discussion with the teacher and with the other students present. On FutureLearn, in the comment section, students can choose to follow the activity of another student whose answers they may like, however. In this way, we can engage in further discussions with students that develop their own opinions or give answers based on which we would like to continue to further develop the issue with them if they respond and keep the discussion going for as long as it is needed.

While the students' needs can be difficult to set up for teachers, as they have a huge class for their lectures and seminars, of students from all over the world, some standards could be set based on universal needs of beginners in learning a foreign language. The foreign language learning courses on FutureLearn and Coursera specify the level. Some courses can have a continuation with intermediate level and also advanced level. This is the case of a Spanish set of courses on FutureLearn platform. In helping come to terms with students' needs, artificial intelligence is used to select those courses in which various students may be interested. The courses can be self-selected by checking a certain domain of interest, and further, when opening the home page, recommendations of courses appear.

The MOOC platforms have, as merit, made the learning experience online interactive. They prompt communication, to the degree to which each student wishes for it. An example of interaction between two students can be seen on FutureLearn platform, in the Mandarin course, during week one, under the video *Impression of Taiwan—What do you do in Taiwan?* One of the students asked a question regarding the use of tenses in a sentence. Another student offered explanations and then the interaction ended with the first student posting thanks for the answer. This type of communication is informative regarding grammar explanations and could help other students understand the issue, making them aware of its existence if they have not yet noticed it.

The same course offers an example of conversation based on exchange of information related to entertainment when students comment on the section *What is your impression of Taiwan?* There they have the opportunity to present their own opinion in what looks like a light conversation, which could be regarded as a good time for taking a break from the language learning drills types of exercises and to express themselves in the language franca, English.

The comment by one of the users on April 6 is, unlike other comments, a critical one, addressing the less positive aspects of Taiwan, such as expensive houses and with being crowded. Others are enthusiastic to visit in the near future or have already visited Taiwan.

In the course on Korean Philosophy and Culture on Coursera platform, the forum discussion prompts are initiated by the course instructor. The instructor also recommends students to give each other feedback.

We could regard this invitation as an attempt to determine students to use collaborative learning. According to source [21], collaborative learning could be defined as including a series of approaches referring to students participating actively in class, and working together with the teacher or with other students. According to this approach, “students are working in groups of two or more, mutually searching for understanding, solutions, or meanings, or creating a product” [21]. Indeed, in the FutureLearn comments below the videos and in the Coursera discussion forum prompts replies, we could see examples of collaborative learning to the extent where students can check the answers of others and figure out the correct answer or the appropriate answer to the teacher’s questions. While the collaborative learning in this case does not involve real-time and direct communication with students, but only reading the comments of others later, by reconstructing the context, students can have the feeling of working together. Even if not physically together in a face-to-face classroom, they can still connect at the level of ideas. The comments are left there to be interpreted later when a new student joins and goes through the course material.

The interpretation of comments can be regarded as part of the following principle on which collaborative learning is founded: “Learning is an active, constructive process” [21]. Indeed, the effort to post a good answer to the drills in the Mandarin course, for instance, is part of this principle, as when as of the belief that “To learn new information, ideas or skills, our students have to work actively with them in purposeful ways.” It may be easier to remember a certain phrase to ask someone’s name in Mandarin or to answer in Mandarin once we see other students’ replies as well. However, we can notice in the comments below the post in the Mandarin course where the question and answer for what our names are (first and last name) is that not all students use accents in Romaji script. Therefore, the correct way would be to watch the video and post using the correct symbols, not just copy and paste from another colleague. Yet, we can be helped by seeing examples of how other students applied their

name and surname in the drills and see this as an example of how to apply our own or we could just feel reassured if we want to check if we answered correctly. Studying a completely unknown language can be a challenging task; therefore, collaborative learning can make the entire experience more interesting: “Collaborative learning activities immerse students in challenging tasks or questions” [21]. The courses on the platforms FutureLearn and Coursera provide a practical approach to learning: “Rather than beginning with facts and ideas and then moving to applications, collaborative learning activities frequently begin with problems, for which students must marshal pertinent facts and ideas” [21]. The last statement is true in the sense that students are allowed to exercise practically. Yet, part of the information, at least in the Mandarin course on FutureLearn, was present in the first video clip. However, the student’s attention is drawn to the phrase asking what someone’s name and surname are, only afterwards, when the teacher gives an explanation in the video material.

Communication among students on task solving is, thus, an element of collaborative learning. For the time being, however, no interaction among students is yet visible, as can be seen in the selection of comments. Regarding innovations in various cultures that are supposed to be mentioned by students as asked by the discussion prompt, the majority of mentions are related to language, alphabet and language reforms.

Occasions for relaxed communication and getting to know other students are also found on Coursera. In the same Korean Philosophy and Culture course, students have, in the discussion forums, the opportunity to introduce themselves and find other students from all over the world shows that the number of comments is not a large one. So far, there are only 29 replies. The first comment is from 15 days ago, while the present time of observing the comments by the chapter’s author is December 19, 2022.

For the Korean Philosophy and Culture course, the discussion prompts are organized by every course week. For each week, students are invited to communicate with others and engage in discussions and debates, as well as to interact checking others sharing similar interests and goals. The course instructor and staff are not the only ones to post prompts. Students can also open up a subject for discussion and are encouraged to do so.

Alternatively, students can simply watch the lectures and not do any of the tasks, as well as never post in the comments or discussion forums prompts sections.

Previous research [3] have mentioned several styles of engagement with the course materials on MOOCs for students:

- “1. Viewers, in the left mode of the plot, primarily watch lectures, handing in few if any assignments.*
- 2. Solvers, in the right mode, primarily hand in assignments for a grade, viewing few if any lectures.*
- 3. All-rounders, in the middle mode, balance the watching of lectures with the handing in of assignments. [...]*
- 4. Collectors, also in the left mode of the plot, primarily download lectures, handing in few assignments, if any. Unlike Viewers they may or may not be actually watching the lectures. [...]*
- 5. Bystanders registered for the course but their total activity is below a very low threshold.”*

Students can choose their own style of relating to the course materials on MOOCs, especially since, generally speaking, nothing is mandatory in this medium. However, the experience is more interactive than simply learning about a certain topic by studying a book, for example in culture and civilization or a textbook for learning a foreign language. The video, audio and reading materials are structured in a way in which students can feel at least that they are listening to a real teacher giving a lecture or giving them seminar instructions. When solving the exercises given, for instance on FutureLearn, students deciding to post in the comments section never feel alone in their experience. They can view the other students' answers and compare their answers to those of their colleagues. While these answers may not all be correct, here is the opportunity to reflect on other colleagues' answers and offer them feedback. Once we explain a certain exercise to someone else, the issue can become clearer for us. We can also receive feedback in our turn from another colleague, and he/she may help clarify a certain issue for us. If our answer is correct, we can receive likes from colleagues. The same can happen if our argumentation is convincing regarding a certain issue, depending on the exercise. Moreover, by providing the opportunity to use sites such as Padlet for certain exercises (such as those asking for associated keywords with a certain concept), online students can collaborate on those tasks and add their own opinion to the others, forming a collective project. Yet, to some extent, the entire platform is built in such a way as to allow collaborative learning in the comments under the video section or on the discussion forum prompts.

4. Results

While the two platforms encourage and recommend interactivity throughout the learning process, receiving a reply to someone's question is not something certain. Receiving enough explanations as in a real, face-to-face classroom may not happen. However, the comments are also not that many, but the purpose of the teacher is to facilitate exchanges among students, mostly. The teacher does not place himself as an authority as in the old teaching methodology, but mostly facilitates interaction among students and asks the students to be active and to solve exercises in search of answers. The courses examined in this paper make use of student-centred learning [22], which has also been designed by terms such as flexible learning [23], experiential learning [24] and self-directed learning [22]. The change from seeing the teacher as an authority and listening passively to him/her to motivate the student to be active has been explained by originating in the book *Freedom to Learn* for the 80s [25], a source, which "describes the shift in power from the expert teacher to the student learner, driven by a need for a change in the traditional environment where in this 'so-called educational atmosphere, students become passive, apathetic and bored'" [22].

Motivating students, especially in a MOOC environment, is a very challenging task for teachers, perhaps even more so than in face-to-face classrooms, where the students are under the obligation of finishing university studies in order to get their diploma and find a job. Most students register for the courses out of curiosity, and for most of them, there is nothing urging them to finish with getting a certificate for the course, unless they decide to pay for getting a verified one. Students of MOOCs may feel like browsing through various courses simply out of curiosity, and not intend to finish the material or even do all tasks proposed by the teacher. However, such phenomena can occur even in real-life university environments, as not all students are motivated to finish their studies. Various reasons can lead to abandoning their studies,

such as wishing to socialize or to focus on entertainment, realizing that their future job is not part of the domain studied at university or simply realizing that, at least at that very moment in life, they cannot focus to complete their studies. On the Internet, and especially in MOOCs, the teacher may find that he/she does not have the same authority as in a real classroom. The institutional setting is not the same as that of a physically existing university where students are already enrolled. These are just some courses someone may sign up for now and then. However, the time factor and various personal life events can interfere with the courses regardless of the setting. Motivation can be coming from someone's personal wish for various reasons to learn until the end of the course or from the wish to comply with the institutional rules to receive the certificate of graduation. Even for MOOC certificates, the accomplishment could count as a desire to go for personal development when presented at the workplace.

Regarding socializing and learning in a face-to-face vs. virtual environment, the collaborative learning method also has an answer: according to Smith et al. [21], "Learning is inherently social", referring to learning after collaborative principles. What is more, collaborative learning based on being social refers to the fact that it "allows for student talk: students are supposed to talk with each other...and it is in this talking that much of the learning occurs" [26]. Therefore, talking among students does not have to centre on entertainment and personal hobbies. It can be based on course material, as collaborative learning implies. Students can talk and do not necessarily need to spend their free time together. They may have the course material as common ground for discussion and from there they can exercise their knowledge and their explanation to someone else skills, as well as their argumentation skills.

Regarding cultural differences, so far in the experience of this author's chapter, there was never the case for having issues because of them. Learners and teachers have taken into account the possibilities of English as a lingua franca to unite them all and to make them all intelligible among one another. Cultural differences have been a frequently discussed topic and could be understood as part of cultural awareness as follows: "Cultural Awareness is the foundation of communication and it involves the ability to stand back from ourselves and becoming aware of our cultural values, beliefs and perceptions" [27]. Even if we focus on the common interest represented by the topic of discussion in the course, and assume the idea that we are different yet we could be similar up to some point, this could lead to wrong assumptions: "Projected similarities could lead to misinterpretation [...]. When we assume that people are similar to us, we might incur the risk that they are not" [27]. We can learn about a different language and culture in a MOOC, yet, at the same time, we may simply leave our cultural differences apart and focus on the way we all perceive English as a lingua franca in order to feel part of the community of MOOC students. Our national cultural identity is therefore replaced temporarily by the identity of being MOOC students and being part of the same community, which gives us common values for the duration of the course at least. Everything else is just pushed into the background, our identity as online students being central.

How much or how little we engage in communication within MOOCs remains up to us. Occasionally, some teachers such as the Modern and Contemporary American Poetry professor can motivate everyone due to his communicative skills and charisma and make the majority of us enjoy the course and be willing to share our opinions.

The communication possibilities on Coursera and FutureLearn are given in different formats (discussion forums vs. comments). However, the main communication tool is related to the way of understanding the course material, via video and reading means.

5. Conclusions

We could think of the process of teaching and learning through the framework of communication. After all, this process involves, regardless of the type of setting, face-to-face classroom or online platform, communication between teacher and students, as well as among students themselves. MOOCs focus mostly on the possibilities of students communicating efficiently among themselves while making the entire communication process public through comments under the videos in the case of FutureLearn platform or in the discussion forums prompts in the case of Coursera platform.

Both platforms are very well-organized, in their own different ways.

The two courses chosen for analysis were based on the criteria of the interests of the author of this chapter, as well as on the availability of these courses at the time the author was writing this chapter. The author of this chapter has been going through participatory observation on these two platforms since 2012, with breaks at some points. Yet, not all courses remain with their material available after a certain period of time, when the student needs to pay for further access or simply to complete the course in a certain number of days. In the future, the author of the chapter may try to pay for the certificates and their verification. However, the author of the paper cannot really use the certificates for anything else but to include them in the curriculum vitae at work. Other certificates are considered, however, relevant, which are those completed for PhD and MA programmes with classical academic settings. The mass open online courses are completed by the author of the chapter for personal development and interest purposes. Based on some of the essays written or material read, the author of the chapter has developed some topics into personal research papers. Therefore, the motivation of the author of the chapter is personal interest when it comes to completing certain MOOCs. With some MOOCs, a function of interest and time, the author of the chapter may or may not engage in conversations with other students. The author of the chapter has not developed strong connections with any other online students. She has focused on the subject matter of the courses. The only course where she has seen personal relationships develop outside the MOOC was the course on Modern and Contemporary Poetry, where social media accounts such as Facebook were used to keep in touch with the course instructor and with other students. The course had a very high emotional impact, which prompted a personal type of communication, which is not seen when it comes to other courses.

The type of communication established between teacher and student also varies in real-life, face-to-face school settings, after all. From this point of view, the online medium can be seen as a variant of the face-to-face type of environment and communication types that can be established. There is no certainty about the durability of relations established between teacher and students, and students and students, even in face-to-face classrooms, after all.


Among the best practices of communication from courses on Coursera and on FutureLearn, we could mention allowing the students to collaborate by helping one another to understand the assignments they are given. Other discussion prompts can help them better explain to one another what they are supposed to do. This can be regarded as an exercise in understanding and then explaining what they are supposed to do for their assignments, which means students clarify what they should write before explaining it to someone else.

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Section 2

Learning Pedagogies

Expert Opinions on MOOCs Challenges: Rethinking of Emerging Pedagogies

Abdelwahed Elsafi and Yousif Al Awad

Abstract

Massive open online courses (MOOCs) are considered as the future of education by means of open to everyone, unlimited number of students' enrollment, deliver multimedia learning formats, greater access to massive educational resources, and track student progress. This chapter aims to gather expert opinions on massive open online courses (MOOCs) practices and address the pedagogical challenges so as to respond to younger generation for future lifestyles and prepare them to compete in the twenty-first century labor market. In this chapter, we will employ the Delphi method process based on multiple rounds of questionnaires results that will send to MOOC panel experts. We will report the challenges and conclude with appropriate emerging pedagogies for MOOCs and its future trends.

Keywords: emerging pedagogies, cMOOCs, xMOOCs, technical challenges, pedagogical challenges

1. Introduction

According to Roy [1], MOOCs is an acronym for massive open online courses. Massive refers to hundreds of thousands of students who enrolled in the online courses that are open to everyone, so that students can access learning materials or course content. Online in terms of most of lectures, meetings, interaction (teacher-to-students and student-to-student interaction) *via* forums, blogs, social networks, and activities can be delivered online. Course materials are made available to be accessed online or delivered for students *via* a particular electronic medium. MOOCs have been developed under a significant discourse particularly for universities, education reformers, and companies [2]. This means “call” for universities leaders, educational politicians or policymakers, and production companies or enterprises that MOOCs have numerous potentials to reshape the traditional education into modern teaching and learning approaches to reach learners interests, diversities, lifestyles, and circumstances of the workplace. The important role that MOOCs plays in higher educational institutions is to grasp attention of universities' leaders to bring higher education into the digital age, and the MOOCs is the strongest candidate among learning technologies for the better future of online learning [3]. The major reasons for higher education institutions to offer MOOCs for students have been identified as alternative

solutions including access, experimentation, and brand extension, providing opportunities for a large number of students, enabling students to personalize their learning through formation of sub-networks, meet students' diversities and styles of learning, improve learners' autonomy, reduce educational costs, and provide global access to exclusive institutions [4].

From the author's experience in the field of education (educational technology field), we believe that integration of technology in the teaching learning process could provide a variety of solutions to the educational problems and mitigate the burden rests on educational stakeholders or those who could reap the merits of learning with technologies. Our motivation for conducting this study we thought that adaptation of MOOCs can not only overcome the teaching learning challenges, but also can provide more equal access to knowledge and educational opportunities.

Since initiation of MOOCs as an innovative approach of online learning, a distinctive set of pedagogical and technical challenges have been arisen. With all of MOOCs platforms available, how could learners be encouraged to complete online course? How do designers of MOOCs take a student-centered approach as a way for customizing learning? How do pedagogies of MOOCs could effectively develop learners' skills and competencies that are required for the twenty-first century workplace? How do learners develop a sense of engagement and adapt themselves with emerging learning pedagogies. This study aims to gather MOOCs experts' opinions from different countries on pedagogical and technical issues, to reach consensus and address the current challenges of MOOCs. The importance of this study is to shed light on the merits and solutions that MOOCs could offer to higher education institutions.

In status quo, the universities leaders and education politicians as well as MOOCs companies as a community of learning are required to engage working with global MOOCs experts and rethink about the future of teaching learning with MOOCs [5]. This study will contribute to the explanation of MOOCs movement and recommend for emerging pedagogies that may require to develop students' critical skills. In the following section, we provide a brief literature review of MOOCs.

2. Literature review

2.1 MOOCs overview

The rapid development of emerging learning technologies and acceleration of social changes have influenced the educational system in a wide range. For instance, online learning has received considerable attention from educational stakeholders as its affordances allow multimedia to be utilized for educational purposes. This considerable acceleration of emerging learning technologies has led to the birth of modern educational technologies. MOOCs have been started since 2008 after George Siemens and his colleagues at the University of Manitoba had participated in a conference that was streamed online using digital tools. The term MOOCs was coined and used for the first time by Georges Siemens from Athabasca University and Dave Cormier from the University of Prince Edward Island [6]. After Siemens and his partners opened their course online, they made it completely accessible for students to access lectures, readings, share their own ideas, thinking, and discussion through Moodle, blog posts, Twitter, and other social networks or synchronous online meetings [7], and this learning approach has gained wide acceptance among higher education institutions. By the years of (2012–2013), MOOCs were accredited and recognized globally

by a variety of international universities, such as Harvard University, Massachusetts Institute of Technology (MIT), and Stanford University, and these leading and good reputation universities have been started to offer open and free courses to students [8]. Other organizations like the Khan Academy and Coursera offer thousands of courses on a wide range of topics using structure of MOOCs. This innovative approach has effectively moved the learning into the hands of learners'. Researchers have anticipated that MOOCs will swiftly replace the existing educational system with openness and scalability [9].

2.2 Pedagogical philosophy of MOOCs

Two different ideological principles' guided MOOCs practices were developed. In the following section, we shed lights on two prominent pedagogical philosophies that differentiate between cMOOCs and xMOOCs namely connectivist and behaviorist pedagogies.

2.2.1 cMOOCs model

This type of MOOCs pedagogy is mainly designed based on constructivist and connective knowledge (CCK08) organized by George Siemens and Stephen Downes and other connectivist learning pioneers in the year 2008 to support processes of relationships, creation, and knowledge sharing [10, 11]. Basically, connectivism is a network-based theory focusing on the learning that occurs *via* the connections made among learners and learning objects [12].

As pioneers and scholars of MOOCs noted, cMOOC was based on the connectivist' pedagogy, relates directly to the pattern of interaction and communication between learners and teachers, focuses on more creation and creativity and emphasizes autonomy-based learning and social networking learning. As stated by Yeager et al. [12] MOOCs connectivist pedagogy can be distinguished from other MOOCs pedagogy by the following features:

Courses are constructed more openness to conversation, discussion, dialogue and creative thinking based on collaboration, connections and sharing, and the creation of *knowledge* is guided by teachers or facilitators; the *learners* should be active in the processes of creation and deepening of knowledge. Since the courses are offered to a large number of learners in an online learning environment, *multiple technologies, tools* to facilitate blended learning have to be available, and learning *interaction* could occur in many distributed online spaces.

2.2.2 xMOOCs model

The xMOOC model is considered much more familiar to both teachers and students, and the designers often use systems that developed to be more traditional online courses. Researchers have been criticizing xMOOC because its pedagogies are relatively not appropriate to support knowledge creation and no sufficient support could exist to help learner's engagement in learning processes [13]. Siemens who is a pioneer of MOOCs asserted that the design of xMOOCs was emphasized more traditional learning modes through video presentations and short quizzes and testing, so it focuses on knowledge duplication rather than knowledge sharing and creation [14]. xMOOCs formats are categorized under the cognitive-behaviorist pedagogy [9] and it designed in consistence with the traditional behaviorist models

in which information can directly be transmitted rather than effective environments in which elements of knowledge building and creation and unique thinking skills are developed. The methodology employed for the purpose of this study is presented in the following section.

3. Methodology

In order to explore pedagogical and technical MOOCs challenges, we adopted a modified Delphi method with focusing on gathering and collating global MOOCs experts' opinions under the phenomenon of study. According to Dalkey and Helmer [15], Delphi is a method for "eliciting and refining group judgments." The Delphi undergoes four distinct phases [16]. The first phase can be characterized by exploration of participants about the phenomenon under discussion, and in such situation each individual contributes by adding additional information that he/she feels is pertinent to the subject of study. The second phase of the Delphi approach concerns how to grasp and understand the participants views on the issue of the study (e.g., where the participants agree or disagree, what they mean by concepts or issues that they think are relevant and important to the phenomenon under the study). If there is a significant disagreement in participants' responses, then the third phase should be considered to bring out the underlying reasons for the differences and possibly to evaluate them. In the last phase, final evaluation occurs when all previously gathered information has been initially analyzed and the evaluation has been given for consideration. The strength of the Delphi technique is fundamentally its consensus building focus, and the responses received from experts well versed on the phenomena under the study [17]. For these unique merits, we thought that the Delphi approach is an appropriate way to proceed this study. In the context of Delphi rounds, we only employed the first and second round of a modified Delphi approach that the panel experts' consensus around pedagogical and technical aspects of MOOCs were confirmed.

3.1 Research design

The selected panel of MOOCs experts is knowledgeable, and they have direct experiences with MOOCs practices. Those who are nominated to participate in the study have informed "the purposes of the study and what things are required from them to be done." The study utilized a purposive sampling technique [18]. The purposive sample is a specific type of non-probability sampling that relies on data collection from individuals who own qualities that a researcher expects from the target population [19]. This type of sampling is best used when a researcher wants to choose members who will be part of the study [20]. For this study, 12 MOOCs experts across a range of international institutions and countries who had a diverse of expertise using MOOCs are selected (see **Figures 1** and **2**; and **Table 1**). In this study, the questionnaire was generated from relevant studies of MOOCs and Open Educational Resources (OER) [21, 22] with both closed and open questions.

At the beginning, two MOOCs experts' who were not part of the expert panel were consulted to refine the questionnaire whether the questions which combined are appropriate for the purpose and nature of the study, and they vetted and provided suggestions for some questions to orient and guide the study to be proceeded by the

Affiliation	Country	Field
North Texas University	USA	Learning Technologies
Sudan University of Science and Technology	Sudan	Computer Integrated Education
Hangzhou Normal University	China	Educational Technology
Sultan Qaboos University	Sultanate of Oman	Educational Technology
Beijing Normal University	China	Educational Technology
Zhejiang University of Technology	China	Educational Technology
Beijing Union University	China	Educational Technology
Beijing Foreign Studies University	China	Mobile learning

Table 1.

Presents participants' affiliations countries and fields.

had right to withdraw before completion of the survey at any time. The anonymity and confidentiality were taken into consideration before carrying out the survey. Participants had given a choice to write their names in the electronic survey, so that the identities might be unknown to the researchers. The protection of the privacy of the participants was ensured, their identities were kept confidential, and data obtained would only be used for this research.

3.3 Delphi rounds

We have undertaken the Delphi technique which employed two rounds processes designed to combine experts' opinions into group consensus, and the deadline for each round was specified.

3.3.1 First round

In the first round, we provided the panel an electronic survey comprised of a list of 18 questions with the panels 'demographics information. The questions are focused to explore pedagogical, technical, and relevant challenges associated with MOOCs teaching learning practices: https://docs.google.com/forms/d/e/1FAIpQLSdr05sLxSXUMNuIpMR1oFQ4MCMsqxAuryPIPQ_rhtTaOwIOg/viewform?usp=sf_link. More precisely, the questionnaire is comprised of three sections; the first section explored experts' opinions to aspects relevant for MOOCs pedagogy (e.g., course content, instructional design, consultations of educators in the process of MOOCs, sustainable models, theoretical basis for guidance MOOCs educational practice). The section was also emphasized to ask the experts panel skills and attitudes they thought are necessary for students/learners to be cultivated for better engagement with MOOCs. The second section focused to skills are important for students to be cultivated for better engagement with MOOCs. The last section was emphasized on experts' views on changes are required in learners' learning habits when employing MOOCs and issues considered to change the future of MOOCs and better enhance teaching learning practices respectively.

3.3.2 Second round

In the second round, we focus to collate experts' feedback of round one and extract their responses to reach consensus. Accordingly, the questionnaire was uploaded and shared on https://docs.google.com/forms/d/e/1FAIpQLSfHLiqPutyJChNq2WKAuPi-8dFd630GK0vZIDtUv9ADFG3qAQ/viewform?usp=sf_link. Before the beginning of asking the participants to look at a questionnaire of the Delphi second round and to revise their responses, they were required to view the responses collected from the first questionnaire based on information provided in the first-round items. Additionally, they asked to rank items to get establishment of preliminary priorities among the second-round questionnaire items. The construction of the second round of questionnaire was made to be more open, so that the participants could input or modify their responses as desired. Based on the results generated from round two, areas of agreement and disagreement were identified.

4. Findings and discussion

This section presents the findings and discussion of the study which are organized by themes. The participants' responses generated from the first and second rounds including pedagogical, technical, and other challenges associated with MOOCs teaching-learning processes are combined and presented following:

4.1 Pedagogical challenges

In the context of pedagogical challenges encountering MOOCs practices, the following points are emerged from the findings of the study.

1. The seniors of MOOCs lack effective instructional design ($n = 8$ "66.7 %").
2. There is a lack of sustainable models to guide MOOCs teaching and learning processes ($n = 8$ "66.7 %").
3. The pedagogies of MOOCs do not cater students' diversity of learning styles and interests ($n = 10$, "83.3 %").
4. Educators are not fully aware of MOOCs teaching and learning potentials ($n = 7$, 58.3%).
5. Educational institutions adopt MOOCs without much understanding of its educational implications ($n = 8$, 66.7%).

It was seemed that the panel (9 of 12 responses) pointed MOOCs designs are still driven by traditional instructional approaches, so that learning scenarios could lack interaction in learning process. The majority of participants agreed that there is a lack of MOOCs sustainable models which means inappropriate teaching and learning approaches and ineffective instructional guidance could prevent teachers from innovation in their subjects; however, students' interests, learning styles, and diversities might not be fulfilled.

There was members' consensus around educators not being aware of MOOCs educational affordances. As noted by panel members, for many educators a better understanding of instructional implications of MOOCs is required. Educators are in need to develop awareness of MOOCs philosophical principles when they are incorporating MOOCs in overall teaching and learning process. Understanding the way how connectivism learning could influence by emerging learning technologies in (dynamic of networks and environments) is a key for success with MOOCs. In this context, learning modes that previously served older generation have to be reshaped to achieve the greater needs of current generation.

In addition, those mentioned emerged themes (MOOCs sustainable models, pedagogical aspects, teachers and students' awareness, and educational institution readiness to adopt MOOCs) are critical ingredients to provide a ubiquitous learning. However, MOOCs are versatile ways that educational institutions have to offer in order to facilitate access to educational across world [23]. These results are consistent with other MOOCs studies; for instance [24], MOOCs are slowly emerging and evolving in higher education institutions.

4.2 Technical challenges

As mentioned in the literature review, designing and delivering interactive MOOCs formats are being challenging for many of educational institutions adopting traditional educational strategies. From the findings of this study, the majority of members ($n = 8$) agreed the delivery of MOOCs courses encountered a lot of technical difficulties. For instance, some designers who had never previously experienced designing online learning or MOOCs, those may lack to visualize the process of best designing of MOOCs learning, and finally what content would be delivered online might be changed and affected the quality and delivery of MOOCs. Refs. [25, 26] suggested that MOOCs formats have to be more innovative than ever before to overcome challenges of assignments, to provide immediate feedback and avoid several expected problems and sophisticated software-driven interactive experiences.

A variety of barriers have been discussed in previous related MOOCs studies. For instance, MOOCs participants who are less skilled of the use of technology have encountered great barriers in the process of using MOOCs [27]. Some other challenges are relevant to MOOCs infrastructures (low Internet, Wi-Fi, and boring MOOCs learning materials that could not easily be accessible) [28].

4.3 Skills are important for students to be cultivated for better engagement with MOOCs

According to participants responses (see **Figure 3**), self-directed learning skills ($n = 11$, 91.7%) and self-regulated learning skills ($n = 11$, 91.7%) are seemed critical for learners to be cultivated for better engagement in MOOCs learning environment. In addition, critical skills ($n = 7$, 58.3%) and personal responsibility ($n = 7$, 58.3%) are obviously important to be developed. No doubt, changing from traditional teaching methods to MOOCs learning styles might require more newly skills to be developed, and consequently changing in learners' learning attitudes should take place. Developing self-regulated learning and self-directed learning skills are not only necessary for helping students to take responsibility of their own learning but also assist to clearly understand themselves and prioritize learning goals.

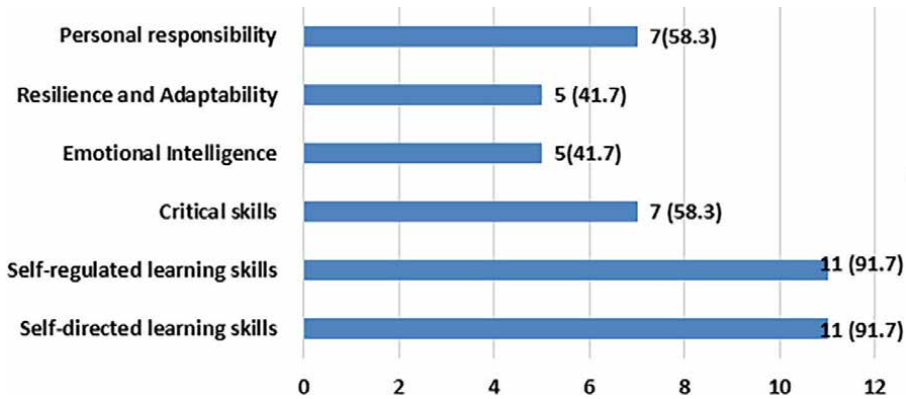


Figure 3.
Presents important skills to be cultivated for better engagement with MOOCs.

For successful learning with MOOCs, combination of knowledge, attitudes, and skills is needed. Students are required to be more autonomous during learning with MOOCs, and hence, they need to improve ability of self-direction which important to self-regulate their own learning to achieve their intended learning goals [23]. In particular, cultivating skills such as self-directed, self-regulated, and critical skills provides students opportunities to teach and assess themselves, to manage their learning and to take responsibility of their own learning, and thus, a total independence of learners with indigenous knowledge and skills that the MOOCs learning environment require could achieve [29, 30].

4.4 Changes are required in learners' learning habits when employing MOOCs

From panel experts' opinions, it seems that MOOCs require a lot of changes and improvement in learners' learning habits. Hence, the role that learners play in the process of learning should change. The participants suggested improvements in learners' habits that can be happened through

1. Developing learners' self-learning ability and to sustain and successfully complete MOOCs learning activities independently and without of supervision.
2. Good communication skills with people from different countries and regions in MOOCs learning platform are essential.
3. Improving information technology literacy is critical for learners, so that they can successfully be able to carry out learning activities.

Drawing from relevant literature [28] and discussion of findings, cultivating online learning habits and skills is critical to rise up learners' levels of engagement, participation, collaboration, commitment, and sustaining to the course completion through learning with MOOCs. The designers of MOOCs have to improve the quality of courses and consider a variety of learning strategies to enhance learners' ability of

interaction. Additionally, developing students' skills of being familiar with the use of technology could help them to be involved actively in learning process carried out by MOOCs.

4.5 Issues are considered to change the future of MOOCs and better enhance teaching learning practices

Emphasizing use of open pedagogies “Methods of teaching practices” is very important, and teachers should be encouraged to develop well-structured teaching designs and deliver learning activities to help students achieve learning objectives by means of involving students to be a part of knowledge creation and active participants in learning process. Teachers also need to interact with students in MOOCs learning environment, so that they could change ways of teaching strategies and learning activities to provide learners' opportunities and increase channels for interaction. MOOCs learning institutions are required to strictly develop mechanisms to help students avoid plagiarism. In such situation, MOOCs institutions might need to go through

1. Improving students' ability of academic writing and develop a sense of honesty when someone quotes other researchers publication.
2. Developing tutorials for students to recognize and understand seriousness of plagiarism.
3. The rules and policies for using MOOCs courses by the universities should be changed.
4. MOOCs communities (e.g., MOOCs experts, universities leaders, and enterprises) have to work together in a harmonious way to draw a road map into the better future of learning with MOOCs.

Changing learners' attitudes to be involved actively in the learning process when courses placed online require MOOCs communities to develop students' awareness in several aspects. Students engage in activities to improve the ability of academic writing and avoid plagiarism that may require universities to get their students involved in specific relevant courses.

In line with related literature concerned MOOCs learning [31, 32] and what we can be concluded from findings of this study, thereby a new wave of policies and instructional approaches are necessary to guide MOOCs practices among higher educational institutions. Teachers have to seek to make paradigm shifts from traditional teaching methods to more modern online learning styles to evolve, innovate, and use augmented learning strategies, and thus, we can expect a promising future for teaching and learning with MOOCs. In the following section, the recommendations and conclusion are presented, respectively.

5. Recommendations

We now list some of the broad recommendations that we thought are important for better emerging pedagogies for learning with MOOCs.

1. It is essential to continue addressing pedagogical challenges and identify appropriate instructional approaches into better involvement with MOOCs learning.
2. MOOCs learning scenarios require teachers or instructors to implement open pedagogies as ways to alternate the practice and method of teaching and meet learners' learning styles and environmental circumstances surrounding learners.
3. The earliest MOOCs pedagogies have been designed to be aligned with previous models of traditional learning and rarely focused to follow the online learning modes; however, to realize the concepts of openness and massiveness, the MOOCs pedagogies should be scrutinized and reconsidered.
4. Principles of connectivist to be considered in overall learning process, as therefore, MOOCs learning can be guided in effective ways.
5. MOOCs discussion forums have to be managed by faculty members or assistants, and thus, the barriers during online learning can be reduced.
6. The delivery course formats should imply elements of interactivity so students could have an opportunity to interact with instructors in learning process.
7. Peer-to-peer assessments are important at twofold, to allow student learning from each other and receive feedback of their work.

6. Conclusion

This study gathered experts' opinions to the pedagogical and technical challenges of MOOCs teaching learning practices. The study undertakes a modified Delphi approach employed two rounds stages designed to combine experts' views and shares their expertise on MOOCs learning. As noted in the literature review, a variety of higher education institutions were interested to adopt MOOCs, and this suggests that MOOCs is a vital and contemporary learning trend that provides numerous of alternative solutions to the traditional learning. As key findings, the study reached panel experts' consensus around important skills that seemed to be critical and immediate needs for better learning with MOOCs. Due to the nature of MOOCs learning, experts' recommended self-regulated and self-directed learning skills as well as personal skills are indispensable and necessary for learners to be cultivated. Hence, educational institutions must prioritize the development of learners' those mentioned skills to support adoption of MOOCs. The study explored experts' expertise and practices of MOOCs, noting that most of incorporated pedagogies are not focused on students-driven, as such pedagogical practice does not widely support the adoption of MOOCs toward improving learning process; however, following principles and guidance of connectivism theory is a key to success in learning leading by MOOCs. These findings indicate the need for ongoing scale-up educators' awareness and understanding of MOOCs implications such as implementing appropriate learning approaches, effective ways of assessment, design course formats, and delivery modes. The findings may inform considerable changes to the MOOCs community (university leaders, institutional practices, educational policy makers, MOOCs providers,

and enterprises) to adopt initiatives, encourage a wider use of MOOCs practices, and develop a sense of learners' engagement to continue sustaining toward course completion. No doubt, trends of MOOC will bring to focus on cultivating learners' skills of workplace. The MOOCs experts have to be consulted through whole processes of designing, development, implementation, and evaluation of MOOCs learning.

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Conflict of interest

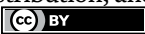
We declare that no conflict of interests regarding this paper.

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Gamification of Personalized Learning through Massive Open Online Courses: Learner-to-AI Enabled Chatbot

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Abstract

Massive open online courses (MOOCs) are considered an educational revolution that widens access to quality education and enhances social inclusion. With their fast advancement and potential influence in education, they have been enlisted in the modernization agenda of many universities globally. Nevertheless, the effectiveness of learning through MOOCs is debatable, while student retention rate ranges significantly. The primary reason is considered the lack of interactivity in MOOCs, which urges enhancement of interaction between teachers and students. Another challenge regarding the MOOCs is to find the best resource fitting a learner's personal profile, interests, background, and learning needs. The first challenge has been addressed from the gamification point of view to measure the impact of gamification on the overall success of MOOCs. However, the second challenge still remains untouched. In online learning setting, course design and interaction with instructors as well as students are the factors that greatly influence students' perceived learning and satisfaction with the online course. The contribution of chatbot-supported MOOCs recommender system is in two-fold. Hence, the current study aims to extend the gamification concept to chatbot-supported MOOCs recommender system with two types of chatbots, namely text and avatar + text chatbot.

Keywords: MOOCs, AI, chatbot, online learning, gamification

1. Introduction

Artificial Intelligence (AI) improves the quality of decision making and problem solving in various industries by exploiting machine intelligence in an effective way (e.g., neural networks and machine learning) [1]. Commercial applications of AI are mainly healthcare, high tech, financial services, automotive, media, retail, and travel industries [2–4]. In the context of a private sector is the deployment of applications interacting with users in a conversational as well as human mimic format, which is also referred as “conversational agent,” “bot,” or “chatbot” is the most popular AI trend [5]. Education is another field that through AI it provides tremendous potential for learners.

It has been evolved from experimental laboratory scenario to the real-time learning platform with its complexities as well [6]. It is added that firms that offer educational technology, or so-called “EdTech” parallelly enhance Individual Adaptive Learning System (IALS) for the aim of providing personalized learning experience. Not limited to learning, the system also assists in classroom activities, such as management, evaluation, and grading of learners, while also solve language problem. According to Mou [7], from 2008 to 2017, global investments into education powered with AI have reached to over hundreds of billions of US dollars.

Chatbots are tools of AI that are massively applied in banking, healthcare, insurance, government services platforms as well. They are acknowledged as taking actions to increase the probability of success reaching a certain goal in response to perceiving the environment [8]. According to Business Insider [9], there are many popular chatbots that serve as virtual assistants, ranging from Alexa to Siri and Google now. They help people to chat with agencies, make bank transactions, get news, book hotel rooms and so on.

What happens in learning environment if AI powered personalized learning is applied? Personalized learning is an approach of education that customizes learning program based on each learner’s needs and skills, as well as interests [10]. In a classroom environment, the application of AI helps to retrieve history of past learning activities, incorporates with current data and a learner’s profile as well as learning gaps and then suggests what steps need to be taken to improve academic performance.

Trends, challenges, and technology developments in education evolve over time with new perspectives and dimensions every year [11]. For instance, mobile and online learning today are not what they were yesterday. Some research works have investigated and analyzed the use of mobile devices in m-learning environment by university students’ and the effect of personality, which addresses data breach in education and the role of excessive technology use on risky cyber-security behavior of students [12]. Yet another research investigated the effect of educational technologies on the perception of tourism students and their intention to work thereafter. Different M-learning and E-learning platforms were compared to assure the most effective platform for CSR education among the students, which eventually found that e-learning tools are rather more effective [13]. Hence, virtual reality, chatbots, and immersive apps have added more functionality and greater potential for learning. While notable examples of artificial intelligence (AI) are utilized in a classroom setting, administrative tasks also implemented with the use of AI [11]. For instance, some institutions improve teacher evaluations by using AI-enabled chatbots to record, organize, and provide detailed feedback from learners.¹ Georgia State utilized Pounce—a chatbot that helps incoming learners navigate through complicated application process and provides a personalized checklist for completing financial aid and enrolling in courses.²

There are several areas of research interest in HCI: (1) Exploration of interfaces that expand representational possibilities beyond metaphors to the extent that users have already been accustomed, such as desktop icons; (2) technology-aided cooperative work; (3) human perception and cognition coupled with the task analysis, which is a particular focus of the current study due to the fact that little attention has been

¹ <https://learningenglish.voanews.com/a/new-ai-technology-lets-learners-evaluate-professors-by-chatting/4301189.html>.

² <https://edtechmagazine.com/higher/article/2018/03/universities-deploy-chatbots-aid-learners-admissions-process-and-beyond>.

paid to socio-cognitive nature of human-technology interaction with particular emphasis on chatbots [14].

According to Class Central³, approximately 23 million new learners started using massive open online courses (MOOC) in 2017, taking the total number of learners reaching to 81 million. The top MOOC providers are Coursera, edX, XuetangX, Udacity, and FutureLearn. Among them, edX is particularly aimed for professional education. Currently, MOOCs cover almost all study disciplines and educational levels. The major motivation for the creation of MOOCs is pedagogical and educational innovation [15, 16]. MOOC refers to online course that involves learners in learning process, offers a way for learners to connect and collaborate, and provides a platform where course materials are shared among learners.

The effectiveness of learning through MOOC is debatable, while learner retention rate ranges between 10 and 50% [17]. The primary reason is considered the lack of interactivity in MOOC, which urges enhancement of interaction between teachers and learners [18]. Another challenge regarding the MOOC is to find the best resource fitting learner's personal profile, interests, background, and learning needs [19]. The study proposed "MOOCBuddy" chatbot that acts as MOOC recommender system based on learner's interests as well as social media profile and it is based on Facebook messenger platform. It is shown that the one way that chatbots transform education is providing teaching assistance.⁴ For instance, Georgia Institute of Technology introduced Jill Watson—a new teaching assistant that responds to learner inquiries in a fast and accurate way. It is powered by IBM's AI system collecting more than 40,000 forum posts.

1.1 Research aim

Although chatbots are gaining massive interest in education, much systematic and empirical work is still needed to approach human-chatbot interaction from psychological aspect and develop theoretical as well as practical guidelines for the design and development of this technology, especially with consideration of communication style alignment between humans and chatbots. Drawing from the previous studies, this research addresses:

- What are the salient aspects of learners' perceptions toward the chatbots that assist them in finding relevant course-driven MOOCs as part of their studies.
- How does learner-chatbot communication style similarity affect the above aspects?
- How does learners' intention to use chatbots affect their academic performance?

This research particularly focuses on text-stream chatbots. Because, Ciechanowski et al. [14] found that users experience less negative feeling in engagement with text chatbot in comparison with animated avatar chatbot. Finally, academic performance is tested as an outcome of learner-chatbot interaction. Fryer et al. [20] found a significant drop in learners' task interest with chatbot compare to human in terms of

³ <https://www.class-central.com/report/mooc-stats-2017/>.

⁴ <https://chatbotsmagazine.com/six-ways-a-i-and-chatbots-are-changing-education-c22e2d319bbf>.

language learning. It may be related to the area of chatbot application. As such, previous sections highlighted the successful application of chatbots in different fields, while chatbot was found to be less effective in language learning. Therefore, it is worthy to investigate whether learners will have positive or negative perceptions of chatbots in finding course-driven MOOCs based on their specific needs.

1.2 The learner-Chatbot interaction process

If the effectiveness is the focus point, the chatbot should be designed in a way that it can convince a learner to be an appropriate tool to perform learning task and to be beneficial in delivering the learning outcomes. According to Ajzen [21], there is a consistency between a user’s belief and intention to perform a task and reach a target.

Figure 1 illustrates a learner’s interaction process with chatbot. According to Al-Natour and Benbasat [22], the factors of outcome, occurrences during learner’s interaction with chatbot, and results of the interaction are identified in the whole process. Moreover, object-based and behavioral beliefs combined with the task (online learning) represent the cognitive processing of learner’s behavior. The proposed model has a guiding role in design of system process that chatbot may have a broader capacity that will not lead learners to perceive it less useful in different tasks as well as different phases of interaction from initiation to completion, and to stop using it.

1.3 Similarity-attraction theory and learners’ interaction with Chatbot

Recently, information system (IS) research has mainly focused on the effect of cognitive and emotional aspects on different behaviors [23]. Both negative (e.g., anxiety and helplessness) and positive (e.g., enjoyment) emotions facilitate user behavior and openness to information reception [24]. In a functional context, when

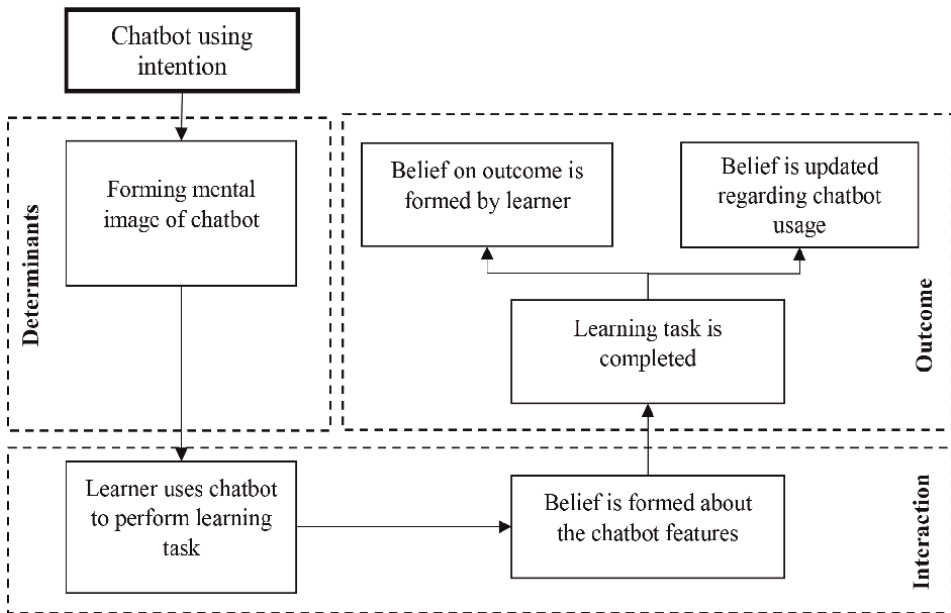


Figure 1.
The learner-chatbot interaction flowchart.

users trust the information they receive and feel informed well, it encourages their tendency for seeking information [25]. Moreover, AI chatbots with higher utilitarian and hedonic features and similarity of chatbot-learner communication style can be expected to enhance learner's adoption of this new communication channel. On the contrary to utilitarian features, hedonic features heavily focus on fun-aspect of IS usage, and encourage prolonged usage rather than productive usage [26].

Based on the similarity-attraction theory the more similar a learner's features and beliefs are to those of other parties, the more likely that learner will be attracted to and build better perceptions of that parties [27]. In the context of virtual intelligent agents, humans regularly perceive them to have human-like behaviors and personalities [22]. Similarity reduces uncertainty, while increases validation and enjoyment of interaction [28]. In their study, Al-Natour and Benbasat [22] conceptualized user-IT artifact relationship and proposed that object-based beliefs, such as individualistic (e.g., information quality and interactivity) and dyadic (e.g., personality similarity and complementarity) factors create behavioral and relationship beliefs. In another study, Al-Natour et al. [29] found that personality and behavioral similarities between users and online shopping assistants positively lead to user evaluation of the technological artifact. Al-Natour et al. [30] distinguished between personality and decision process similarity and found that personality similarity affects trusts, while decision process similarity influences enjoyment and ease of use of online shopping assistants.

To sum up, it is assumed that the similarity-attraction paradigm can be applied in the adoption of AI chatbots by the learners in learning delivery in the context of MOOCs. Hence, this research categorizes task-related and channel-related factors [31], in order to guide prospective system designer's MOOC system by incorporating above aspects in chatbot-supported communication channel.

1.3.1 Direct relationships

Task value (TV) has been extensively used in educational context for evaluating learners' achievement and academic performance. It refers to evaluating how important, interesting, and beneficial the task is [32]. TV is related to attachment to perform well on a given task, pleasure gained from it, and its contribution to long-term goals, as well as cost and energy invested in performing the task [33].

Informativeness (INFO) is explained with the user perception of the system to effectively provide appropriate information [34, 35]. It expresses the feeling of being informed about a specific feature of products or services, such as technical capabilities, which leads users to be positively associated with using that products or services [36]. In the context of virtual health advisory system, Li and Mao [23] proposed that communication similarity between user and virtual health advisory system could reduce uncertainty and make users feel their need for information is easily fulfilled through the system usage.

Similarity might affect building pleasurable interactions [23]. Decision process and personality similarity significantly impacts perceived enjoyment (ENJ) [29]. In addition, Li and Mao [23] found that perceived ENJ positively and significantly impacts both reuse intention of virtual health advisory system and social presence.

Transparency (TRS) is significantly and positively influenced by communication similarity between user and virtual health advisory system, while it also influences reuse intention [23]. In their study, Baxter and West [37] highlighted that similarity creates predictability between partners and enables them to interact with greater confidence.

Similarity in communication style enhances feeling of credibility (CRE) [38]. In consumer research, it has been found that internal similarity increases buyer's disposition to trust salespeople and follow their supervision [30]. However, it was found that credibility does not influence reuse intention of virtual health advisory system and social presence [23].

Trust on internet (TI) is regarded as e-government users' belief on the reliability of Internet for information accuracy and transaction security [39]. Learners must trust Internet as e-enabler to keep their information secure and private to accept and adopt e-government services [40]. In the context of this study, it is proposed that chatbots can be considered as e-enablers, while learners' trust on them can be crucial in their motivation e-government service adoption.

Irreplaceability (IRR) refers to the extent that a certain product has a symbolic meaning to a person that is not apparent in other products, even if they are physically identical [41]. When a product is irreplaceable, consumers are less likely to replace it, whereas more likely to retain it for a long term [41]. To our best knowledge, there are not many studies utilized irreplaceability in the MOOC learning context. It is proposed that IRR of chatbots in e-learning service delivery could have significant influence on the adoption of this technology by learners.

Drawing from the discussion above, the current research proposes the following hypotheses:

H1. Communication style similarity will significantly impact task-related factors in learner-chatbot interaction.

H2. Communication style similarity will significantly impact channel-related factors in learner-chatbot interaction.

H3. Task-related factors will significantly impact learner's intention to use chatbot-supported e-learning service in MOOC.

H4. Channel-related factors will significantly impact learner's intention to use chatbot-supported e-learning service in MOOC.

1.3.2 Moderating effect

Ciechanowski et al. [14] studied human-chatbot interaction with different types of interfaces. The two types of chatbots, namely simple text and avatar chatbots were used in the experiment. The major emphasis was on feeling of eeriness and discomfort

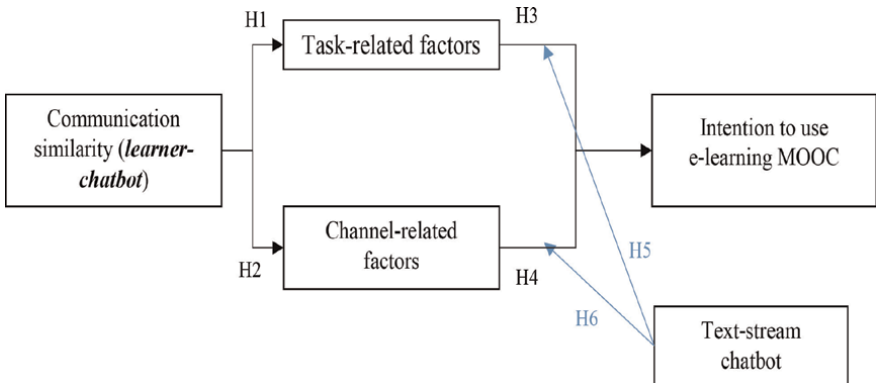


Figure 2.
MOOC learner-chatbot interaction model.

about the medium in human-machine communication, and results showed that users experienced less negative feeling in association with simple text chatbot compare to more complex (animated avatar) chatbot. It can be proposed that before introducing the chatbot, it is essential to understand user psychology and design better chatbots to contribute to human-machine interaction. Therefore, in the current study, text-based chatbot is tested as a main moderator (see **Figure 2**). Drawing from the findings, the following hypotheses are proposed:

H5. Text chatbot type will have moderating role between task-related factors and learner's intention to use chatbot-supported e-learning service in MOOC.

H6. Text chatbot type will have moderating role between channel-related factors and learner's intention to use chatbot-supported e-learning service in MOOC.

2. Methods

Primarily, the current study aimed to investigate the perceptions of learners toward the AI supported chatbot. To attain this aim, in total of 32 participants selected randomly based on the population were given open-ended survey questionnaires, through which the researcher could identify the most attractive channel for learners to use in e-learning process. For instance, it could be through online courses, YouTube channels, various websites with learning resources, and so on. Henceforth, six criteria (C) for evaluation were identified in regards to three learning channels (Ch), namely, (1) Web search, (2) YouTube learning channels, and (3) online courses official websites. Those criteria are (1) Information retrieval time; (2) Request on personalized learning; (3) Sense of human touch; (4) Comfortability; (5) Credibility; (6) Ease of use of channel.

Results based on a mixed methodology approach revealed significant difference among the six criteria across three e-learning channels ($F(3, 28) = 0.21, p > 0.05$). In terms of **C1**, web search is more effective ($M = 4.08, SD = 0.87$) than YouTube ($M = 3.72, SD = 0.85$), and online courses ($M = 3.19, SD = 0.91$). The learners also think that online learning is more personalized ($M = 4.12, SD = 0.85$) in YouTube channels,

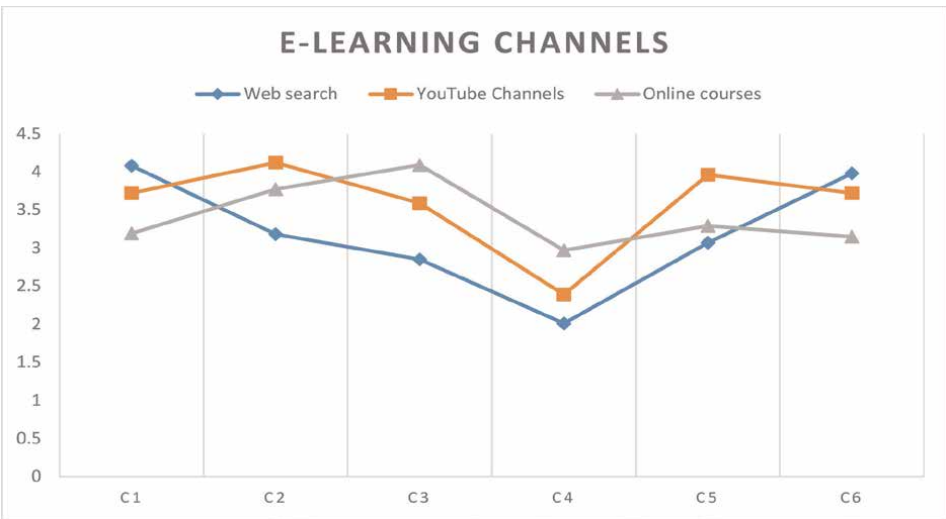


Figure 3.
E-learning by interaction characteristics of learning channels.

giving sense of human touch, ($M = 4.09$, $SD = 0.92$) through online courses, and easy to use ($M = 3.98$, $SD = 0.82$) in web search. The details are demonstrated in **Figure 3**.

What is learnt from the above finding is that with the full potential of AI integration and learning capability of chatbots, MOOCs may benefit from this technology to motivate learners to switch from traditional to modern learning channel.

2.1 Quantitative study

A quantitative method was used for the data collection procedure due to the extent that online survey fosters the geographical distribution of the questionnaire with relatively less cost and higher time efficiency [42].

This study used AMOS v.24 software for the statistical analysis of the proposed hypotheses and moderation effect. Initially, measurement model was assessed, followed by structural model, as suggested by Hair et al. [43]. A 5-point Likert scale ranging from 1 being “strongly disagree” to 5 being “strongly agree” is used.

2.2 Sampling process and collection of data

This study was conducted in the Middle East during the period 2021–2022. The data was collected from the learners who mostly prefer using digital channels to access to learning materials and conduct learning activities. The subjects of the study were distributed the online questionnaire with the use of emails and official pages of MOOCs on social media (e.g., Facebook, Twitter, and others).

Prior to the final survey, a pre-test was carried out with 14 participants, who had experience with chatbot in other platforms. It helped us to refine the questionnaire in terms of clarity and language. Because, questions were firstly translated into Arabic and then back to English language to ensure that the meanings were not lost. The items representing CE, TI, and ENJ were re-worded in order for increasing the generalizability of the findings. Cronbach's alpha (α) was used to test reliability of the pre-test results, and it was found that α values of the study variables were higher than 0.7, indicating the adequate reliability [44]. The final questionnaire (Appendix) comprised of 42 questions, 6 of them being related to demographics.

Data was analyzed using AMOS v.24 software with structural equation modeling (SEM) technique. Firstly, measurement model was assessed, which was followed by structural model of testing the proposed hypotheses [43]. The overall analysis included construct validity including convergent and discriminant validity, and model testing including model fit and hypotheses.

3. Data analysis

3.1 Demographics of respondents

The demographic analysis showed that majority of respondents are male (58.4%), while they belong to 26–30 years old age group (35.9%) and with undergraduate degree (49.6%). In the context of Internet usage, they reported that more than half of them use Internet for above 21 hours in a weekly basis, with mobile devices (52.3%). However, nearly 60% of them are unfamiliar with chatbot use in the context of online activities, not limited to learning process (see **Table 1**).

Demographics (N = 373)		Frequency	Percentage (%)
Gender	Male	218	58.4
	Female	155	41.6
Age	<25	116	31.1
	26-30	134	35.9
	31 - 35	67	18.0
	36 - 40	39	10.5
	> 41	17	4.6
Education	Undergraduate	185	49.6
	Master	109	29.2
	PhD	79	21.2
Frequency of Internet use/weekly	> 5 hours	11	2.9
	5 - 10 hours	17	4.6
	11 - 15 hours	39	10.5
	16 - 20 hours	117	31.4
	> 21 hours	189	50.7
Device type for Internet use	Desktop PC	38	10.2
	Laptop	56	15.0
	Tablet	84	22.5
	Mobile phone	195	52.3
Familiarity with chatbot use	Fully familiar	43	11.5
	Somehow familiar	107	28.7
	Not familiar at all	223	59.8

Table 1.
Demographic profile of study respondents.

3.2 Measurement model

The constructs and their underlying items were assessed for reliability and validity. Reliability is to measuring the consistency between multiple measurements of a construct [45], which must be carried out before validity test. Reliability was assessed with the use of Cronbach’s α , which is a commonly applied measure [44]. There are four cut-off points that define the reliability level of the constructs, recommended by Hinton et al. [46]:

- Excellent reliability >0.90 .
- High reliability $0.70 \sim 0.90$.
- Moderate reliability $0.50 \sim 0.70$.
- Low reliability <0.50 .

In this study, four constructs, namely UV ($\alpha = 0.79$), INFO ($\alpha = 0.76$), TI ($\alpha = 0.71$), and CS ($\alpha = 0.73$) show high reliability, while other constructs showed moderate reliability.

In the next stage, convergent validity is assessed. There are three measures that utilize the convergent validity test: (1) Confirmatory factor analysis (CFA) for measuring scale validity with indicator factor loadings. The indicator loadings must exceed threshold of 0.5 [47]; (2) Composite reliability (CR) that must be over 0.6 acceptance level [48]; and (3) Average variance extracted (AVE), which must be higher than 0.5 [49]. **Table 2** shows that all criteria regarding the convergent validity test are met. CR values ranged between 0.71 and 0.86, while AVE values ranged between 0.54 and 0.69. In CFA analysis, IRR3, ENJ2, and TRS1 items did not load on their underlying constructs and therefore excluded.

Finally, discriminant validity test is used. According to Fornell and Larcker [49], square root of AVEs for each construct must be greater than correlation coefficients between the constructs. **Table 3** indicates that this criterion is also met.

3.3 Structural model

Primarily, the structural model between CS and task-related and channel-related factors was tested. CS was found to be positively and significantly related to TV ($\beta = 0.314^{***}$, $p < 0.001$), INFO ($\beta = 0.302^{***}$, $p < 0.001$), ENJ ($\beta = 0.217^{**}$, $p < 0.01$), TI ($\beta = 0.179^{**}$, $p < 0.01$), IRR ($\beta = 0.114^*$, $p < 0.05$), and PER ($\beta = 0.356^{***}$, $p < 0.001$), whereas it does not influence perception of transparency (TRS) ($\beta = 0.041$, $p > 0.05$). It may be explained to the extent that transparency is rooted in learners' prior experience with e-learning service providers. Even though they are introduced with new communication channel, they may still have concerns on trust and transparency, while they find chatbot communication informative, enjoyable, and irreplaceable, and so on. Hence, **H1a**, **H1b**, **H2a**, **H2c**, **H2d**, and **H2f** are confirmed, whereas **H2b** is rejected.

Next, task-related and channel-related factors predicted INT. It was found that both task-related factors, namely, TV ($\beta = 0.289^{***}$, $p < 0.001$) and INFO ($\beta = 0.252^{**}$, $p < 0.01$) positively and significantly predict learners' intention (INT) to use chatbot-supported MOOCs. In the context of channel-related factors, ENJ ($\beta = 0.245^{***}$, $p < 0.001$), IRR ($\beta = 0.126^*$, $p < 0.05$), and PER ($\beta = 0.276^{***}$, $p < 0.001$) positively and significantly influence INT, whereas TRS ($\beta = -0.057$, $p > 0.05$) and TI ($\beta = 0.021$, $p > 0.05$) are not related to INT. Moreover, **H3a**, **H3b**, **H4a**, **H4e**, and **H4f** are supported, while **H4b**, **H4c**, and **H4d** are not supported.

3.4 Moderating impacts

As moderators, CT was included to test whether it strengthens or weakens the main effects. CT was added in line with the assumption that text-based chatbot type may significantly enhance learners' motivation to use chatbot-supported communication channel, which may also increase learners' perceptions of e-learning service features that could ultimately lead to switching from traditional to digital communication channel. In the context of task-related factors, it was found that CT plays a strong moderating role between TV and INT ($\beta = 0.297^{***}$, $p < 0.001$), and between INFO and INT ($\beta = 0.328^{***}$, $p < 0.001$). Hence, **H5a** and **H5b** are supported. In terms of channel-related factors, CT strengthens the effects of ENJ ($\beta = 0.257^{***}$, $p < 0.001$), IRR ($\beta = 0.233^{**}$, $p < 0.01$), and PER ($\beta = 0.387^{***}$, $p < 0.001$) on INT. Thus, **H6a** and **H6d** are confirmed.

Constructs & items	Mean	SD	Standardized factor loadings	Cr α	CR	AVE
<i>Task value</i>						
Intrinsic or interest value (IV)				0.65	0.82	0.62
IV1	3.07	0.81	0.72	3.07	0.81	0.72
IV2	3.12	0.82	0.75	3.12	0.82	0.75
IV3	2.94	1.13	0.79	2.94	1.13	0.79
IV3	3.14	1.18	0.77	3.14	1.18	0.77
Attainment value (AV)				0.63	0.84	0.69
AV1	3.26	0.86	0.83	3.26	0.86	0.83
AV2	2.87	0.79	0.82	2.87	0.79	0.82
AV3	3.11	1.04	0.91	3.11	1.04	0.91
Utility value (UV)				0.79	0.71	0.55
UV1	3.87	1.07	0.79	3.87	1.07	0.79
UV2	3.74	1.24	0.71	3.74	1.24	0.71
UV3	3.42	0.76	0.70	3.42	0.76	0.70
Informativeness (INFO)				0.76	0.75	0.56
INFO1	3.14	1.28	0.71	3.14	1.28	0.71
INFO2	3.08	1.13	0.74	3.08	1.13	0.74
INFO3	2.95	0.79	0.78	2.95	0.79	0.78
Enjoyment (ENJ)				0.71	0.72	0.64
ENJ1	3.56	0.84	0.82	3.56	0.84	0.82
ENJ2	3.27	0.88	0.79	3.27	0.88	0.79
Transparency (TRS)				0.69	0.73	0.57
TRS1	3.11	0.83	0.75	3.11	0.83	0.75
TRS2	3.06	1.05	0.73	3.06	1.05	0.73
Credibility (CRE)				0.76	0.82	0.56
CRE1	2.85	1.13	0.77	2.85	1.13	0.77
CRE2	2.91	1.27	0.71	2.91	1.27	0.71
CRE3	3.04	1.08	0.82	3.04	1.08	0.82
Trust of Internet (TI)				0.71	0.86	0.68
TI1	3.17	0.74	0.80	3.17	0.74	0.80
TI2	3.26	0.81	0.83	3.26	0.81	0.83
TI3	3.10	0.89	0.91	3.10	0.89	0.91
Irreplaceability (IRR)				0.68	0.82	0.69
IRR1	3.28	0.83	0.86	3.28	0.83	0.86
IRR2	3.16	0.77	0.79	3.16	0.77	0.79
Personalization (PER)				0.66	0.81	0.66
PER1	3.47	0.92	0.83	3.47	0.92	0.83

Constructs & items	Mean	SD	Standardized factor loadings	Cr α	CR	AVE
PER2	3.21	0.96	0.85	3.21	0.96	0.85
PER3	3.18	0.84	0.87	3.18	0.84	0.87
Communication style alignment (CS)				0.73	0.81	0.65
CS1	2.78	0.85	0.82	2.78	0.85	0.82
CS2	2.69	1.06	0.79	2.69	1.06	0.79
CS3	2.81	1.17	0.78			
Intention to use e-government service (INT)				0.64	0.75	0.57
INT1	3.29	3.29	3.29			
INT2	3.17	3.17	3.17			
INT3	3.06	1.03	0.77			
Chatbot type (CT)				0.67	0.71	0.54
CT1	3.17	0.85	0.72			
CT2	3.39	0.83	0.74			

Table 2.
Measurement model results.

	1	2	3	4	5	6	7	8	9	10	11	12	13
1	0.77												
2	0.32	0.85											
3	0.28	0.53	0.73										
4	0.17	0.31	0.41	0.83									
5	0.23	0.46	0.58	0.56	0.74								
6	0.21	−0.04	0.06	0.23	0.05	0.81							
7	0.39	0.11	0.02	0.08	0.15	0.43	0.74						
8	0.25	0.31	0.12	0.17	0.68	0.09	0.56	0.77					
9	0.01	0.48	0.03	−0.23	0.47	0.16	0.34	0.29	0.85				
10	0.42	0.62	0.08	0.56	0.31	0.09	0.38	0.17	0.27	0.82			
11	0.29	0.49	0.65	−0.07	0.36	0.62	0.26	0.26	0.47	0.17	0.85		
12	0.31	0.57	0.49	0.19	0.26	0.43	0.22	0.09	0.71	0.22	0.76	0.73	
13	0.49	0.04	0.25	0.09	0.04	0.06	−0.08	0.11	0.51	0.35	0.55	0.39	0.14

Table 3.
Discriminant validity analysis.

4. Discussion

Irrespective the popularity of e-learning service delivery in many countries in the context of MOOCs, majority of learners still prefer using traditional channels to

request learning materials either by web search or YouTube learning. Understanding the reason why digital divide exists for e-learning services, but not for other types of Internet use, is very important research problem.

Chatbot-supported communication between companies and their clients are becoming a norm of digital communication and service provision. Consequently, surrounding the core themes of “similarity-attraction” theory, the recent study explored the value of chatbot-supported communication in e-government domain and tested the effect of chatbot-learner communication style alignment and similarity on the realization of the value of such communication type.

Through the open-ended online survey, the most important aspects of e-learning service delivery to learners were identified. If properly designed and integrated with the features of personalized content, credibility, and human touch, chatbot-supported communication channel can potential draw the attention of learners in their interaction with MOOCs. In the next stage, quantitative study was conducted to comprehensively address the prevalent aspects of learners’ perceptions toward adoption of chatbot supported e-learning services and the impact of learner-chatbot communication style similarity on those aspects. It was found that communication style similarity between chatbot and learner leads to learners’ perceptions of this communication type being more informative, enjoyable, credible, and irreplaceable. In addition, this type of communication increases the valuableness of the information-seeking task, trust in Internet, personalization, while also makes learners feel anxious about using this technology. Moreover, it does not change the learners’ perceptions on transparency and trust. This is very critical finding that must be addressed by the system designers. Making the interface and content simple and accessible may reduce the anxiety. However, transparency and trust are purely service provider-related problem. If AI functions are fully deployed in designing this type of communication, it can reduce learners’ perceptions on manipulation of information, especially by telling them that chatbot can “learn and improve itself by communicating.” It was also found that task value, informativeness, enjoyment, credibility, irreplaceability, and personalization lead to learners’ intention to use such communication channel.

Chatbot type was added as moderators to see whether or not they strengthen learners’ perceptions toward using chatbot-supported communication. Similar to human communication, people want to interact with computers in their own language [14]. It was postulated that in order to facilitate human-computer interaction, users must be allowed express their interests, wishes, or requests directly and naturally, by speaking, typing, and pointing [50]. It was found that chatbot type being text stream moderates the relationship of task value, informativeness, enjoyment, irreplaceability, and personalization with learners’ intention to use such communication channel. Overall, the results clearly indicate what would be the possible outcomes if communication style between chatbot and learners is aligned well.

4.1 Implications

In theory, this study contributes to the improvement of HCI for learner-chatbot interaction, especially with an understanding on the impact of similarity-attraction theory on learner perceptions and intention to use chatbot-supported e-learning services. The alignment of communication style of chatbots with learners’ needs may lead to sense of “in-group” effect that could ultimately create various benefits for both e-learning service providers and service receivers.

Despite the social and economic potential of AI in public and private sectors, the major concern is the possible negative effects of AI. In economic perspective, it can be explained by the employment effects of AI, as robots are threat to labor market. Special Eurobarometer [51] revealed that 74% of citizens are worried that more jobs will be taken by robots and AI. However, another study in developed countries has revealed that technology replaces low-skill jobs mainly, which enhances productivity [52]. In addition, the real business and public service cases also show that the utilization of AI and especially chatbots contribute to organizations as well as clients. This study identified some patterns of communication between learners and MOOCs providers that can guide designers and decision-makers. In addition, offering chatbot-supported communication channel revealed that learners find it enjoyable and comfortable to engage with, while also efficient in terms of information retrieval time. However, traditional channel is still believed to be effective in being personalized, credible, and has a sense of human touch. One reason can be that they were only provided with relatively simple chatbot without a language style they are happy with. Well-known Chinese e-retailers such as Taobao.com and JD.com use trendy Internet slang, such as “Qin,” meaning “my sweet heart” when they begin conversation with customers, which increases the customer stickiness to e-retailer’s service [23].

5. Conclusion

The current study examined e-learning in Arabic context, with an introduction of chatbot-supported communication channel as well as its comparison with existing channels. Initially, the gaps in government service delivery were addressed and then the potential for chatbot-supported communication between learners and service providers was discussed. In addition, the factors that may significantly affect learners’ channel-choice were assessed to see whether communication style similarity between learners and chatbots would lead them to use this communication channel. Rather than being divider, this study mainly targets the advancement of communication process between learners and MOOC providers by incorporating intelligent, timely, fun, personalized, and efficient features of communication tools. As AI continues to cover wider scope of services, its application in chatbot-supported communication in e-learning setting can be highly beneficial for both learners and service providers. From MOOC providers, it can have a considerable implication for staff and costs [53]. Cross-channel integration (or integration of the beneficial features of all communication channels in one platform) can lead to response consistency, timeliness, access to the same data, and implementation of transaction in a single platform and without conventional ways of learning process.

One of the limitations of this research is that it has been conducted in a single cultural setting. However, extending this study to cross-cultural setting would be highly beneficial for a higher validation of communication-style alignment. As communication style similarity between learners and chatbot is a central focus, it might be different in every country. Moreover, drawing from cultural differences, learners may have different expectations from interacting with chatbots in terms of their functionalities, fun features, service query types and others. In addition, only text-based chatbot has been developed and tested in this study. It could be worthy to add visual features such as avatars, facial elements to chatbot, and test learners’ preferences with the use of Anthropomorphism scale.

Appendix

Construct/item	Description	Source
Task value		
Intrinsic or interest value (IV)		Hagemeier and Murawski [54]
IV1	I enjoy advancing my information base by exploring E-learning chatbot	
IV2	The challenge of using E-learning chatbot for service request is exciting	
IV3	I liked the challenge of retrieving learning materials through chatbot	
Attainment value (AV)		Hagemeier and Murawski [54]
AV1	I value the prestige that come with using E-learning chatbot for learning	
AV2	I need the E-learning chatbot to fulfill my information retrieval potential	
AV3	Completing information retrieval through E-learning chatbot allowed me to attain high sense of self-worth	
Utility value (UV)		Hagemeier and Murawski [54]
UV1	I think chatbot can be an integral part of what I want to do in future in terms of learning service	
UV2	Chatbot usage is important because it provides me better functionality	
UV3	I think chatbot can be beneficial because of my need for personalized service	
Cost of engaging (CE)		Hagemeier and Murawski [54]
CE1	I worry that spending time for chatbot usage would take me away from other activities	
CE2	Prior to using E-learning chatbot, I was concerned that using this channel would not be worth of effort	
CE3	I worried that I would waste a lot of time using chatbot for retrieving the specific information	
Informativeness (INFO)		[23]
INFO1	with the use of E-learning chatbot, I feel well-informed about the service I request	
INFO2	with the use of E-learning chatbot, I know how to request the information based on my needs	
INFO3	with the use of E-learning chatbot, I can retrieve more information from linked sources	
Enjoyment (ENJ)		[23]
ENJ1	I find interacting with E-learning chatbot enjoyable	

Construct/item	Description	Source
ENJ2	I find interacting with E-learning chatbot interesting	
ENJ3	I find interacting with E-learning chatbot exciting	
Transparency (TRNS)		[23]
TRNS1	The advice given by E-learning chatbot is easy to understand	
TRNS2	The advice given by E-learning chatbot is not confusing	
TRNS3	I understand about what E-learning chatbot talks about	
Trust of Internet (TI)		Lallmahomed et al. [55]
TI1	Internet makes me feel comfortable using it to interact with learning services	
TI2	I feel assured that legal and technological structures adequately protect me from problems on Internet	
TI3	Internet is a robust and safe environment to transact using learning services	
Irreplaceability (IRR)		Zhang et al. [56, 57]
IRR1	I think chatbots are superior to conventional channels in learning service delivery	
IRR2	I think conventional channels cannot complete some functional tasks as chatbots do	
IRR3	I think there are some functional differences between chatbots and conventional channels	
Personalization (PER)		Kim and Han [58]
PER1	I feel that E-learning chatbot is tailored to me	
PER2	I feel that contents in E-learning chatbot are personalized	
PER3	I feel that E-learning chatbot is personalized for my usage	
Communication style alignment (CS)		[23]
CS1	I feel the language style of E-learning chatbot matches my preferences	
CS2	I feel the design of E-learning chatbot matches my communication preferences	
CS3	I feel E-learning chatbot communication with me in a style that I like	
Intention to use e-learning service (INT)		Lallmahomed et al. [55]
INT1	I intend to use chatbot-supported learning services in the future	
INT2	I predict I would use chatbot-supported learning services in the future	
INT3	I plan to use chatbot-supported learning services in the future	

Construct/item	Description	Source
Chatbot type (CT)		[14]
Text stream	<i>I consider the text-based E-learning chatbot:</i> (1) Extremely weird; (2) Highly weird; (3) Moderately weird; (4) Less weird; (5) Not weird at all	

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MOOCs and Problem-Based Learning: A Happy Marriage?

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Abstract

Massive Open Online Courses (MOOCs) target a large number of participants, typically without entry requirements and for free. Inherently, the amount of teacher support is limited and interaction is often limited. This exploratory study aims to investigate whether characteristics of PBL can be implemented in a MOOC, thus applying a student-centred instructional design. The results of two runs of the MOOC *Problem-Based Learning: Principles and design. Students at the centre!* show that it is possible to design a MOOC based on student-centred learning theories. Participants discussed authentic problem cases in groups and followed a similar structure as in regular Problem-Based Learning (PBL): a brainstorm phase in which they collaboratively generated their own learning questions, a self-study phase in which they individually searched resources to study, and a reporting phase in which they collaboratively discussed what they had found. In the absence of tutor guidance and feedback, participants learned with and from each other. Participants were positive about the design, the learning materials, and the learning process in the PBL. Successful groups managed to collect insights and genuinely co-construct knowledge. However, the absence of a tutor makes means that this design is not comparable to traditional forms of PBL and is not successful for all MOOC participants.

Keywords: MOOC, online learning, problem-based learning, PBL, online collaborative learning

1. Introduction

1.1 Research topic

Massive Open Online Courses (MOOCs) target a large number of participants, typically without entry requirements and for free [1]. MOOCs have been proposed as a way to make higher education accessible to a wide range of learners, independent of time, place, and financial resources of the participants. However, inherently, the amount of teacher support in MOOCs is limited and interaction is often limited [2]. At first sight, this seems at odds with current learning theories favoring a more student-centred approach [3]. In face-to-face higher education, this has led to the adoption of small group learning formats, such as Problem-Based learning (PBL) [4]

or Team-Based Learning [5]. This raises questions about the quality of learning that is possible in MOOCs. To what extent can principles of student-centred learning be implemented in a MOOC?

1.2 Literature review

Historically, MOOCs emerged from the Open Educational Resources (OER) movement. The term MOOC was first used in 2008 by David Cormier in relation to the course ‘Connectivism and connective knowledge’ [6]. Although the first MOOCs specifically aimed at co-construction, the vast majority of MOOCs have had a more traditional teacher-directed design [7, 8]. The dropout in MOOCs is often high, typically more than 90% [9, 10]. Completion rates may not be a good way to assess learning in a MOOC, because not all participants may have entered the course with the intention to finish it [11, 12]. Regardless, MOOCs have been criticized for lack of sound instructional design [10]. Collaborative working formats are not used, participants work on individual assignments, and interaction is limited to discussion boards and peer review [2]. Participants complain about the lack of interaction with instructors and poor feedback from peers [9], whereas more interaction is a predictor of completion [13]. A recent literature study showed that also for teachers involved in MOOCs the incompatibility of expectations is one of the main challenges, i.e., they feel challenged to enact their teacher role well in the context of a MOOC [14].

From a learning theory point of view, the complaints and large dropouts are not surprising. Student-centred learning theories stress that learning is a constructive, contextual, collaborative, and self-directed process [3]. PBL is a well-known approach to student-centred learning [4], aiming at co-construction of knowledge by students centred around authentic problems. Typically, PBL groups meet face-to-face in the presence of a tutor and follow a stepwise approach, which includes a collective brainstorm or pre-discussion, followed by individual self-study, and a collective reporting phase or post discussion regarding their findings [15].

Online PBL has been implemented successfully [16]. Research has shown that synchronous online PBL group meetings with tutors can be similar to face-to-face PBL, when students and tutors are motivated and prepared, and adequate technical support is available [17, 18]. These conditions are not always met, and there are also examples of online PBL with less favorable results during the pandemic [19] and general concerns about online education potentially increasing systemic inequities: at home, some students will have better study conditions and more control over their own time than others [20]. PBL using asynchronous online tools, for example, using only asynchronous discussion boards, appears to be generally less successful [16], although it does seem that adding online interactions on a discussion board in between face-to-face meetings can be a valuable addition [21].

In PBL, the role of the tutor is important. The tutor guides the learning process, promotes in-depth discussions and facilitates collaborative knowledge construction [22]. Experiences with tutorless PBL have been mixed. One study found that experienced PBL learners could manage tutorless meetings using ICT support, such as mapping software and communication tools enabling to reach out to a tutor, when necessary. Students enjoyed the increased autonomy, experienced more team cohesion and rarely sought online tutor support [23]. In another study, three conditions were compared: traditional PBL meetings with students and the tutor in one room, synchronous online meetings with students and a tutor, and students meeting in a room with the tutor working as a consultant, giving comments asynchronously and digitally [18]. The results show that

the presence of the tutor was influential, regardless of whether the meetings were onsite or online. Students reported less (self-perceived) learning and overall effectiveness and slightly lower motivation when the tutor only gave comments asynchronously. In this study, the researchers did not find a relation with students' prior PBL experience. In a third study, researchers found no differences in exam scores between tutored and untutored groups, but students were more content with the learning experience in tutored groups and there was more variation in exam scores for the untutored groups. Furthermore, the authors stress that there were other forms of support available to all students, such as formative evaluation and feedback [24].

1.3 Motivation for this study

In summary, many MOOCs employ a traditional teacher-centred instructional design, which is in disagreement with current insights from learning theory, and this likely contributes to suboptimal learning and large drop-out. PBL is a student-centred approach that has been implemented successfully in many domains and contexts. PBL focuses on small-group learning with tutor guidance. There is evidence that online synchronous PBL can be used successfully. In MOOCs, however, there are no tutors and synchronous meetings are often difficult when participants live in different time zones and/or are working professionals. There is limited evidence that PBL does not always require the presence of a tutor, although most studies into tutorless PBL did offer on-demand advice from a tutor at a distance or other supports provided by teachers.

It is clear that PBL in its classical form cannot be implemented in a MOOC, since the massive character prevents designers from implementing much teacher support, but there is clear need to develop cooperative learning activities in online education [20]. Moreover, the authors of this study were driven by growth motives and interested in exploring innovations in online teaching and learning [1, 25, 26]. Therefore, this exploratory study aims to investigate whether characteristics of PBL can be implemented in a MOOC and, thus, contribute to a more student-centred instructional design, while maintaining the massive and open education character of MOOCs. We designed a MOOC about PBL (as content) that also followed the learning format of PBL as far as possible.

2. Design of a 'PBL' MOOC

The MOOC *Problem-Based Learning: Principles and design. Students at the centre!* was designed following PBL principles of learning as a constructive, contextual, collaborative, and self-directed process. Learning is contextual because it is centred around authentic problem cases of teachers, instructional designers and educational leaders trying to implement PBL in their own curriculum. **Table 1** gives the text of the first problem. Later ones focused, for example, on the role of the tutor, problem and curriculum design, and assessment in PBL curricula.

Constructive and collaborative learning are stimulated by making participants study these authentic problems in groups. Participants in the MOOC are asked to form groups in the first week. The first group assignment asks them to discuss task and role division and work strategies with the help of a team Charter [27]. Subsequently, the groups work on four authentic problem task. They are asked to hand in their work and peer review the work of others, but there is no formal assessment.

<p><i>"I traveled to Maastricht, the Netherlands, to see whether their „problem-based learning” approach in education, would be suitable for our educational program. I stayed a week at Maastricht University (...). I learnt that students work in small groups guided by a staff member, called tutor. They discuss peculiar texts, which they call “problems”. Students are required to discuss these problems in small groups. Subsequently, they spend considerable time in the library or at home, searching for and studying appropriate learning resources. Thereafter, they meet again as a group and discuss the problem. Students have to do a lot on their own and they need to interact with each other a lot.</i></p> <p><i>In short, PBL offers a very different learning environment with different building blocks: small groups, problems and tutors. This approach is used in this university across a variety of disciplines, including medicine, health sciences, psychology, business and science, with commonalities but also differences. They claim that it prepares students well for the demands of our current society.</i></p> <p><i>I do not know, however, whether this approach is suitable for our own educational program. And I wonder how it works and why. I need to know more...”</i></p>
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Table 1.
Text of the first problem.

The instructions (**Table 2**) stimulate participants to follow PBL-style learning activities. They are instructed to start with a group brainstorming about the problem and to generate study questions for the group. The study questions are meant to guide individual self-study using resources provided in the MOOC (recorded short lectures, literature, examples, and links) and found elsewhere. In the discussion phase, participants are instructed to share and discuss what they have learned from their self-study. Self-regulated learning is stimulated by allowing participants freedom in making groups, as well as the freedom to choose their own task and team approach. The instructions in **Table 2** force participants to collaborate and provide structure in the form of a ‘collaboration script’, while allowing freedom in, for example, role

Brainstorm phase	<ol style="list-style-type: none">1. Discuss the problem description given above in your team. Brainstorm about what you know already, and what you do not yet understand about [Problem name].2. Generate questions that need further study.3. When you have done this, ask one group member to submit a document with your group's list of study questions using the ‘Get Started’ button below.
Self-study phase	<ol style="list-style-type: none">4. Study the materials individually. Watch the web lecture and other videos. Consult the resources below. There is a long list of open and licensed resources in the bibliography.5. Look for other relevant materials in your own collection or on the internet, e.g., searching with [suggested key words]. Try to find resources about PBL that fit your disciplinary background.6. Share your resources and experiences with your team (in the team space) and with all participants (on Discussions [Title discussion board])
Discussion phase	<ol style="list-style-type: none">1. Report to each other which resources you have used, and what you have learned from them.2. Discuss which of your study questions you can answer and which (old or new) questions cannot be fully answered. Optional: Share your experiences with other groups (on Discussions - [Title discussion board])3. Make a brief summary of the group discussion and the lessons learned. Be creative with the format of your summary. It can be a document, but it can also be a concept map, a word cloud, etc.4. Ask one group member to upload your summary, using the ‘Get Started’ button below.

Table 2.
Instructions given to groups with each problem case.

division and communication tools [25]. Arguably, the absence of a tutor to guide the group puts a larger demand on the participants' self-regulated learning skills.

The MOOC was implemented in NovoEd (<https://novoed.com>), a platform that explicitly supports small group work. Each group was given a private group space with chat facilities, file exchange, and facilities to schedule meetings. A more detailed description of the design of the PBL MOOC and how it relates to PBL principles can be found in [28].

3. Research methods

3.1 Study design

This study can be characterized as design-based research aimed at understanding the complex world of educational practice [29, 30]. In this study, quantitative and qualitative data are used to evaluate a MOOC designed in accordance with PBL principles. The results contribute to an improved design for the MOOC, as well as the theory and practice of PBL and online collaborative learning.

3.2 Setting

The MOOC *Problem-Based Learning: Principles and design. Students at the centre!* was piloted in the spring of 2015 and subsequently executed twice in the autumn of 2015 and 2017. The MOOC was free and there were no entrance requirements. The target audience was described as 'teachers, course designers and managers in education in all domains interested in Problem-Based Learning'. The two runs used a similar course design with small variations. The workload for participants was estimated at 4–8 hours a week. There was no formal assessment, but participants who completed the course were offered a 'Certificate of Participation'.

3.3 Participants

Participants subscribed themselves to the course. Those who filled in the profile page and joined a group were considered active participants. A larger group of participants joined and presumably looked at study resources, but never participated in the PBL group activities (see **Table 3**). Data from the profile pages show that there is a more or less equal gender division, a majority of participants over 30 years old, and most teachers involved in education professionally. Their background in PBL varied: most participants had no or some experience with PBL; a small minority had extensive PBL experience. About two-thirds of the participants that filled in their profiles had never taken part in a MOOC before. In both runs, participants came from all over the world (see **Figure 1**).

3.4 Data collection and analysis

For this study, the following data were used:

- Learner profiles and participation data logged by the platform;
- Evaluation surveys filled in by participants;

	Participants	Active participants	Groups
Run 1	2799	794	109
Run 2	849	301	37

Table 3.
Participants in the two runs.



Figure 1.
Participants voluntarily pinned themselves on a Google map (left run 1; right run 2).

- Assignments handed in by participants;
- Verbal interactions on the discussion boards on the MOOC platform;
- Group interviews with facilitators half-way and at the end of the MOOC; and
- Communication and collaboration in the group space of 21 teams (only Run 1).

For the log data, descriptive statistics were generated by the platform. For the questionnaire data, descriptive statistics were computed using SPSS version 24. Discussion fora and assignments were inspected, but not systematically analyzed. Some quotes and assignments will be reported as illustrations. Group interviews with facilitators were summarized and sent back to the participants for member check. During the first run, the interaction in 21 groups was studied in detail to uncover how virtual teams collaborate in online collaborative learning tasks. Detailed results of this study are reported elsewhere [31]. Here, we will only refer to conclusions that relate to how these groups followed the typical phases of PBL (see **Table 2**).

3.5 Procedure

The MOOC was advertised through the platform website, communication channels of Maastricht University (UM) and the School of Health Professions Education (SHE), existing mailing lists (e.g., for alumni), and at some conferences (with flyers and presentations). In the first week, participants formed groups and they filled in and discuss a team charter. The course platform provided a shared workplace, but the groups had full freedom in deciding how to work together and which communication tools to use. They worked on four consecutive PBL problems. After handing in their results, they were asked to peer review the results handed in by other groups. The course facilitators kept a general overview, answered general and technical questions, and provided general comments or tips in announcements and during short Google Hangouts sessions.

Participants who completed the course received a Certificate of Participation, which could be downloaded from the platform. Questionnaires were sent mid-term and at the end of the MOOC through the MOOC platform (automatically forwarded to the participants' e-mail addresses. All assignments and the content of the discussion forum were downloaded after the end of the MOOC.

Participation in the MOOC was free and participants could withdraw at any time without explanation. Participants subscribing to the MOOC were asked for permission to use their anonymized data for research purposes upon entering the platform. Participants whose assignments are shown in publications were asked for permission explicitly by e-mail when anonymity could not be guaranteed.

4. Results

4.1 Completion rates

Table 4 shows the completion rates for both runs. Completion rates for active participants who had filled in their profile page and joined a group were considerably higher (28.4% in run 1; 34.2% in run 2).

Group completion rates were 44% in Run 1 and 51.4% in Run 2, but all groups lost members along the way. Data from questionnaires and profile pages show that groups often shared a common interest (e.g., worked in a certain domain, e.g., an international group of teachers in English, or a group of medical educators) or were based in the same region.

4.2 Student satisfaction

Table 5 provides data from the questionnaire filled out by participants at the end of the course. The responses show that active participants were very positive about the PBL MOOC, and felt that they learned a lot. Team functioning and the short sessions organized by the facilitators scored slightly lower. Comments on the discussion boards confirm that active participants valued the PBL MOOC.

4.3 The PBL process in group learning

Contributions to the discussion boards and inspection of the assignments show that participating groups followed a PBL-like process in three phases: brainstorming, formulating learning questions, reporting and discussing results. On the discussion boards, it was clear that some participants saw the PBL-based group work as a large benefit:

"All the best, and the MOOC has been an outstanding success for me, I have to say. I have always been a sceptic about MOOCs, and have never really committed to one before, but the attraction of working in small groups in a structured way (i.e. PBL!) meant that I had to change my status late in October, from 'audit' to 'participant' [...] it has made for a memorable experience. We have enough active members still, even at this late stage now, which is a very good sign I think."

Others, however, struggled to find a good group: "I am having a problem with my group. I was part of Group 7, but all of them left the course." And: "I have [been] unable to join any team in the last three days, hence unable to make any progress."

	Participants	Active participants	Finished the course	Completion rate
Run 1	2799	794	264	9.4%
Run 2	849	v301	103	12.1%

Table 4.
Completion rates.

Item	Run 1 Mean on Scale 1–5 (SD)	Run 2 Mean on Scale 1–5 (SD)
Overall, I am satisfied with the way this MOOC was organized	4.1 (0.8)	4.3 (0.8)
I have learned a lot during this MOOC	4.3 (0.8)	4.3 (0.7)
The content of this MOOC linked well with the level of my prior knowledge	4.2 (0.8)	4.1 (0.9)
This MOOC encouraged me to formulate my own specific learning objectives that required further study	4.3 (0.8)	4.3 (0.8)
This MOOC encouraged me to study the learning resources that were offered	4.1 (0.8)	4.4 (0.8)
I see how I can apply what I learned in this MOOC to ‘real life’ (in practice)	4.1 (0.8)	4.4 (0.8)
The activities I performed in this MOOC are relevant to my professional goals or field of practice	4.3 (0.8)	4.4 (0.7)
This MOOC encouraged me to collaborate with my fellow students	4.2 (0.9)	4.1 (1.0)
The collaboration with other students in this MOOC has been productive for my learning	4.2 (0.9)	4.1 (1.0)
This team functioned well	3.9 (1.0)	3.9 (1.1)
In this team, I shared all relevant information and ideas I had	4.4 (0.8)	4.2 (0.9)
If something was unclear, we asked each other questions	4.3 (0.9)	4.1 (1.0)
Team members elaborated on each other’s information and ideas	4.1 (1.0)	4.0 (1.0)
The sessions (e.g., Google Hangouts) organized by the instructors were useful	3.7 (1.1)	3.8 (1.0)
The platform of this MOOC (NovoEd) worked well	4.0 (1.0)	4.2 (1.0)
Using this online learning system supported me in my learning	4.1 (0.9)	4.2 (1.0)
I felt comfortable conversing through the online medium	4.0 (1.0)	4.0 (1.0)
I felt comfortable interacting with other course participants	4.2 (0.9)	4.1 (0.9)

Table 5.
Questionnaire results at the end of the course (n = 169 for Run 1; n = 104 for Run2).

Inspection of assignments by the facilitators showed a large variety in quality. Some were very superficial or even almost empty. Others were more elaborate but mostly a list of individual contributions (identified by the name of the contributor) without an in-depth discussion of results. Some groups, however, clearly constructed

new knowledge, synthesizing their main findings in their own words and/or applying it to their own context. The problem designers commented that the quality of the best assignments went far beyond their expectations. Groups submitted assignments in different formats, mostly in text and/or concept maps (see **Figure 2**), sometimes using more creative formats (see **Figure 3**).

Detailed analysis of the interaction in the group spaces of 21 groups in Run 1 confirmed this but also showed that groups collaborated in very different ways [31]. Most groups opted for asynchronous interaction and this may have limited the amount of discussion. A minority of groups engaged in a deeper level of discussion where input

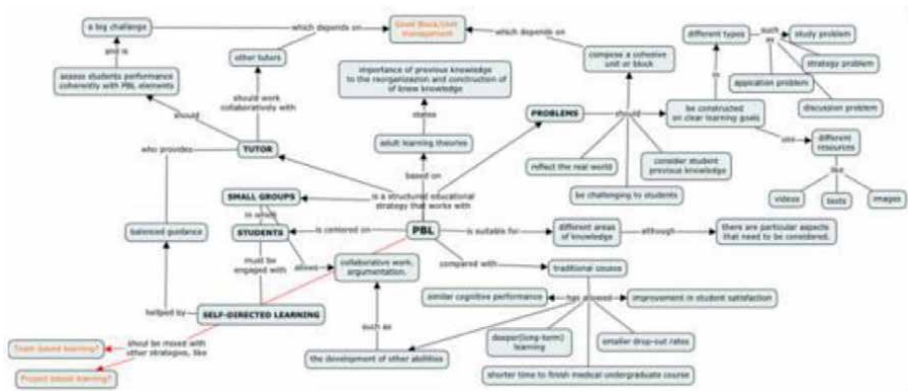


Figure 2.
Example of group product summarizing what the group had learned in a concept map (screenshot used with permission).



Figure 3.
Examples of creative group products for the last assignment: A handbook summarizing lessons learned as 'The future of PBL', comparing PBL aspects to artworks, and an animation (screenshots used with permission).

was combined and synthesized, with new insights developed collaboratively. We saw the importance of having team members explicitly discuss team processes and task division, and set clear expectations and timelines. Successful teams showed team adaptability in a positive atmosphere and were able to plan reactively, which helped them to deal with unexpected events.

5. Discussion

The results of two runs of the MOOC *Problem-Based Learning: Principles and design. Students at the centre!* showed that it is possible to design a MOOC based on student-centred learning theories. Participants discussed authentic problem cases in groups and followed a similar structure as in regular PBL: a brainstorm phase in which they collaboratively generated their own learning questions, a self-study phase in which they individually searched resources to study, and a reporting phase in which they collaboratively discussed what they had found. In the absence of tutor guidance and feedback, participants learned with and from each other.

A part of the assignments shows truly creative and innovative thinking and co-creation of knowledge. However, the envisioned kind of learning was not realized in all groups, and the absence of a tutor is likely to have been an important factor in this. Tutors are an important part of PBL [22, 32]. Another reason might be that many participants did not have much experience in MOOC participation and may have had limited digital literacy. Co-creation requires intensive brainstorming and discussion, which is not well-supported by basic asynchronous tools such as chat and file exchange that were provided by the platform.

The evaluation results show that participants who completed the MOOC were very satisfied with the design, the learning materials, and the learning process in the PBL MOOC. Individual completion rates were comparable to other MOOCs or slightly better: 9.4% in Run1; 12.1% in Run 2. cf. [10]. There was a large dropout, which may have been caused by participants discovering that they do not have enough time or that the course is not what they expected. Participants may have subscribed just to look around, without the intention of completing the course [11, 12]. Higher initial commitment and motivation, especially intrinsic motivation, might be related to performance, perceived quality, and satisfaction [33, 34], but working professionals may be more driven by their current learning needs and knowledge gaps than by completion or certification [35].

Completion rates of active participants were much higher (28.4% in Run 1; 34.2% in Run 2), possibly because those who subscribed to groups were more motivated from the start, but it is also possible that they felt a commitment to their group to continue. There are indications that some participants could not find a suitable, active group to work with. They may lack self-regulated learning skills that are important in MOOC settings [36] and/or need more support to develop skills needed for virtual group work [31]. One option would be to stimulate and support regrouping more actively. It is not clear, however, whether participants would like to regroup halfway through.

Groups form around common interests, and participants taking action to get into a group are likely to be more motivated. Once in a group commitment may have been enforced by social cohesion and social equalization, which is also typical of online group work, may have helped to share information on PBL in culturally diverse groups cf. [37]. On the other hand, some of the dropouts and poor group performance

may be explained by social comparison. Exposure to exemplary peer performances might cause participants to quit a MOOC when they perceive that they cannot attain their peers' high levels of performance. Insufficient teamwork skills and digital literacy skills [31, 37, 38] may add to this. MOOCs are bringing together thousands of learners from diverse backgrounds across the globe. Research on inclusive learning cultures in MOOCs has only recently gained attention [39, 40].

6. Strengths and limitations

The MOOC *Problem-Based Learning: Principles and design. Students at the centre!* is designed for a specific target group of people with a professional or personal interest in education in general, and PBL in particular. This group may have been more motivated to follow a PBL approach in their group work, so more research is needed to explore whether similar student-centred MOOC designs would be possible for other target audiences in other domains.

Another limitation of this study is that our data do not give much insight into the quality of the interactions within groups and the reasons for the more in-depth discussions in some groups vs. the superficial discussions in other groups. Synchronous PBL group discussions or specific tools to support brainstorming or knowledge synthesis could be tried to improve the PBL group discussions [31]. Another option would be to stimulate more explicit discussion of the group process [21, 25]. Future research could explore if and how different styles of leadership and role division might enable group participants to take over (part of) the role of a tutor.

7. Conclusion

In conclusion, this study shows that innovative student-centred instructional designs for MOOCs are feasible. The design of the MOOC *'Problem-Based Learning: Principles and design. Students at the centre!'* applies PBL learning principles of stimulating constructive, contextual, collaborative, and self-directed learning. Successful groups managed to collect insights from active group members, despite dwindling numbers of active participants and a large number of participants who were new to PBL, MOOCs, and virtual group work. However, the absence of a tutor makes means that this design is not comparable to traditional forms of PBL and is not successful for all MOOC participants.

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Conflict of interest

The authors declare no conflict of interest.

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Situating Self-Learning Video Materials within the Paradigm of the ARCS Model: A Hands-on Experience

Arnab Chatterjee

Abstract

The ARCS Model of learner motivation looks into the various parameters that foster learning. In this paper, I strive to show how a proper implementation of this model and its various pedagogical ramifications can be profitably applied while shooting video SLMs or self-learning materials for ODL/OL learners. I argue that the strategies inherent in the making of video self-learning materials can be embedded within the conceptual grid of the said model. This is based on a real, hands-on experience while shooting videos for an English undergraduate course for ODL/OL learners. Any topic for the learners had three videos—a trailer that was a quick introduction to the subject matter, a slightly longer video that enumerated the sub-topics within the topic, and the main video that explained the subject matter in greater detail, with the inclusion of power point. It was increasingly felt that such a tri-partite division would foster greater learner participation and involvement instead of a single, long video that is likely to disrupt learner participation in this teaching-learning paradigm. Thus, the ARCS Model's applicability is extended to the realm of video SLMs that are likely to result in the percolation of the target subject matter deep within the learners.

Keywords: ARCS Model, ODL/OL, pedagogy, SLMs, teaching-learning

1. Introduction

The ARCS Model of learner motivation, pioneered by John Keller in 1979, relies on the four foundational elements cardinal to learner motivation—attention, relevance, confidence, and satisfaction. John Keller formulated this idea with the aim in view that a proper synthesis of the four elements can alone result in learner motivation and desired outcomes, if learning takes place within this positivist paradigm of expected returns and value addition. Keller was of the firm view that the previous behaviorist theories were more concerned with external stimuli and paid scant attention to learner motivation and its various ramifications. Though the effectiveness of the said model has been time and again demonstrated with recourse to learner motivation of

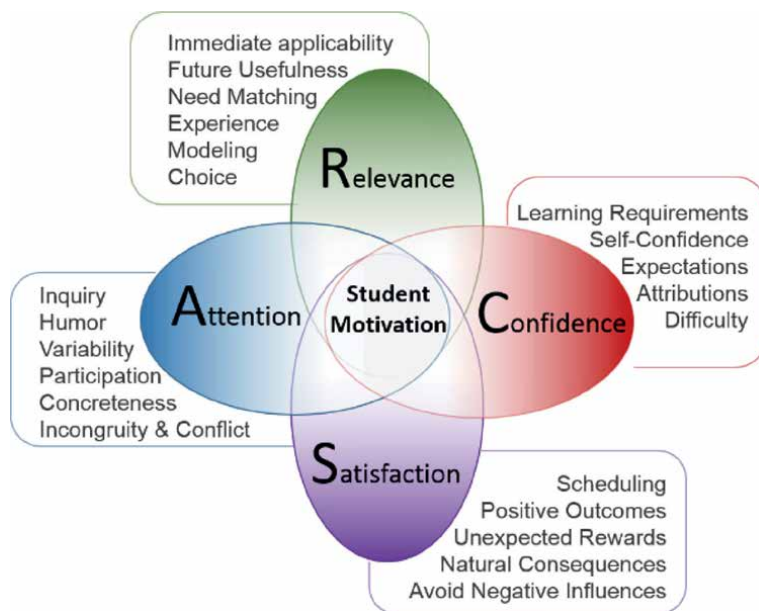


Figure 1.
The ARCS model of learner motivation. Image courtesy: <https://educationlibrary.org/model-of-motivation-arcs-instructional-design/>

learners in ODL/OL modes ([1], p. 194; [2], p. 38; [3], p. 97; [4], p. 707). The application of this model in various branches of knowledge, especially in ODL modes of education employing open systems and instructional technologies, has been a nodal point of investigation (Figure 1) [5].

As S. Kurt [6] puts it succinctly in his article entitled “Model of Motivation: ARCS Instructional Design”:

With the rise of online learning, there has been renewed interest in John Keller’s Instructional Model of Motivation. It is much more challenging to motivate students online than it is in class. Keller’s model offers ways to keep students on task throughout online instruction. It is based on expectancy-theory, which—assumes that people are motivated to engage in an activity if it is perceived to be linked to the satisfaction of personal needs (the value aspect) and if there is a positive expectancy for success (the expectancy aspect).

2. Background and motivation

The author of the paper has been teaching in a certain dual mode, UGC-recognized university in India. A dual-mode university is an institution of higher learning in India where students can pursue their degrees both through conventional and regular mode/s and the online and distance modes of instruction. As part of his daily activities at the CDOE, or Centre for Distance & Online Education, he is supposed to prepare SLMs or self-learning materials for the online and distance education students. In course of time, there was a need to prepare and shoot videos for instructional efficacy in line with online learning platforms like the MOOCs—SWAYAM, Unacademy, Course Era are some of the cases in point that employ online videos that

explain a topic clearly and that seek to engage the learner with a more pronounced trajectory. A video room was made available where the videos were shot. To make the topic more accessible to the learner, the video related to a particular topic was decided to be divided into three distinguishable parts: (i) a two-minute video that opened the topic with an interesting anecdote or story, coupled with the quick introduction of the presenter, (ii) a six-minute video that explained the topic in some detail with the relevance of the topic for the online learner, and (iii) a twenty- or thirty-minute video that explained the topic in detail with the accompaniment of a power point presentation.

This three-level, tri-partite division looked germane to the educational motivation model proposed by the American educational reformer and psychologist, John Keller (1938) who proposed the ARCS Model of learner motivation wherein he postulated the idea that external stimulus is more vital and is often conducive to learning when the appropriate learning environment is created. Keller was more concerned about the external factors that motivated the learner, and was less concerned about what happened inside the learner, much in the lines of Skinner who was keen to measure and determine external stimulus through his novel experiments with pigeons. The ARCS Model of learner motivation is firmly based on the behaviorist models that went before him that emphasize on repetitive, positive reinforcements that foster the learning process. However, the recent upgrade to this model pays attention to some of the hitherto neglected theories that lay special emphasis on “emotions and intrinsic motivators as drivers” (Waggindton and Dell *Arcs Motivation and Distance Learning*). Also, there look some problems in the application of the said model for learners who are already motivated and are not in special need for extra dose of motivation. Also, the theory looks to be heavily influenced by the idea and constructs of volition as a motivational construct, popularized by Kuhl. Here, “positive reinforcements” lead to pronounced learning patterns, especially in the third phase of the theory called “Confidence.” It is only when positive and salubrious learning situations are created when a positive learning pattern emerges. The said model was extensively field tested and then applied to a wide range of educational stakeholders.

The author, in light of the above background, was motivated to see how the video self-learning materials and this tri-partite division for better instructional efficacy could be situated within the conceptual grid of the model proposed by Keller. As a department that aspires to achieve the status of a full-fledged wing of research and support, much in lines with the credo of the university, the author thought it incumbent to look at such instructional strategies within a theoretical background in online and distance education.

3. The research gap

Previous research in online instruction and the use of motivational videos are mostly concerned about the efficacy of these in context of online learning and learning theories. There exists sufficient literature with respect to the ARCS Model and its dexterous application in online and distance teaching, especially with regard to non-completion of courses [1], learning independence in elementary education [7], motivation [8], and application in courses per se and the results obtained thereof [9, 10], and little research has been conducted on how the said model can be studied within the conceptual grid of self-learning video materials and content. These studies take into account the myriad ways in which the famed instructional model by

Keller proposed in the 1980s find numerous applications in different areas of flipped and blended learning, especially in areas of instructional pedagogy and praxis, but literature is relatively scarce when it comes to the application of the model in developing online, especially video content. There is no denying the fact that the model has been tested by other researchers and found applicable and relevant in a number of instances, but the biggest application of the same is in the way it has been applied to instructional motivation and how it can elicit learner autonomy and participation. However, a substantial learning content is online now and especially in the form of online videos, and the matter to what extent such videos can elicit learner motivation is a matter of debate. Making video content for the sake of content will be ultimately self-defeating, and it remains a matter of open debate so as to what should be and not be the stuff of video self-learning materials that aid learner growth and autonomy. One of the increasing and pronounced strains in the application of the ARCS Model is to fish out the areas that aid learner empowerment and this paper looks to fill the gap with recourse to the development of electronic content and situating it within the conceptual grid of the said model.

4. The methodology and conceptual grid

It is rather difficult to ascertain any one methodology or theory that can be used in distance and online education. The reasons range from the diversity of mechanisms used to elicit learner participation to that of the competing ideologues at work see to it that the best theory of learner motivation is at work. A methodology is a sustained application of any theory and how the theory explains and shapes the resultant discourse of the theory. Online, flipped, and blended learning styles all have their own methodologies and learning styles, and owing to the plethora of techniques, any one single, monolithic theory and the use of the same are rather difficult. The noted online teaching expert and theorist, Terry Anderson has opined that it is rather difficult and cumbersome to build an over-arching theory of online education:

As noted, Terry Anderson (2011) examined the possibility of building a theory of online education, starting with the assumption that it would be a difficult, and perhaps impossible, task. He approached this undertaking from a distance education perspective, having spent much of his career at Athabasca University, the major higher education distance education provider in Canada. While he acknowledged that many theorists and practitioners consider online learning as “a subset of learning in general” [...] he also stated: online learning as a subset of distance education has always been concerned with provision of access to educational experience that is, at least more flexible in time and in space as campus-based education (in [11], p. 176).

Anderson focused on a number of well-respected theorists here, including Bransford et al. (1999), who posited the idea that learning is dependent on the four parameters of community centeredness, learner centeredness, knowledge centeredness, and assessment centeredness. Anderson was more interested with the connections, rather vital connections that are made between peers, the learner, and the teacher (**Figure 2**).

What can be easily understood from the picture above is the way learning in the online mode is an interconnected whole. True that many educational theories do well document the importance of this interconnectedness, called constructivism, but

5. Applications of the methodology and relevance to the ARCS Model

While a theory helps explain complex phenomenon and bind concepts, methodology may be seen as a concrete application of that theory and how it can be put to best use in a real-world setting. The ARCS Model of Attention, Relevance, Confidence and Satisfaction look at increasing learner autonomy and participation, and this means that the learner in an online setting is firmly placed within the grid of the teaching-learning paradigm. S/he is presented the topic in ways that will percolate deep within and this is achieved in a systemic process where materials are presented in ways that will ensure optimal learning. Anderson's aim to bind various aspects of online learning, no matter, however, difficult that might be and Activity Theory reinforce the idea of online activity and how the same is presented to the learner in piecemeal initially, and then explained in ways that ensures the attention of the learner in question brings home the idea of motivation and the overall environment that is two of the many parameters that AT looks into. SAAT and its application in the hands-on experience bring home the idea of how the latent skills, motivation levels and tasks, tools, methods, and objects coalesce to bring about the various parameters that need to be combined or taken into account together to elicit learner participation. While the paper involves the ARCS Model as a theoretical tool to bring forth its main idea of learner participation through the use of video SLMs, it also employs many facets of Activity Theory and the multifarious ways in which the latter takes into consideration the total learning "environment" at work to elicit learner participation. While breaking a topic into its constituent parts in form of the tri-partite division, the paper also looks into ways in which this methodology involves both the learner and the instructor positioned within the online environment in a fruitful, symbiotic relationship of the learning environment. AT pays attention to the fact that a learner is situated within a learning paradigm—within a social and semi-otic matrix that employs the instructional design, learning objectives, and outcomes, the world of the hyperlink and above all, the discourse of mutual understanding and learner participation. Since AT is more concerned with the "gamut of experiences" that a learner may have while situated within a social setting, it is imperative that the application of the ARCS Model and its aim to elicit learner autonomy and support is quite in line with this methodology of AT, but this also means that this idea of video self-learning materials and the strategies employed to gain learner attention and independence do employ AT as a methodology and Keller's model as a theoretical tool of analysis.

6. The ARCS Model: further discussions

Each element within this model can be broken down into three sub-units that constitute the four main elements. For example, the first element, that is, attention can be sub-divided as comprising three sub-elements:

- a. The perceptual arousal of the students must be an event occurring within the learning process.
- b. This is followed by the inquiry arousal where the online instructor asks a few questions that pique learner interest further.
- c. This is concluded by what is called—variability—the instructor takes recourse to various multimedia to prove a point and later sub-divide the students to work in groups.

This can be repeated with the other remaining three elements. For example, the second element relevance may comprise of sub-units like (a). goal orientation, (b). motive matching, and (c). familiarity.

Whatever be the thrust of investigation, the focus has been on learner motivation and how instructional design can help foster this. Since any ODL mode of instruction relies on technology-mediated learning, it is important to keep in mind its various ramifications vis-à-vis the methods “that go into it and how this mode of instruction relies on a teacher-student symbiosis in acquiring various ways to provide instruction”:

There is no one method for providing ODL, so a wide variety of courses are described as open learning “oras= distance learning” [...]. The variety is instructive. In some cases, students work almost entirely by themselves (e.g., correspondence courses); in others, they study in groups (e.g., interactive radio); and in still others they might meet together at intervals (e.g., distance teacher training). There is an equally wide variety of purposes to which ODL is put, ranging from primary education to post-school study of the secondary curriculum and, ultimately, professional updating [12].

India has a diversified population and the need of the hour is to increase the skilled task force of the nation. Since the arrival of the present government at the Centre, the same has stressed more importance on the concept of a new nation that will not be divided along digital lines. This is to say that there has been a resurgence of technology-mediated learning and the spurt of new e-platforms of learning like *Udemy*, *Unacademy*, *e-Skill India*, *SWAYAM*, and others. The emphasis is on the concept of technology and learning for all. These platforms emphasize on the deft use of videos for effective learning. True that technology best leads to learning and its resources should be used wisely [13], these platforms provide materials to the students through the use of videos that are readily comprehensible to the students. As it can be well-understood, videos are indispensable when learning has to be more effective ([14], p. 1061) and the use of such videos leads to greater learner participation ([15], p. 323).

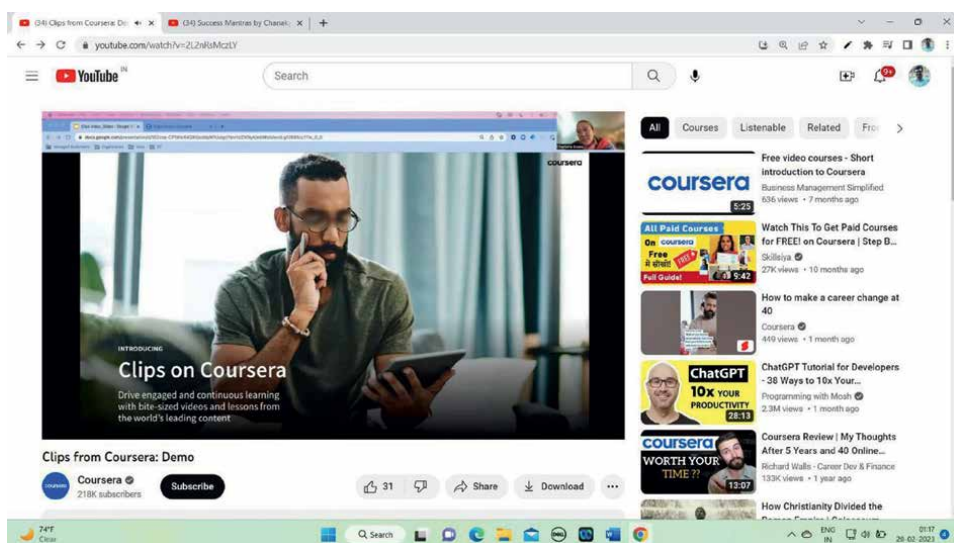


Figure 3.
A typical course era environment on YouTube. Courtesy: <https://www.youtube.com/watch?v=zL2nRsMcZLY>

For example, the SWAYAM program launched by the AICTE or All India Council of Technical Education, New Delhi, there is an increasing use of videos to elicit learner participation and this has led to the immense popularity of the said project to strengthen the skill building capacity of the learners. It is not only the digital literacy that the nation needs, for mere use of technology might be self-defeating if that does not lead to the achievement of quality outcomes, and may lead to—digital divides (UNCTAD—Foreword, [16]). Similarly, other e-platforms of learning like the Course era that has virtually every kind of program available at its disposal to further learner participation, there is an increasing use of videos to help achieve the avowed objectives of the said program as well (**Figure 3**).

Online learning platforms like these use the aid of videos to elicit learner participation.

7. Aims and objectives

The paper looks forward to achieve the following objectives:

1. It seeks to situate the video self-learning materials within the paradigm of the ARCS Model as popularized by Keller and investigates how the same can be explained and further explored with recourse to Activity Theory that looks forward to integrate the cognitive level with the perceptual level in real world settings. It looks forward to situate the video SLMs in line with this methodology and the theory of learner participation and motivation that takes a more pronounced trajectory with recourse to learning experiences and attitudinal predilections vis-à-vis content.
2. It looks at the gradual progression of the 2-minute, 6-minute, and 20-minute videos and looks into the practical application of the said model to buttress the idea that the fragmentation of a long video is feasible into smaller parts or micro-units, as they are expected to percolate better into the learners to ensure better learner participation.

The paper is a real, hands-on experience on the issue of the preparation of video self-learning materials for an undergraduate course in a certain university in India in the Centre for Distance and Online Education. The video content developer was entrusted with the job of preparing a series of video lectures for a paper on English language and comprehension called Integrated Professional English. It is a university course and all the students in humanities and engineering disciplines had to take the paper to pass successfully in the said paper. The syllabus of the paper was divided into four COs or competencies and each had components as diverse as elementary grammar and composition, workplace documentation and communication, formal communication and etiquette and external, coupled with internal communication in the professional sphere. The paper seeks to evaluate the 4 _integrated skills of LSRW, *viz.*, listening, speaking, reading, and writing. Thus, components are divided for each skill in a particular CO or module in order to hone all four skills in a learner. Since the said CDOE was engaged in making SLMs or self-learning materials in the shape of tangible reading materials, it also carried on the novel idea of walking a bit an extra mile and preparing content for videos with the help of a dedicated fleet of content designers. Initially conceived as a single, long video, it was later decided to split it into three parts as follows:

1. **PHASE I:** A 2-minute video that introduces the course and the instructor, often starting with an interesting anecdote to pique learner interest. The video begins with an interesting anecdote or story and tries to hook the learner's interest by analyzing the subject matter firmly in the discourse of practical applicability of the topic in a real-world setting.
2. **PHASE II:** A 6-minute video that builds upon the previous 2-minute video and that explains the course in greater detail, situates it within the conceptual grid of relevance within the ARCS Model. Students are told why they need to watch the video and what they can expect to gain from this. This phase relies on two vital parameters within the ARCS Model—relevance and attention. By situating this part of the video within the said parameters of relevance and attention, learner motivation gains an upward trajectory and the student is riveted to the video. This second phase of the video gives credence to the idea that learner motivation can be increased if these parameters are given adequate attention. This part of the video might also be seen to be the phase where a form application of the AT is seen—online learners are made to be part of an entire community of learners—teachers along with an entire array of complex, embedded networks, that includes the online platform, the discourse centering on learning, realia, the world wide web, the schemata of the learner that is set into motion and how it is set to be replaced by new knowledge. This phase also prepares the learner as well as the teacher on the deft “negotiation” of meaning—there is no one, “correct” way to learn and thus, it becomes incumbent on the part of both the parties to settle on the most appropriate way to negotiate meaning and the aim of the topic to engage the learner in meaningful settings. This phase is vital as without this, the potential learner will not be in a position to move meaningfully to the third phase.
3. **PHASE III:** In this particular phase, attention is given to a long, 25–30-minute video where the instructor talks about the main matter of attention, or in simple words, the main topic under consideration. Since the two earlier phases have already been covered, this particular phase takes into account the fact that learner attention and relevance of the subject matter have already been achieved. In this phase, the two other remaining parameters are expected to be achieved—that of confidence and satisfaction. Since the learner has been already exposed to a positive learning environment since the beginning, it is expected that s/he would be more attuned to assimilating the subject matter with positive outcomes. This phase is a summation of the earlier two phases wherein more attention was given to inducing the learner to accept the initial learning environment. It had more to do with the positive stimulus during the learning plan than the plan per se. The two phases look into various ways in which the online learner as well as the instructor is firmly situated within the paradigm of Activity Theory—how various modes of apprehending reality and the integration of skills are achieved. The skills here are those of attention and relevance gathering—the multifarious ways in which the learner understands the subject matter as a sunset of the larger world viewed through the lens of the various cognitive constructs and negotiating parameters.

This model of learner motivation was applied to a course called Integrated Professional English, a compulsory paper that was offered as a university course to the combined students of BBA, BCA, B.Com and other allied streams. The paper contained elements of grammar, composition, communicative competence in formal

contexts, that is, in a professional setup. Other allied areas that were open for investigation were documentation and its various ramifications in a formal context as well. As it has been well pointed out by language experts, a knowledge of elementary grammar is necessary for communicative competence (*American English* “Teachers Corner” [17]), but it has also been observed that students shy away when they are confronted with the dry and unappealing rules of the internalized system of a language system that grammar represents. Since the first module of the syllabus dealt with grammar, it was deemed more important by the course instructor to resort to this model of learner motivation to look into the possible strategies to help the student assimilate the contents of the course (Figure 4).

In this part of the video, the following steps were taken to pique learner interest and participation:

- a. The course instructor welcomed the students and started the lesson with an anecdote or a useful story that highlights the importance of grammar and punctuation. The example that was taken into consideration is the following sentence:¹

“Woman! Without her, man is nothing. “Woman, without her man, is nothing.”

It was stressed that with a subtle play of the punctuation marks, the entire meaning of the sentence changed. Many other examples were supplied to hook the learner’s attention, well in keeping with the ARCS Model of motivation. The section also saw the course instructor introducing himself with a smile trying to connect with the online learners then and there (Figure 5).

In this particular video, which can be seen as a spontaneous extension of the previous, 2-minute video, the instructor welcomed the learners and made a slight reference



Figure 4.
The 2-minute introductory video. Photo courtesy: Centre for Distance and Online Education, KLEF University. (All the videos stills are courtesy of the Centre for Distance and Online Education, KLEF Deemed to be University, Vaddeshwaram, Andhra Pradesh State; India. Special thanks to the esteemed Director for giving permission to use these stills for the purposes of the paper. Copyright KLCDOE Studio, 2023.)

¹ Such anecdotes are useful in soliciting learner interest and induce them hooked to atopic.



Figure 5.
The 6-minute extension video. Photo courtesy: Ibid.

to the previous video where the topic was introduced. The instructor begins with an elaborate mention of the topics within the module/unit and progresses with the enumeration of them. The video also gives them some idea about the wider implications and applicability of the topic and what are its various applications in the job market. This section talks about the various forms that documentation can assume in a professional setting (**Figure 6**).

This main video may be seen as a natural extension of the previous two videos. Here, the course instructor, after having prepared the necessary ground for learner motivation, proceeds to acquaint the learners with the main topic within the



Figure 6.
The 20-minute main video. Photo courtesy: Ibid.

particular module. The power point associated with the topic was flashed on the screen and the instructor summed up the major ideas within a particular slide. This is the longest part within the entire spectrum of three videos. Had not the instructor not taken care of appending the two earlier videos, this entire section would have looked uninteresting and dull to an online learner.

After having taken stock of all the three stages in a particular topic with recourse to the ARCS Model, the online learner is expected to have absorbed the topic in consideration and would have been exposed to all the four levels: attention, relevance, confidence, and satisfaction. The first two videos are supposed to cover the first two parameters, *viz.*, attention and relevance. The learners are first exposed to a positive learning environment where the smiling subject expert or counselor welcomes the online learner and starts discussing the topic by giving some real-life examples that are relevant to the learner. In the next stage, the learner is given an idea about the topic in detail and in what can be called—micro-units; each sub-topic is presented within a slide in a particular power point presentation.

8. Further discussions and future applications

The above-mentioned hands-on experience asks many questions. To what extent is such a tri-partite division of a subject or topic of discussion feasible? Though it was applied to a group of undergraduate students who had an English component as a compulsory paper, but does the application of Keller's model indeed elicit positive responses—for instance, what happens to a learner who is already motivated and may find this approach to learning redundant?

9. Conclusion

The ARCS Model is a motivational model that looks into the factors that facilitate the teaching-learning process. This paper has presented a real, hands-on experience conducted with recourse to a paper of English language meant for undergraduate online learners. The paper has tried to show how the idea of making videos for online learners in an online setting can be situated and firmly embedded within the paradigm of the ARCS Model as propounded by Keller.

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Cultivating Active Learning and Learner-Centered Pedagogical Practices on MOOCs

Fatima Al-Abdulaziz and Ahmad Q. Al Darwesh

Abstract

Massive open online courses (MOOCs) have innovated the field of education. These courses are delivered online, attracting students from around the world in a single course. We argue that the design of these courses should leverage student-centered pedagogies that encourage fostering critical and analytical skills, two important twenty-first-century learning characteristics. The goal is not only to deliver a content-driven course but also to promote active learning through three types of learner-centered interaction: learner-content, learner-instructor, and learner-learner. Applying concepts and information entail guiding the learners and increasing their responsibility for their own learning. An example of learner-instructor interaction is feedback given by the discussion led by the instructor. Assigned collaborative activities such as small-group projects and group problem-solving assignments could enhance the learner-to-learner interaction.

Keywords: online learning, massively open, active learning, activity theory, technology-enhanced learning

1. Introduction

Increasingly, massive open online courses (MOOCs) are gaining more attention from researchers in the field, although some are approaching them with less enthusiasm than others. MOOCs are often described with a tone of criticism as “disruptive innovation,” which has given a warranty to the speculation floating around the literature about its negative influence on higher education—even though the technology itself is far from disruptive. Understandably, a platform that follows a didactic structure around its content development, curriculum design, and assessment could raise legitimate questions about the viability of its pedagogical approach. Especially true that we live in an era of learner-centered pedagogies in our face-to-face settings with stupendously successful results. However, many negative views became more convinced about the opportunities MOOCs offer amid the COVID-19 pandemic. Having forced many countries around the world to shift from offline to online classes, online learning, and by extension MOOCs, has proven their utility in offering affordable access to learning and knowledge. And this led to their current status: MOOCs

have become more relevant in higher education and lifelong learning, particularly in engendering twenty-first-century learning characteristics.

These learning characteristics could be described by the four Cs of twenty-first-century skills: critical thinking, creativity, collaboration, and communication. However, as things currently stand, MOOCs are still facing an apparent pedagogical limitation that can hardly be reflective of learner-centered learning due to factors associated with the invariability of culture and discourse. The internal design of MOOCs is intended for students regardless of their geographical location and cultural background. Its exterior, by contrast, that is, its content design and discourse is rather facilitated within an Anglo-Saxon mindset. This may preclude the inclusion of students whose learning contexts such as Asia and the Middle East come with vastly different experiences. Hence, the current pedagogical apparatus of MOOCs, we argue, are in dire need of the active learning approach in order to develop and nurture the twenty-first-century skills.

In this chapter, we are adopting the activity theory to argue that to accommodate cultural and discursal variability, the student's learning experience must exist in a virtual social fabric in which they interact, engage, and belong to a community of practice within the MOOCs environment. Activity theory is viewed from the perspective of the student and their interaction with other peers, the instructor, as well as the content. This chapter is divided into three sections: The first section delivers a propitious view of the pedagogical framework that should be used in designing MOOC platforms. The second section investigates the cultural, pedagogical, and technological limitations in non-Anglo-Saxon learning contexts. Finally, the third section draws on the first two in cultivating active learning, as informed by activity theory and in consideration of the aforementioned limitations.

2. Current pedagogical frameworks in designing MOOC platforms

Theories that emphasize self-learning using technology have influenced MOOCs. Many of these theories were based on philosophical and hypothetical concepts that promote individual learning. However, learning online is not isolated from what happens in the actual classroom. Students still need to interact with each other and exchange thoughts and ideas, and this is what would help them to construct meaningful learning. The social aspect, even in an online setting, is an essential component of learning, as many learning theories have indicated. MOOCs students need to communicate with each other and the professor to become part of the community and to complete the course. One of these theories is activity theory, which argues that learning occurs when an individual is part of the community and through a social context. It refers to a variety of sociocultural theoretical perspectives that address real-world complexity.

According to Engeström, communication is a specific human activity necessary to be considered as part of the community. Specifically, activity theory emphasizes group versus individual on cognition and constructs real-world experience. Furthermore, it refers to a psychological framework based on the concept that humans are defined by the activities they perform on objects in the real world and by the tools used to accomplish these activities. In addition, these activities occur within the social, cultural, and historical contexts that give them meaning [1]. The following theory model displays the interactions between the different elements, which are the subject and the object mediated by the community. All the interactions between the subjects should follow structured instructions and collaborate in the community (**Figure 1**) [2].

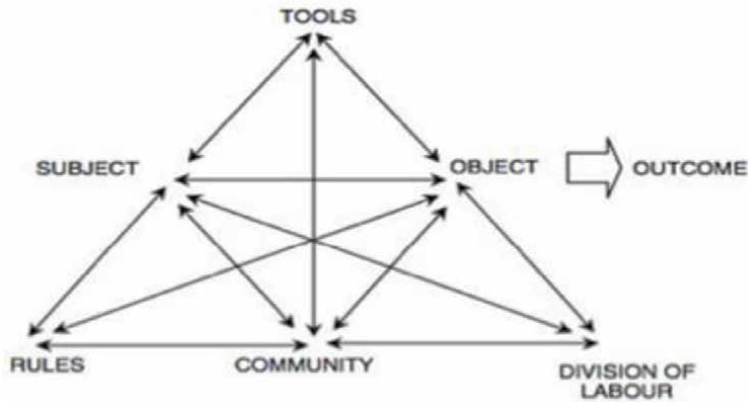


Figure 1.
 Activity theory model adopted from Jaworski and Potari [2].

This chapter adopts the model of the activity theory as a framework that explains how the students learn as part of the social context. According to the activity theory model, in MOOCs, a student is the subject, and the student is using an online tool to reach a certain learning outcome. In addition to the tools, the theory model emphasizes different components, which are the community, rules, and collaboration. MOOCs are mostly offered by American institutions where the instruction pedagogies influenced by the teaching approaches are common in the American education system. However, a massive number of the registered students in this class are from different countries that are following different teaching approaches such as grading, class participation requirements, and others. Also, cultural sensitivities and teaching pedagogical differences should be in consideration [3]. Setting up the rules and course policy would limit the student's dropout and help the students to reach a desired outcome [4].

Since MOOC is an open learning opportunity that allows students worldwide to register for a course, it is worth considering the students' community. Addressing the different aspects that the activity theory might help in designing and developing these courses and, therefore, enhance the students' engagement. The model should clarify how the students interact and actively participate in online classes. Activity theory indicates that students should not only be cognitively engaged to learn rather than make meaning of their learning by engaging in a community. This requires the MOOCs students to stay active in terms of the class communication. MOOCs classes are like any other online learning context in which students should use email, discussion forums, or blogs to communicate. Students who registered for the MOOC were required to create their network and seek the answers to their questions. Studying online in MOOCs is not a linear approach to teaching, as it does not offer class content in the traditional way. Therefore, MOOCs instructors should consider creating a class structure that allows students to interact with each other. Assigning a group assignment or project would provide the opportunity for the registered students to be actively engaged with each other. Offering the students step-by-step instructions and setting up the expectations of their role as online students may help them to stay active. Setting up the rules and regulation is another aspect that activity theory emphasizes. It is very critical for online students to manage the expectations of their responsibilities. They have to be aware of how to collaborate, complete their tasks, and reach the goals by achieving the intended learning outcomes [5].

The MOOCs instructors have to be aware of the challenges that may face their students in such an online context, which involves a large number of students. The main challenges that many registered students in MOOC courses may face are the lack of the instructor present, self-efficacy, and computer and English literacy as mentioned earlier in this chapter, especially for the students in the Middle East or other developing countries [6].

In a traditional classroom, the presence of the instructor would make the communication and collaboration inside the classroom easier with less efforts from the students. Usually, the instructor gives instructions at the same time as the class and arranges the class communication between the students inside the classroom. This would help the students be cognitively focused. However, in an online context such as MOOC with a large number of students registered, instructors should create a learning environment that encourages their participation. Also, instructors should set up the expectations of the students' participation and communication. Unlike the traditional classroom, the instructors are required to follow up and remind the students frequently of all the expected work they have to turn on or work on [7].

Instructors who are teaching MOOCs should be aware of the self-efficacy factor that may impact the students' learning and participation. Many of the students who registered in MOOCs classes are from around the world. The massive number of students requires MOOC instructors to be aware of the different instructional pedagogies that the students are used to. Students who are from developing countries or the Middle East tend to take a passive role in the classroom as they may be used to teaching pedagogies that are driven by the behaviorist learning theories. The behaviorist teaching approach focuses on individual learning and views learning as a measurable behavior. This teaching approach is different from what the students may be exposed to in the MOOC experience [8].

Since MOOCs are open to students from a variety of educational environments, there could be presence of challenges related to the impact of sociocultural factors, especially if the course follows a pedagogical style different from what the students are exposed to [9]. According to Fischer [10], "A fundamental challenge for cultures of participation is to conceptualize, create, and evolve socio-technical environments that not only technically enable and support users' participation but also successfully encourage it. Participation is often determined by an individual's assessment of value/effort. The effort can be reduced by providing the right kind of tools with meta-design, and the value can be increased by making all voices heard by supporting social creativity."

3. The status of MOOCs in the Middle East and Asia

Since 2012, MOOCs courses have begun to attract a massive number of students around the world. In 2013 alone, students from English-speaking countries such as the United States and the United Kingdom comprised the majority of enrollees on Coursera, one of the first online learning platforms to emerge on the market. More astonishingly, in the same year, MITx MOOC was able to deliver courses to students from 194 countries [11]. From there, the spread of MOOCs never stopped; increasingly, more students from other parts of the world such as Africa, Asia, and the Middle East found an alternative learning opportunity by attending online courses [12], which is a testament to the utility of MOOCs in simultaneously delivering content knowledge to students regardless of their geographical location, unlike

traditional education, which could only successfully deliver instruction through a controlled classroom size.

The following year witnessed a significant rise in the variety of subjects from different institutions. Shah reports that the number of MOOCs providers doubled to 400 universities [13]. The increasing interest among not only Western students but also international students shows that what these institutions offer in their MOOCs are worthwhile incentives. And students have various motives to engage with these online courses, depending on multifaceted cultural and educational factors. However, unlike the North American and European contexts that have enjoyed relative success with MOOCs, the success of MOOCs in non-English-speaking contexts has been propelled away by numerous impediments such as the lack of digital literacy, poor IT infrastructure, pedagogical setbacks, as well as language and cultural barriers.

Ideally, students who are partaking in MOOCs need to adjust the skillsets they have acquired from their traditional education. One thing to bear in mind about MOOCs is their democratized nature, which is the backdrop ideology behind the initiative. Democratization of knowledge involves making it equally accessible for everyone while blurring the line between the student and the instructor [14]. While the intended vision of democratization was to equalize the role of instructor and student, this kind of virtual environment in fact limits the instructor's traditional role. As of consequence, the responsibility of learning is greatly shouldered by the student due to existing in an open-ended network space.

This necessitates that the students gain the ability to socialize differently from the usual in-person setting and be aware of certain behaviors and newly emergent social etiquettes. As for readjusting their academic skills, information literacy, that is, being able to identify, locate, aggregate, synthesize, and evaluate knowledge to address or solve problems is a prerequisite to navigating through the content in MOOCs [15]. Moreover, being familiar with the relevant discourse, from writing relatable blogs to posting comments, allows the student to engage with the discourse community. Most important academic skill is arguably self-evaluation. Since teacher-to-student evaluation might be modestly little, given the limitless size of MOOCs courses, being aware of one's learning trajectory amid the diversity of discourse can either break or make the student's experience [16]. All these skills can be categorically placed under a singular concept, "student autonomy."

Recently, student autonomy has been investigated in different fronts of education such as STEAM, foreign language teaching (FLT), and early childhood learning. In the STEAM field, integrating autonomy support in teaching mathematics was found to be associated with developing twenty-first-century skills such as critical thinking and complex problem-solving [17]. In FLT, Irgatoglu et al. implemented Oxford's Language Learning Strategy (LLS) to promote the autonomy of Turkish learners of English as a second language and observed that the use of LLS has helped reinforce their autonomous learning [18]. In a similar finding regarding early childhood education, Hunter-Dongier demonstrated the effectiveness of autonomy when integrated into the design of the subject content taught to children [19].

Although those skills are frequently emphasized in the literature, their emphasis falls flat in the classroom whose context is acculturated by a variety of rote-learning backgrounds. As a result, not all students, particularly outside the English-speaking educational context, are expected to come equipped with these baseline competencies. The philosophical and cultural backdrop of Asian education, for instance, has for so long rested on perceiving the instructor as the fount of knowledge from whom knowledge is transmitted to students [20]. One can anticipate resistance from

students to the teaching method that contradicts this cultural perception. Recent reports articulate the same challenge in changing the status quo [21–23]. In fact, the teacher-centered tendency was exacerbated during the COVID-19 pandemic [24].

Similar discernible issues with regard to student autonomy can also be observed in the Middle Eastern context. The way these issues manifest, however, is partly due to the underdeveloped technology of the time. Unlike the educational context like China, which has somewhat been more familiar and flexible with online learning, the potentiality of technology in the Middle East surfaced in the 1990s and it was bare-bone for a long period of time. Its technological feats have just recently reached an optimal level of maturation. Still, for many years to come, incorporating technology to establish online learning was excluded in public schools and higher education until the COVID-19 pandemic [25]. Their inclusion was merely due to the predicament of the time.

Another equally disruptive factor is the institutional and cultural resistance to the concept of online learning. For example, Saudi universities introduced distance-learning bachelor programs and, in the end, issued certificates that the same institution refused to recognize. Saudi universities opposed giving recognition to degrees earned by distance learning while the Ministry of Education prevented holders of distance-learning degrees from any employment opportunities in the educational sector. This caused a coalition of students to respond with a series of lawsuits against their institutions. One lawsuit that came to the public limelight was a student with a distance-learning master's degree applying for a Ph.D. program at one of the top universities in the country. After being disqualified for having a distance-learning degree, the student filed a suit against the university. In response, the Board of Grievances annulled the decision of the university on the basis of giving equal opportunity to distance-learning and full-time degree holders.

By and large, the impact of this structural resistance to online education seeped into the culture. The universities ensured that online learning was devalued and remained discredited as a way of acquiring knowledge and skills in the eyes of the public and private sectors. However, when the transition from face-to-face learning to online was made amid the pandemic, the educational system in the Arabian Gulf, especially, realized its potential. That said, the transition to online learning was rushed, thus, giving birth to new teaching and learning difficulties pertaining to the absence of student autonomy and independent learning among Arab students.

These difficulties can also be noticeably translated into the participation of Arab students in MOOCs courses. Maksoud mentions three underlying factors that intervene with the participation of Arab students [26]. First, there is a significantly high dropout rate of Arab students attending MOOCs. It must be pointed out that although this problem is prevalent in nearly all virtual learning contexts, the problem is compounded in the Arabic-speaking learning context. This could be explained by the language barrier, where the majority of the courses are sponsored by prestigious institutions that use English as a medium of instruction (EMI).

Second, since most participants come from North America and Europe, there crops up a cultural alienation inside the virtual platform. Consider the cultural relevance of instruction and learning activities on MOOCs platforms mirrored for a Western cohort as opposed to a cohort attending from North Africa. Not only is there a polar opposite of cultures but also of learning experience between the two. In other words, only one of the student populations would more likely relate to the cultural cues of the MOOC than the other. The results from probing student populations in 10 MOOC platforms by Rizvi et al. point to the inhibition of a singular context, mostly

Anglo-Saxon, on the progress of students from non-Western cultures such as the Middle East and South Asia [27].

Third, Arab students, Maksoud reports, lack computer literacy, which precludes their effective involvement and continuation in MOOCs. This is in conjunction with Ja'ashan's findings who surveyed Saudi students at the University of Bisha. He enumerated five technology-related difficulties: (1) lack of technology for home access; (2) lack of technical support; (3) lack of training provided by the institution; (4) complicated software; and (5) inaccessible materials [28]. In a more recent investigation, Alanazi and Walker-Gleaves interviewed 45 Saudi students from Majmaah University about their attitude toward integrating MOOCs in their flipped classrooms, which is a novel combination of pedagogy for this cohort. According to the researchers, the instructional approach conflicted with their past learning experience from which emerged frustration and academic concerns. Only after a period of time did they become accustomed to navigating their hybrid classroom after which they recognized its advantages, from being time-saving to being goal-oriented [29].

Despite the advantages sowed by online education during the pandemic, until now, nearly all Arabic-speaking universities in the Middle East do not incentivize students who have enrolled at MOOCs courses with credits for the college specialization. MOOCs never began from those institutions. They have largely neglected the apparent upsides of MOOCs in providing accessible and lifelong education amid the inexorable changes in technology in modern life. Considering the average Internet user, in 2018, Egypt had the highest penetration of Internet users in North Africa at 43%. In 2019, it is estimated that the penetration rate of mobile internet users in Saudi Arabia reached 91%, whereas in the United Arab Emirates, 96%, population-wise [30]. This means that in that year, Saudi Arabia had 31.19 million users out of 34.27 million.

Rather than university-funded support, early initiatives to establish MOOCs in the Arab world started from individuals. The earliest inception of MOOCs, Sallam recounts, was heavily reliant on YouTube channels as of 2011. Individual university professors and schoolteachers would upload their lectures on their personal channels to make them available to the public. With time, these channels grew into a structured online platform. The first online learning platforms were Aldarayn Academic and Tahrir Academy, founded in 2011 and 2012, respectively. Aldarayn offers language learning courses, Quran recitation, accounting, as well as adult literacy. Tahrir Academy was more specialized, on the other hand. It had physics, astronomy, and Arabic grammar. Apparently, the former lacks funding but barely survives as it is based on volunteerism while the latter stopped adding content due to financial struggles as of 2015 [31].

Perhaps, among the most successful MOOCs are the Saudi-based Rwaq and Dorooob, thanks to the multi-company sponsorship. Having the infrastructural and financial support played a pivotal role in its continuity as a MOOCs platform, which Aldarayn and Tahrir academies were lacking in their initial charter. Rwaq was first charted by Fuad Al Farhan and Sami Al Hussain in 2014 in response to the prevalence of MOOCs in the United States. The Saudi-run MOOCs cover a broad range of fields such as computer science, business administration, and social science. Within a short period, many different institutions, from academies to universities, partnered with Rwaq to make their courses accessible to a wider audience.

A similar approach was followed by Dorooob. Unlike its predecessor, Dorooob was launched by the Human Resources Development Fund that targeted professional development areas such as English language proficiency, computer literacy, and

communication skills, as well as clerical training such as accounting, marketing, and secretary. Both MOOCs platforms pride themselves on their flexible access, but their focus seems to differ. Rwaq happens to be more community-centered, whereas Dorooob is more outcomes-driven and focuses on ensuring accredited certification for the professional audience that aims to expand their skill set. For a complete list of MOOCs in the Arab world, see [32].

Arab students are motivated significantly differently with regard to joining prominent MOOCs platforms like Coursera or regional ones like Dorooob. That said, understanding the reasons behind their participation can be laden by overbearing theoretical models. Studies probe the concept of motivation differently from one another. Some studies view motivation as an intrinsic-extrinsic dichotomy; others view it from a theoretical model such as the self-determination theory and self-regulated learning. Nevertheless, the findings can reveal the reasons that spur Arab students toward MOOCs courses.

Davis et al. listed 16 motivators for enrolling in a MOOCs course, for instance, “*they are free*,” “*curiosity*,” “*career change*,” and so on. They distributed these motivators in a questionnaire to 194 Arab students alongside 52 English-speaking and 40 Spanish-speaking students. Not surprisingly, Arab students were motivated by professional goals such as improving their CVs by learning from reputable, world-leading universities [33]. Being motivated by career-oriented rewards speaks volumes to the need for employment in a constantly changing economy within the Arab world. Furthermore, this finding is mirrored back in other similar studies that observed the same professional-oriented mindset [34–37].

On the same note, Asian students from Japan and China, who were interviewed, factored their motivation as a result of seeking future employment [38, 39]. The only difference is that, unlike Chinese students who mostly regarded MOOCs as a way to bolster their resumes, Japanese students expressed more inquisitiveness toward MOOCs for the sake of experiencing a new method of learning and having an international outreach with culturally diverse students.

Though motivation provides a somewhat reasonable explanation for why Arab and Asian students seek MOOCs platforms, we find it inadequate as an explanation when it comes to the absence of autonomy among such cohorts. This obstructive factor, either birthed structurally or culturally, presents a monumental challenge for both the Middle Eastern and Asian contexts to assimilate with MOOCs in commensurate effect as their Western counterpart. Besides that, students reported many frustrations with MOOCs regarding the overall course design, course content, and most importantly, the pedagogical approach or the lack thereof [40].

The MOOCs platforms available in the regional context and language in the Middle East and Asia may have availed culture-friendly content and virtual environment. Having done so may have also alleviated some of the struggles, which students typically face in West-dominated MOOCs. Regardless, adulterating the cultural content and virtual environment failed to contain two persistent issues: first, students still prefer MOOCs delivered by reputable Western platforms to the ones provided locally. It is no secret that a market-driven approach is a global phenomenon at universities, specifically at English-speaking universities. Even prior to the proliferation of online education and MOOCs, international students from all over the world have always placed a higher premium on Western education than their local universities [41]. Institutions in the West have a stronger foothold in their technological aptitude, pedagogical experience, and extensive subject knowledge, which makes them perceived as authority in deciding what constitutes knowledge [42]. Therefore, it comes

as no surprise that the same currency is given to the MOOCs provided by the same institutions.

Second, MOOCs in Asia and the Middle East are in their infancy. The technological and pedagogical shortcomings on part of the instructors persist even with the infrastructural support given to the platforms. These shortcomings are part of the educational climate that is described as traditional in which memorization permeates the classroom practice and the curriculum design. It is seemingly not enough to avail advanced technology to a cohort of instructors who are considered knowledge providers yet lack the appropriate teaching approach. Instructors with one-fits-all teacher-centered approaches (e.g., rote-learning, lecturing) will more likely struggle to manage MOOCs that rely on teacher-student collaboration and communication. Of course, training teachers to adopt learner-centered approaches as general mindset can raise their awareness of their pedagogical practice on a MOOCs platform, as Menon and Banerjee demonstrate in their evaluation of a teacher training course conducted in a MOOC setting [43].

Before the peak of online learning, the foreseeable shift from the traditional classroom to the virtual one presented an uncomfortable change in perspective. At that time, instructors had held a generally negative attitude [44, 45]. However, due to the increasing demand for instructors to gain competence in online teaching, instructors underwent a pendulum shift in their general attitude, becoming more receptive toward the importance of this new format [46–49]. And this was emphasized during the upheaval of COVID-19 as an intervention to ameliorate the twofold barriers, intrinsic and extrinsic, which obstructed students' progress to a considerable degree [50].

Intrinsic barriers perceived by online teachers can boil down to the instructivism versus constructivism debate. Instructivist approaches posit that knowledge is seeded in the real world and it needs to be transmitted to the learners in a linear manner. This type of teaching philosophy is instantiated in the teacher-led learning. The latter, however, believes that knowledge is co-constructed from the learners' subjective reality, their thought, and cognitive processes. This teaching philosophy is instantiated in the learner-centered approach [51]. Accordingly, instructivism has created students hugely dependent on their instructors. Constructivism, on the other hand, invited more behavioral change in participation, which maximizes the students' learning curve. In the same vein, Cheng and Ding observed that Chinese teachers' performance became significantly more efficient in the classroom after using collaborative learning strategies [52]. To increase student participation and attention lifespan in the learning environment of MOOCs, not only should the presentation be visually appealing but also highly animated and entertaining in order to captivate and prolong their attention [53].

By contrast, extrinsic barriers are things beyond the teacher's control, mostly related to the time constraint, the adeptness of the technology in class, and family environment under which students are brought [54]. These barriers are also reported in MOOCs, in addition to the difficulty of bringing a gamifying spin into the course [55].

These intrinsic and extrinsic barriers may hugely affect teacher attitudes and beliefs about online learning and, specifically, the value that MOOCs bring to thousands of students. Albelbisi and Yusop recommend that teachers focus on three primary aspects, technical, pedagogical, and soft skills [53]. Teachers involved in online education and MOOCs should undergo continual training programs, which mainly focus on planning, designing, developing, and delivering MOOCs. Moreover, the training should promote learner-centered pedagogy.

This section has investigated the current status of MOOCs in the Middle Eastern and Asian contexts. We have argued that at their current state, MOOCs are still under development and are impeded by the technological, pedagogical, as well as cultural and institutional challenges. Though the challenges are overwhelming, the learning environment on MOOCs could improve drastically when the following conditions are met. Students should become autonomous and independent learners; by the same token, teachers should equip themselves with effective pedagogical approaches. In other words, to achieve this, active learning and learner-centered practices must be cultivated.

4. Cultivating active learning and learner-centered pedagogical practices

Adopting twenty-first-century learning skills in online courses has drawn researchers in the field of education. They have explored the application of the twenty-first-century skills to fill the gap between the school curriculum and children's real-life experiences. Implementing active learning pedagogies could increase the opportunity for the students on MOOCs to gain and demonstrate the twenty-first-century skills such as problem-solving, critical thinking and evidence-based practice. Developing twenty-first-century skills as part of the students' learning process could consist of three emphases. First emphasis focuses on developing the students' skills in both formal and informal learning. Instructors must use the different learning pedagogies to allow the students to transfer the skills from the online platform to actual social context [56].

The second emphasis focuses on both individualized and collaborative learning approaches. Instructors have to consider giving the students the responsibilities of planning their learning goals, monitoring their learning progress, and evaluating their own learning outcomes by themselves or collectively with their peers. Allowing the students to work cooperatively and communicate with each others promote active learning that complements these twenty-first-century skills. Regardless, the lack of physical contact between the instructor and peers presents a challenge. Designing the MOOC on active learning-based activities should increase the students' interactions and participation. There is an advantage of MOOCs instructors can capitalize on by promoting active learning since there are usually massive number of students from worldwide registering for these courses. These students are coming from different cultural and educational backgrounds, which may create a good opportunity for them to exchange thoughts, build new skills, and enhance the learning process [57].

The third emphasis focuses on the awareness of the students in their learning process to develop their skills. The MOOC could increase the student's awareness of the learning process by designing a range of activities. During the learning process, MOOCs can provide evidence of improvement collected from the learners' performance. Processing real-life information, reflecting on other students' presentations, and analyzing real-life situations could be indications of applying twenty-first-century skills. The online environment provides the students with all these opportunities of monitoring their development. The learning goals usually consist of both knowledge and skills that instructors aim to measure as outcomes of the learning process. The learning outcomes need to be monitored throughout the learning journey. Usually, in a traditional classroom context, instructors may be overwhelmed with the number of the activities that they have to monitor and follow up on, which is a huge challenge.

Nevertheless, MOOCs platforms provide technology tools and features, which allow the activity reports and results generated automatically from the system. Such automated functions provide automated comments, generating grade reports and learning process data would make it convenient for the instructors to apply active learning. The MOOC platform could help the instructors to increase the number of the learning activities and provide timely feedback. This will make it easier for students to apply the skills and not be limited to summative, which is at a single learning time as in the traditional classrooms [58].

Promoting twenty-first-century skills among students in online learning requires implementing active learning pedagogies that fit the design of MOOCs platforms. The instructor may assess the application of interactive learning process among the students and, therefore, develop their skills [59]. Applying active learning requires the instructor to provide and develop adequate and relevant issues, in order to allow students to deal with scenarios related to the real world. Online instructors, therefore, need to change their pedagogical practice and lead students in multiple approaches: engaging students in, constructive and interactive learning processes to develop their application and reflection of twenty-first-century skills, and increasing their awareness of the learning processes [60].

All the students' online interactions and activities fit under the scope of learning community, which was explained earlier by activity theory. Maximizing the students' experience and developing their skills is impacted by different factors relevant to the student's engagement and awareness of the learning process. One of the instructor's roles in supporting the student in such an online context is to allow the students to develop their plan for their learning outcomes. According to the activity theory, students must use mediator tools and interact with their community to reach their outcomes. Instructors must be aware of how to implement these approaches in their online activities.

Until now, MOOCs have been designed around multiple technological features that are regarded as advantageous over the traditional classroom. Supposedly, the more advanced the technology is, the higher the engagement becomes among students. Fostering a learning community that promotes variable social integration and engagement (i.e., student-to-student, instructor-to-student) seems encumbering. The community integration of social media like Facebook and Twitter was replicated to facilitate student groups on MOOCs at the expense of dismantling the instructor's authority. Similar to how people engage with one another on social media apps, students befriend others by selecting them, thus, creating a community-run learning environment [61]. The previous section discussed the possible emerging problems from removing the instructor, as they are perceived as a point of reference for their students in the non-Anglo-Saxon learning contexts. This adds further skepticism regarding the conclusiveness of dressing MOOCs with technological features to create a classroom community and a classroom culture run solely by students. It appears that until the present day of writing this chapter, the traditional classroom still reigns over in terms of social integration of students.

Having said that, MOOCs have transformative opportunities that could somewhat mirror their traditional counterpart. Since MOOCs facilitate an astronomical number of students compared to the face-to-face classroom, it is vital to implement instructional strategies that foster different types of student engagement, namely, cognitive, metacognitive, emotional, and social in proportion to the size of the MOOC class. Hmelo-Silver et al. suggest the implementation of project-based learning (PBL) to actualize the various aspects of student engagement [62]. Dissimilar to the social

media integration, the instructor has a performative role as a facilitator. Students, on the other hand, have directed their learning and evaluated their performance accordingly. The facilitator's role is to ensure that students are active during the lifespan of the given task, and by and large, the course. This is done so by eliciting the students' accumulated knowledge and inviting them to consider facts and information, which is yet to unravel for them. The facilitator acts as a director wherein they stimulate a discussion among the students. This pushes them to expand upon what they already know and reassess their current acquired knowledge.

Without the facilitator's role in mediating the discussion for the students, there is a chance that they are left unprobed, unchallenged, and hugely unattended for. Unlike the view that opts for a completely student-run MOOC platform, this approach might prove inadequate, as there is no expertise to drive the discussion forward and invoke critical and analytical thinking about the subject matter. This teacher-to-student interaction offers mediation to the open-endedness of the content. This is in line with the view propounded by Zhao who argues that open-source content poses a developmental challenge to sustainability [63].

Another type of interaction is student-to-student, which is central to both face-to-face and online learning. If the importance of the former type of interaction lies in keeping the students active, the importance of this one lies in its construction of meaning. In other words, students develop a sense of belonging from the groups they form. The main means of communication for student interaction is through discussion forums, which can encompass numerous engagement opportunities. Yet, researchers have found that text-based discussion can be somewhat lacking, which is why, recently, MOOC software has come out to complement and enhance student-led discussions such as Rain Classroom and DanMOOC. For instance, DanMOOC organizes the comment section in the form of a timeline, allowing the students to create a thread of annotations on video playbacks. Students' annotations and comments enrich both the discussion and content, as it facilitates "extra explanations, personal reflections, and extended discussions [64]." Certainly, integrating such discussion-boosting applications has been demonstrably beneficial inside and outside the MOOCs class [65].

Certainly, mediating the type of interaction on the MOOCs bears a number of benefits, specifically, in light of the twenty-first-century competencies that should be considered in the course design and development. The most common competencies identified in the literature are cognitive skills (e.g., analytical thinking and problem-solving), interpersonal skills (e.g., presentation skills), and intrapersonal skills (e.g., adaptability, self-management, and self-development). Literature on equipping students with these skills is documented heavily in the offline setting. On MOOCs, however, research is still in its infancy, particularly, when one bears in mind that the environment of discussion in one MOOC class is hugely different from that of another. Thus, differential outcomes are expected to arise and, in the process, hinder the acquisition of these competencies. In fact, even though a discussion-based approach is considered a part of active learning, its effectiveness relies primarily on student performance and preparedness [66].

For example, if students are required to do some key readings prior to the class, they will not reap the benefits of the discussion and it will have a scant impact on their learning. Similarly, low-performing students may struggle to prepare for the class, unlike their high-performing peers who find navigating the virtual platform relatively easy. Of course, the reasons for these difficulties may vary depending on the kind of barrier (discussed in the previous section). One way to alleviate this is to break down

the massive size of online students into small cohorts with variable performance and skills. This way, students who are falling behind could seek peer support and advance in their learning at their own pace.

From the technological perspective, the design of the discussion layout gives vibrancy to the student user, from the colors, graphics, and the web layout. This is known as technology-enhanced learning (TEL). Even though the visuals are an indication of the platform's technological sophistication, there exist supporting criteria in complementing the discussion-based approach. Yousef et al. identified four technical criteria: user interface, video content, learning and social tools, and learning analytics [67].

This is irrelevant to the quality of discussion content, which is under the pedagogical criteria. In examining the perception of instructors and students, the researchers found that in the technical criteria, the user interface and video quality are fundamental for a self-sufficient MOOC course. The user interface was shown to impact the efficiency and student satisfaction in MOOC environment while the impact of the video quality was exemplified by its accessibility, appropriate length, and accuracy.

5. Conclusion

Adopting active learning pedagogies in MOOC context would enhance the student's participation and engagement and, therefore, maximize their learning experience. MOOCs could be very beneficial for students to develop their skills if they received the appropriate support and awareness of their responsibilities. Instructors can enhance the students' experience and help them to develop twenty-first-century skills if they implement the above-mentioned active learning approach. Considering the cultural and technological factors are essential components that influence the MOOC experience.

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Perspective Chapter: A Firm Belief in Online Virtual Learning Environment

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Abstract

Because of today's technology, understanding the components of online learning facilitation also requires an essential understanding to transfer knowledge, skills, and abilities (KSAs), especially within the adult learning classroom. Remote learning has become a way of the world, especially within academic and business environments. From new hire training to corporate leadership concepts, anything and everything with a topic have a premise for the many types of online learning environments. Even early childhood learning is benefiting from online learning. Virtual learning conceptually has many facets of user operation, such as virtual-led learning, eLearning, on-demand, and cohort-style learning environments. Within this scope of one form or another, transferring knowledge, skills, and abilities (KSAs) is vital to learning exchange. Therefore, those responsible for ensuring delivery must become subject matter experts (SMEs) using the online platform to extend a likeness of an actual brick-and-mortar face-to-face+ classroom. This chapter brings the concepts from principles to the practice of online virtual learning environments.

Keywords: virtual learning, adult learning, KSA, online learning platforms, online delivery, learning professionals

1. Introduction

There is a belief among learning and development professionals that anything delivered in the classroom may also apply to the delivery in a virtual learning environment [1, 2]. Amidst opinions, some may also argue that face-to-face offers the ideal learning experience. However, research has explained the comparisons between virtual and traditional classroom learning, where statistically, learning from a virtual environment has better learner performance than face-to-face classroom instruction [3].

The background to support virtual learning as a broader option to extend learning with newer technology approaches is discussed. Due to the ingenuity of the bells and whistles within online platforms allows the learning delivery to evolve usual and customary teaching techniques continually. Therefore, we can thank the software and web-based developers in our current culture for thinking outside the box and listening to the end-users for making the improvements. Likely, we could imagine that more

will come into our learning and teaching world as technological advancements progress into the future.

This author agrees from first-hand experience that the outcome of virtual learning weighs heavily on the ability within constructs of learning delivery, even for each generation population. Supported by many other studies, this premise is substantiated, including how adaptation is critical to successful learning delivery outcomes [4]. This chapter shares how adopting virtual learning is a practical concept from the new methods that abound each coming year to teach others how to achieve equal or better success.

This chapter furthers the readers' understanding of how the dynamics of the virtual platform tool impact the learning of all who participate. Although an entirely different delivery method from a face-to-face encounter, virtual environments also meet the agile framework of learners in general. The chapter aims to recognize how virtual learning is an enhanced learning experience for all ages and each type of learning delivery.

1.1 Background support for virtual learning

From the onset of virtual learning, concerns embracing the value of this alternative have raised pros and cons among educators, students, parents, and scholars alike. As with most new technology resources or advancements, it raises concerns from users and other advocates to ensure good probability with new methods. The premise of receiving an education through technological means had many taken aback initially about the effectiveness versus traditional classroom face-to-face instruction. Wilson (1996) describes a virtual learning environment (VLE) as a self-contained computer-based learning environment accessed by a web-based platform using various technologies as tools to support a learning environment much like the traditional classroom [5].

Initially, there were concerns that the human element of direct connection and communication would be absent within a virtual learning environment among the doubters, having misconceptions about real-time contact and prompt feedback to students. The same especially came when Massive Online Open Courses (MOOCs) first hit the scene [6]. However, as the web evolved, so has the experience from lessons learned for virtual learning. Aspects of approach and preparation for both the facilitator and learner are necessary to know before attending a virtual learning session [7]. Leon Ronzana, an assistant manager of organizational development at American Honda, concurs with advanced learning implements a culture change for any type of online learning, which requires planning, communication, and persistence [7]. When American Honda set out on the new excursion of virtual training scopes, they indicated they learned a lot of pros and cons from offering a virtual online option [7]. When in hindsight VLEs expand the space of learning broader with technology, interaction, and control [8]. Authors have supported that technology helps to increase teacher/student interactions [8–10]. The misconceptions about an alternative learning platform can be overcome by deploying instructional strategies to remove any barriers to attain learning goals [11, 12], which are discussed and shared further in this chapter.

1.2 Research topic

The background on virtual learning leads to a research topic of expending strategies to transfer knowledge, skills, and abilities in virtual learning environments in

attaining learning goals. However, equally important to understand are the do's and don'ts. The University of Illinois (UI) identifies the strengths of online learning on this eLearning program website [13]. The UI site promotes anywhere, anytime, at any pace to an asynchronous learning opportunity [13].

Basically, to learn virtually, all you need is a device with an Internet connection, plus a willingness to a freedom of learning participation without physically being present. Online learning (virtually) provides for a dynamic interaction between instructor and student while being among other students. The format delivers a come-as-you-are approach to form a synergetic structure to contribute and take part in the wholesomeness of other learners. However, constructs must be in place to make a virtual learning environment successful. This chapter is to identify and inform those techniques for VLE delivery. Let us take a moment to learn about some key terms and references regarding VLE.

1.3 Learning relevant key terms

The first of the key terms within learning environments is the reference to those individuals who teach and instruct others. In academia, we find titles of Teachers, Instructors, and Professors. In business, there are a few commonly used titles of Trainers and Facilitators from their human resource departments for job role instruction. There are also areas for leadership-led topics, seminars, and conferences that reference topics led by a Presenter. Conceptually, each of these terms is all the same quest to teach others, as a means to transfer some form of knowledge, skills, and abilities (KSAs).

The second of the key terms is the actual learning environment. A learning environment can be defined as the place where learning conveys the KSAs onto individuals, as the chapter progresses specificity to the different types of learning environments and their descriptions in length.

A third key term relates to the delivery method of learning. The chapter will share a compare and contrast to the differences between training, facilitation, and presenting. Basically, all convey a degree of KSAs, but within the delivery constructs, the focus implores how much the instruction-to-learner interaction is applied or expected.

The chapter further describes and defines several other key terms as they are relevant to each section within an orange box.

1.4 Studying the problem

This topic of virtual learning has triggered many in the profession both academia and business to seek for a resolve of acceptance to this form of learning transfer [14]. Those who are stewards of a learning and development profession realize how valuable technology has supported alternative means of teaching others. However, even some within the profession still struggle to embrace the technology at its fullest capacity. The latter is primarily due to availability to learn something new rather complete opposition [15].

Academic institutions, businesses, industries, and others have mixed reviews on moving into some version of virtuality for educational purposes [16]. In retrospect, each of these entities is likely using a software program within their specificity for one reason or another. We could say that everyone has at least a cellular phone these days; in fact, over 91 percent of the global population use a mobile device (visit <https://>

www.bankmycell.com/blog/how-many-phones-are-in-the-world). Technology has encompassed a good majority of our personal and business lives. Learning is no different when in the use of technological means. However, there is still a resistance to deploy, even beyond cost and benefit. A cognitive deduction rests with belief in virtual learning environments. An article written for *Frontiers in Psychology* addresses the learning beliefs regarding virtual learning modalities. Within this article, a study of university students and instructors found that the origin of self-efficacy warrants the belief system for a person's learning [17]. Basically, believe that you can learn from any type of learning source or not. For this author as a personal witness, concurs with self-efficacy beliefs. Several individuals lack the fortitude to embrace technology as a whole, and it is not even generational, for the individuals known to this author range from mid baby boomer, gen X, and millennial. Therefore, a quandary of individuals, having a limited or no belief where they cannot acquire the same transfer of KSAs within a technological delivery that can only be achieved by learning within an actual brick-and-mortar classroom, presents a gap in the literature as to what is the cause. Thus, this chapter hopes to alleviate that concern and supply a clear basis; no matter the subject matter within a physical classroom can also convey the same subject matter in a virtual classroom.

Several studies have supported the firm belief in virtual learning. The research is to seek support to the conveyance of KSAs virtually equal to the classroom. The literature shares a vast support into all the outward concerns, there appears to be no argument among authors and researchers about the technology, feasibility, structure, and so on.

The time is now for entities to join those on the band wagon of virtual educational resources. An added commentary to this research is that no one has ever stated to reduce, exclude, or stop any physical classroom instruction, seminar, workshop, conference, and the like. Moreso to have an acceptance that full learning spectrums and reaching optimum learning goals are not compromised, if executed virtually. Consideration to embrace new approaches to the collection of avenues delivering learning does require different skill sets by those who instruct on topics. Thus, a learning curve for both instructor and learner is no doubt going to be a necessity.

1.5 Motivation for this chapter

The overall motivation for this chapter is to have the means to convey learning with alternatives to meet the needs of all learners and learning situations. An example is a business where customer service agents are readily available for inbound calls. From the business perspective, time is money and customer-centric support services are vital. Having the agents off the phones for an extended amount of time likely would affect call volume and hold times for the customer. To remove the agent into a classroom environment means extra time to arrive, partake, and return to the job. Since every minute counts in the business, a virtual choice right from the agent's desk would alleviate the extra time and, thus, reduce the backlash of customer support complaints. One could argue there are many distractions within the call center environment for an agent to learn subject matter cognitively. However, the argument would not sustain if the business used proper learning strategies to convey KSAs. At the same time, policy and procedures can be explored to minimize the distractions without causing more cost-related concerns. Learning and development professionals with experience within virtual learning environments have a conglomerate of resourceful methods and tools to meet such learning needs virtually.

2. Literature review

On a quest to research the initial onset of virtual learning using a data search of publications from 1983 to 2000 has presented over 7100 results in ProQuest. From the abundance of journals, articles, and other sources, those from scholarly journals lead the way with 97 percent of the resources. Using this date range considering that the Internet did not become available to the public until 1983, and the first online educational programs emerged in 1989 from University of Phoenix using CompuServe (visit <https://www.onlineschools.org/visual-academy/the-history-of-online-schooling>). From this same website, Jones International University established the first fully web-based distance learning online programs in 1996. Clearly, online learning is not a new concept. A polarizing effect has occurred online to significant virtual realities for essential learning scopes worldwide since this inception [18–20].

There is a difference in the delivery of online versus virtual. However, conceptually this form of learning takes on a direction as an alternative source, not necessarily a replacement for the physical classroom [21]. This also renders concerns if one learning environment is better than another. The literature is not one-sided to state either is better than the other; however, several studies do promote how all technological learning platform outcomes can be supported to meet learning objectives, as they do in the traditional classroom [21–24]. To understand the learning delivery in these environments it is necessary to value their existence.

In addition, there are thousands of online articles from a Google search on the value of virtual learning environments. It is evident that solution, strategy, enhancement, engagement, confidence, benefit, impact, importance, and value are all the benefits that coincide with the familiarity of learning in a capacity made necessary for alternative learning choices. The Drexel University School of Education, located in Pennsylvania USA lists the top ten benefactors of an online course in a virtual environment: Flexibility, Reduced Costs, More Free Time, Increased Course Variety, Career Advancement Opportunities, Increased Collaboration, Personalized Education, Enhanced Time Management Skills, Immediate Feedback, and Repeated Access to Course Materials (visit <https://drexel.edu/soe/resources/student-teaching/advice/benefits-of-online-and-virtual-learning/>). These listed advantages allow learners to control their education journeys. Even pedagogy learners receive the same advantages, plus: Learn at your Pace, Improved Technology Skills, and further gamification for engaging learning strategies [visit <https://www.prodigygame.com/main-en/blog/benefits-of-virtual-learning/> and <https://leadschool.in/blog/learning-at-home-one-of-the-many-advantages-of-a-virtual-classroom/>). Throughout this chapter, general concepts of learning principles and learning delivery methods are shared to establish the foundations to meeting learning goals.

The transfer of knowledge, skills, and abilities (KSAs) is formative attributes necessary for learning to take place. Those who are learning instructors require the skillsets to convey KSAs regardless of the learning environment. However, in the ever changing landscape of learning delivery options, advanced skills are necessary for the instructor to acquire to convey successful learning objectives (visit <https://elearningindustry.com/virtual-classroom-why-future-online-learning>) also found in studies deemed crucial to reliable and quality standard of a task-technology delivery [25, 26]. The literature is clear on these premises of what strengths are needed to be supported in learning delivery. There is also competing and contrasting views to the trend of alternative learning scopes offered by academia and business organizations globally.

The developments within virtual, online, and eLearning spectrums insist upon employing strategies to avoid pitfalls and use better practices [27], whereas a solid suggestion of promoting effective delivery within virtual learning environments acts upon the instructor's treatment of learners by changing the way learners embrace and comprehend the subject matter and ultimately acquire the KSAs with cognitive presence [27, 28].

Therefore, collectively to fully acquire the information about virtual learning environments takes a premise of technology conceptualization, being abreast of commonly used KSAs for the conveyance of learning subject matter, and the learning delivery modality and the skills necessary for its operation. Further in this chapter, this information is shared with narrowing points of reference for practical application.

3. A methodology to support VLE

Within the context of the articles and studies in support of virtual learning environment (VLE) one particular methodology was found to be relevant to this chapter as it encumbered each of the characteristics and necessary attributes for which this chapter discusses. The study by which Webster and Hackley 1997 [26] employs was the most thorough with regard to the teaching effectiveness in a technologically mediated distance learning delivery, embracing such aspects of the implementation of modalities, communication, information exchange, learner experience, self-efficacy, and overall learning outcomes. The hypothesis is organized categorically:

Technology characteristics measure both reliability and quality.

Hypothesis 1. The reliability of the technology used in distance learning should relate positively to learning outcomes.

Hypothesis 2. The quality of the technology used in distance learning should relate positively to learning outcomes.

The next category is face-to-face instruction versus any technology medium rendered first to those in the classroom.

Hypothesis 3a. Students will perceive the technology used in distance learning to be a less rich medium than traditional, face-to-face instruction.

Then, students in the classroom with blended environments have both face-to-face and technology versus 100% remote learning;

Hypothesis 3b. Students at origination sites will perceive the technology used in distance learning to be richer than those at remote sites will perceive it to be, continuing with an actual instructor-led virtual environment versus eLearning courses;

Hypothesis 3c. Students in courses using full-motion video will perceive the technology used in distance learning to be richer than students in courses using compressed video will perceive it to be.

Lastly, those students strictly only consider online learning courses;

Hypothesis 3d. Students will report higher learning outcomes to the extent to which they perceive the technology used in distance learning to be rich.

Addressing instructor characteristics is a categorical measure.

Hypothesis 4. To the extent that instructors have positive attitudes toward the technology used in distance learning, students will likely experience more positive learning outcomes.

From here, the instructor's teaching style and interaction become crucial to learning success;

Hypothesis 5. Students will experience more positive learning outcomes from technology-mediated distance learning with instructors who exhibit more interactive teaching styles.

There is also the instructors' abilities and task competency using the technology;

Hypothesis 6. Students will experience more positive learning outcomes from technology-mediated distance learning with instructors who exhibit more control over the technology.

Course characteristics such as the number of students and interactions between students during distance learning course delivery (based on 1997 a lapse in two-way video capacity. This may not be relevant in current day technology and could rephrase the hypothesis to suit today's technology);

Hypothesis 7. Students will experience more positive learning outcomes in technology-mediated distance learning courses with fewer student locations.

Student characteristics vary in their on-screen actions, and some may be more reluctant to participate than others;

Hypothesis 8. Students who are more comfortable when their images are displayed on a screen will experience more positive learning outcomes from technology-mediated distance learning.

Lastly, social influence suggests classmate attitudes affect learning outcomes;

Hypothesis 9. To the extent that classmates have positive attitudes toward the technology used in distance learning, students will experience more positive learning outcomes.

3.1 Methods

The study instituted a mixed method of both quantitative and qualitative data. A questionnaire was administered to random students, with a 69 percent return of completed surveys. In addition, observance to both face-to-face classroom and remote classes took place and recorded the virtual learning environments with informal interviews with both students and instructors to gather further feedback from open-ended commentary.

3.2 Measures

The questionnaire used a seven-point Likert scale from strongly disagree to strongly agree. The questionnaire was evaluated for validity and approved by the university steering committee evaluation. Reliability gave consistent internal Cronbach alphas for all scales.

Variables identified are listed to their categorical hypothesis for dependent and independent means. Several variables were adaptations from other studies, and the article renders specifics to each applied.

Independent Variables of:

- Reliability of the technology
- Quality of the technology
- Perceived medium richness
- Instructor's attitude

- Teaching style
- Control over the technology
- Number of student locations
- Comfort with image
- Classmates attitude

Compared to the following dependent variables for each of the Independent Variables listed above:

- Involvement and Participation
- Cognitive Engagement
- Technology Self-Efficacy
- Attitudes toward the Technology
- Usefulness of the Technology
- Attitude toward Distance Learning
- Relative Advance of Distance Learning

Analysis consisted of triangulation in descriptive statistics using Pearson correlations finding supported outcomes to hypotheses 1, 2, 3a, 3b, 4, 5, 6, 7, 8, 9, whereas 3c and 3d were unfounded mostly due to a lack of use of the full medium. The authors' Webster and Hackley determined that perceived medium richness related to all seven outcome variables; and in sum the results suggest that instructors need to make additional efforts to involve students in the learning process. Thus, an agreement to the authors that in the time since the 1997 study, the same premise remains valid. Even with the advances of current day technology, a strong reliance to the capability of the instructors can make or break the learning outcomes, especially within VLEs, as this chapter proposes. It appears the methodology would be relevant to repeat a study in current times.

4. Generalities in learning delivery

Facilitation principles for learning.

Several universities across the globe, and those specifically located in the United States, have referenced several studies about general facilitation principles. Included within the context are techniques for executing both classroom and virtual facilitation. With many online resources available, there is a direction in the development areas for the successful execution of facilitation. Facilitators must retain basic facilitation principles echoed throughout the literature, suggesting engagement, sharing, and remaining unbiased, to name a few of the core elements [29–33].

For most facilitators, the basic facilitation principles are instinctive, and includes how engagement, sharing, and remaining unbiased become intrinsic ability when exercised regularly. Generally, those who become facilitators have innate characteristics of being an effective communicators while demonstrating energetic positivity and the ability to maintain neutrality; thus, why many facilitators achieve effective learning outcomes.

4.1 Delivery attributes for the learning environment

Other generalities for facilitators are in the preparation to deliver a positive learning environment. Facilitators are consistent in establishing class rules and entrusting a safe learning place. While each of these two generalities is, for the most part, a standard practice, it allows for priming the foundation for learning. Facilitators must exercise content conveyance in a fluid and seamless approach when the learning environment foundation is in a “ready, set, go” mode. Where the multitasking talents of the facilitator effectively control transitions in using the learning platform, learning materials, and other necessary systems, both business and web-based. Key attributes of the facilitator are clarity and conciseness to drive probing questions and stimulate dialog from participating learners, along with the ability to shift focus and prioritize ideas or lead brainstorming concepts. These and more adaptable tactics to implement learning delivery allow for the best learning experiences for the participants attending. The facilitation attributes and skills can be improved from the novice to an expert when the skills exercised model the ideal facilitation delivery [34].

Review the additional terms relevant to this section below.

Terms for General Learning Foundations:

Principles: engagement, sharing, unbiased

Characteristics: effective communicator, energetic positivity, neutrality

Learning Environment: class rules, trust, safe

Learning Delivery: multitasking, clarity, conciseness, probe questions, stimulate dialog

Terms to 4.

Generalities in learning delivery.

5. Facilitation versus presentation

Before going any further in this chapter, it begs to clarify the difference between facilitation and presentation. Both environments can teach a topic, share concepts, and apply examples; however, a fundamental difference is the purpose of the audience.

5.1 Learning delivery

There is no argument that learning can occur from a different type of learning delivery, such as from a training, facilitation, or presentation environment, whereas instructors use the titles of trainer, facilitator, or presenter based on the delivery method see **Table 1**. However, a clear difference exists between the

Learning Delivery Types
Training: Executes instruction of teaching others specific skill development or behavior within an organization or industry. A basis for usually learning relates to job function within a process to an individual or group of the same type of learners
Facilitation: Initiates direction and instruction in a group setting to learn broader processes, fundamentals, and concepts. Usually, facilitation stems from having a level of participation regarding many role tasks or organizational development implementation to understand actions in an overall process for a collective desired outcome or engage solution insights from a group.
Presentation: An activity to share, describe, or inform a subject topic to a group of people, usually to inspire others

Table 1.
Learning delivery types.

learning delivery types. In **Figure 1** describes the components of each delivery type to a focus, deliverable, and approach with the contrasts of telling and listening percentages.

Training and facilitation are not uncommon in the learning and development world as one-in-the-same or a combination of both; mainly, the two occur for an occupation or job role. However, presentation is always a separate form of learning delivery and has not been confused or combined with a learning delivery based on task-driven or skill-oriented roles. For this chapter, the term used for instructors of learning delivery may refer to learning deliverers or learning professionals to keep all things related to a learning and development perspective.

Review the additional terms relevant to this section below.

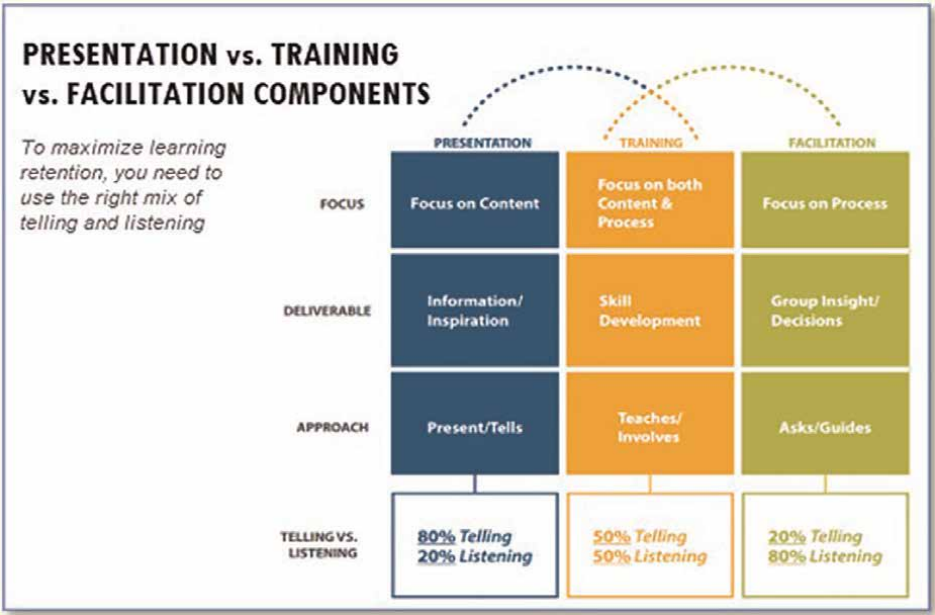


Figure 1.
Leadership strategies <https://www.leadstrat.com/infoguide-presenting-training-facilitating/>

Terms for Learning Delivery Types

Learning Delivery: Training, Facilitation, Presentation

Instructor types: Trainers, Facilitators, Presenters

Components of delivery types: Focus, Deliverable, Approach

Retention measures: Depending upon the delivery type requires the right mix of telling and listening

Terms to 5.

Facilitation versus presentation.

6. Identifying the classroom facilitation environment

To simplify, the learning environment of face-to-face instruction is no different from the K-12 learning environments (pedagogy) and most of us grew up in from our local school districts, such as subject orientated with a single learning instructor commonly referred to as the teacher. Learning principles consist of a subject organization; relationship for motivation; reward and reinforcement; applied teaching-learning techniques. Usually, a set learning curriculum conveyed knowledge to the learning population while skill, if any, was practiced along with an aptitude test at the end of the learning module. The knowledge, skill, and aptitude described are the KSAs of learning and development. This same premise remains the basis for learning delivery in the modern adult world of andragogy with adult learning principles applied—self-directed learning; life experience application; methods to real-life scenarios; internally motivated. In pedagogy or andragogy traditional learning, it would be more like saying a classroom is a classroom, with no difference from one classroom to another, except for the subject matter—the same execution with learner-to-teacher/instructor basis applied. The classroom description implies the physicality of the environment.

There is an expectation that these traditional learning concepts are business as usual in the hopes that businesses and organizations worldwide have initiated such practices. This chapter does not plan to revisit the elementary concepts of child or adult learning theories; therefore, it is with a premise that the reader understands these learning concepts in advance. More often, the content within this chapter may default to more adult learning concepts. When to reference this learning topic for child learning references is with the understanding for the reader to apply child learning principles as needed.

The pictured classroom environment is a brick-and-mortar four-walled room with tables and chairs and the instructor at the front of the room—better known as face-to-face instruction. Often with some or many forms of learning instruction tools at their hands reach, listed are a few examples:

- chalkboard, whiteboard, projector screen, projector
- desktop computer/laptop, flip chart, bulletin board
- hand-held type of learning instruments/tools
- hard copy of learning materials (books, guides, job aids, handouts)
- soft copy learning material when electronic devices are used

- writing materials, podium, and computer stations set up for the learners
- other learning objects or protective equipment

Learning occurs here as the subject and the nuances of the topic, and several learning elements are either applied or directed by the instructor or a teacher/facilitator. Learning elements such as listening take up the majority of responsiveness, including the question and answer period. Nevertheless, introducing a practical skill occupies a portion of that listening curve. Looking back at **Figure 1** from the previous section, it describes an expected percentage of telling versus listening for all three learning deliveries.

Now that a visual of the classroom environment is shared, it is hopeful that most would all agree is an accurate description of face-to-face learning. The overall premise for this chapter is how online learning is at least equivalent to classroom expectations. However, more so than one thought possible, an abundance of KSA results from an online environment.

Review the additional terms relevant to this section below.

Terms for Classroom Environment

Environment: Brick-and-mortar location, Face-to-face instruction

Instructor types: Teachers, Trainers, Facilitators

Instruction tools: Fixed boards, projector equipment, computers, hard learning materials, equipment

Maximum retention: An equal amount of telling and listening

Terms to 6.

Identifying the classroom facilitation environment.

7. Identifying the online/virtual facilitation environment (part one-descriptive)

Often the terms online and virtual is used as a one-in-the-same concept— a clear difference exists. A virtual classroom means alternative learning delivery execution; for instance, it is not a brick-and-mortar classroom, nor is it considered face-to-face instruction. The physicality of both instructors and learners is not in the exact physical location; therefore, the meeting place is on a virtual platform. Most common virtual platforms are web-based, such as WebEx, Zoom, Skype, and Microsoft Teams, to name a few of the commonly used conference meeting tools. A simple Google search will render several more and identify the best free video conferencing platforms where video cameras allow viewing all participants in a single-room setting. Video camera conferencing allows for the ability to mimic a classic learning environment.

7.1 Video conferencing, aka virtual platform

Today's technology has gone beyond to provide the perfect substitute for the traditional classroom setting. Even before the impact of the global pandemic of 2019 did not begin the idea for this version of alternative learning options, rather virtual learning concepts, and practice have catapulted nearly every industry to get on the bandwagon because of the pandemic limitations [35–38]. Heralding into this new global era of virtual classrooms has become available to early childhood learning to the

vast political arenas. Each industry entity and its organizations have touched the virtual classroom from state to state, country to country, and continent to continent. This learning delivery has quickly become the preference instead of the alternate [37–39]. Amazingly, even our Eastern neighbors, compared to Western cultures, have consummated the virtual world of learning against their traditional cultural methods [36].

7.2 What is distance learning?

Another variable to add to this new mix of learning opportunities is the term distant learning. It is the same thing as virtual learning. There is no physical learning location, and it can be executed by multiple means; virtual conferencing/training, video recordings, self-paced learning, online courses, eLearning, and webinars will be discussed further in this chapter.

7.3 What is the online reference?

The next question is what is online in this significance to learning virtually? The simple answer is the location of the connection for virtual learning, which is directly an online website link! The online aspect confers the pathway to connect to the virtual learning environment but is not the actual learning environment. An example would be an email invite to the scheduled virtual learning, and the location is an online link.

However, online learning can have a two-fold meaning as another form of virtual learning that exists and expanding. Not seeking to confuse the context, but yes, there is such an aspect of online learning where only a one-click online link displays immediate learning content. This one-step version of online learning is customarily referred as OnDemand learning within the learning and development profession. A unique and often used learning tactic connects every audience type to instant learning information.

Noticeably, post-secondary learning institutions are extending OnDemand learning subjects more often. As a format for the working adult learner who cannot commit to a regimented learning schedule taking an OnDemand course is a great choice. OnDemand learning content is available 24/7 for the learner having the capacity to learn at one's own pace.

7.4 Other online learning examples

Let us review the following list in **Table 2** below of other learning options available and the purposes for use within learning and development environments.

7.5 Where online learning is today

The previously mentioned online learning options have excelled; it all began over thirty years ago. Yes, online learning commenced first from few unaccredited learning institutions. However, it was in 1982 that Western Behavioral Sciences Institute used computer conferencing to provide a distance education program to business executives [40, 41]. Shortly after that, in 1989, the University of Phoenix became the first to offer educational programs through an initial consumer online service, CompuServ. Once the unveiling of the world wide web (www.), the University of Phoenix was the

Other online learning options	Top purposes for use
Video conferencing	Training; Facilitation; Teaching; Conference Calls; Meetings; Collaborations; Interviewing
Video Recordings—Created from multiple platforms and tools, i.e., PowerPoint, Authoring Tools, YouTube, and others	Communication and demonstration; Feeds the visual and audio learner; Elaborates on a topic; Entertaining learning; Responsive learning <ul style="list-style-type: none"> • It shortens the learning curve and allows for interjecting another voice of instruction.
OnDemand—eLearning	Broadened to consist of several learning materials and formats: <ul style="list-style-type: none"> • An electronic copy of learning materials, i.e., books, guides, job aids, schedules, notes, games, exercises, assessments • Feeds self-pace learning option • Freedom to repeat, rewind, and fast-forward • Instant learning/Instant content • Reduces waste of time/convenience
Webinars	Mostly presentations; Announcements; Surveys; Polling; Campaigning; other collaborations. To educate with little audience responsiveness/engagement.
Massive Open Online Courses (MOOCs)	Certification; Further studies; Mission-oriented; Diverse or global learning experiences; lecture courses
Adaptive eLearning	Simulation learning; improved learner engagement; custom learning topics; Requires more online responsiveness/interaction by the learner; not ideal for novice computer users
Computer Managed Learning (CML)	Computer-generated learning; automatic systemic learning plans; no human contact nor responsiveness
Cohort Online Learning	It differs from large MOOCs due to smaller groups of learners interacting and keeping accountability to complete assigned learning. Posting and continued dialog feed the learning curve—a community to collaborate on learning experiences and joint learning exercises requiring two or more participants.

Table 2.
Other online learning options.

first to offer online learning through the Internet. From there, many others followed, and within a short time, several learning institutions and businesses took to this alternative learning environment. A chronological timeline is provided in the below image (see **Figure 2**).

By 2014, an estimated 18 million students enrolled in at least one online course (see **Figure 3**). The result was accurate and continued increasing at a whopping 43.1% enrollment rate by 2016, according to Research.com (<https://www.research.com/education/online-education-statistics>) and echoed by Patra & Sahu [42]. Today the year is 2023, and the statistics have far outreached those prior expectations (see **Figure 4**).

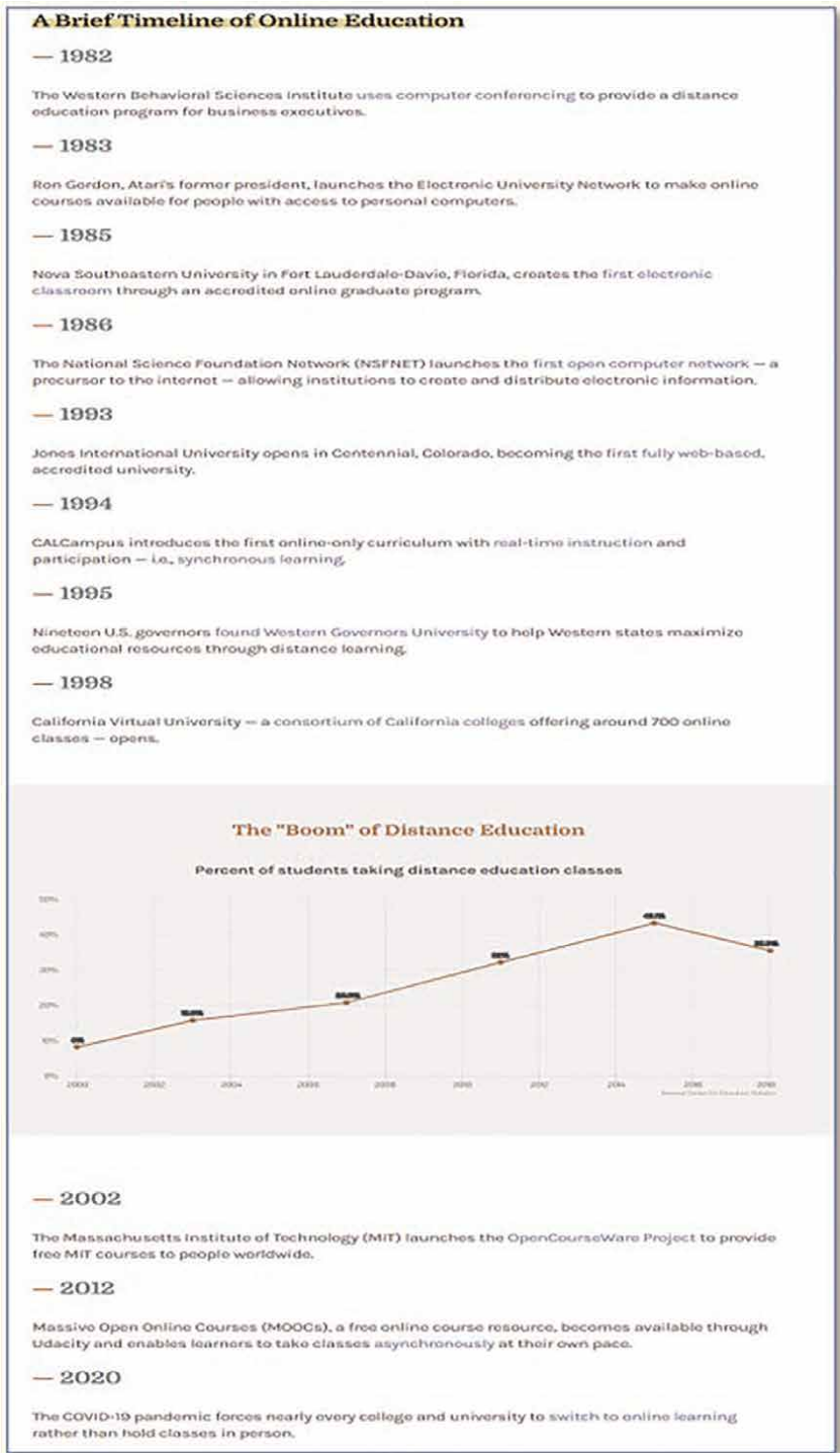


Figure 2.
Chronological timeline <https://thebestschools.org/magazine/online-education-history/>



Figure 3.
Number of online students by 2014 <https://www.onlineschools.org/visual-academy/the-history-of-online-schooling/>

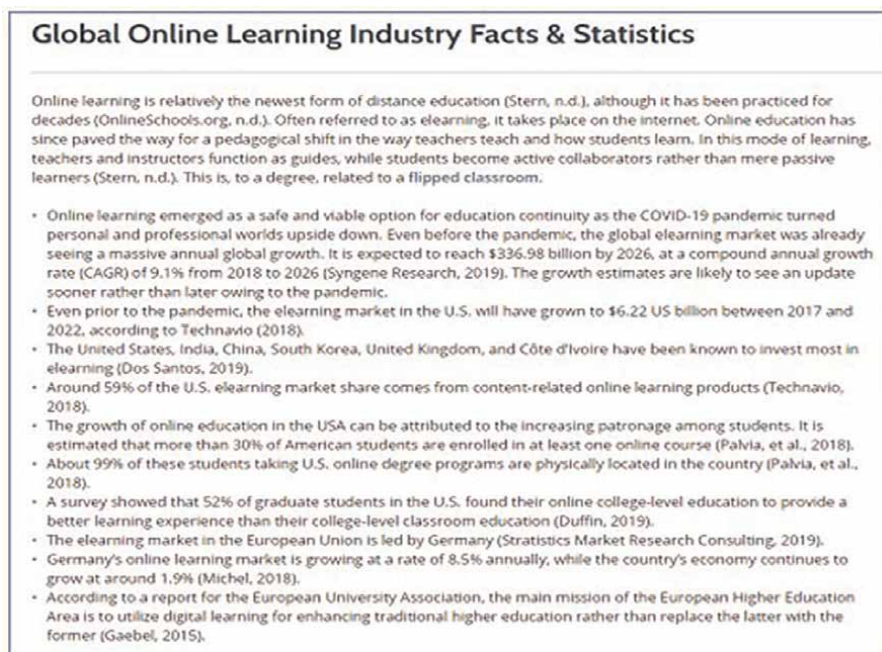


Figure 4.
2023 Global Online Industry Facts & Statistics <https://research.com/education/online-education-statistics>

The global pandemic ushered the numbers to date as displayed in **Figure 4**. Although a belief that even with the pandemic having padded the numbers, virtual online learning remains the most realistic learning option having the improvements to technology. Even if the pandemic did not occur, it would not be many more years before learning alternatives to reach the same optimum results seen today. In contrast, the technology has far exceeded practical online platforms and capability despite the pandemic altering [38].

Review the additional terms relevant to this section below.

Terms for Online Virtual Facilitation – Descriptive

Learning Environment preference: Virtual platforms

Difference between Virtual vs. Online vs. OnDemand:

- Virtual is a learning environment platform to mimic a classroom
 - Online is two-fold; 1) a link to the virtual platform or 2) a link to OnDemand learning
 - OnDemand learning is instant learning linked to self-paced learning
-

Terms to 7.

Identifying the online/virtual facilitation environment (Part One—descriptive).

8. Becoming an online virtual SME (part two: Practical application)

Within this context, the rubber meets the road in understanding the practical application of online virtual learning delivery. Those who share experiences become storytellers. These individuals talk about compelling information; meanwhile, the listener is focused and able to visualize from the brain to explore the same experience. Did the listener notice the props or hand and face gestures for emphasis? Did the listener need to watch to learn a process or to conceptualize thought? The same analogy can apply to this section. The art of storytelling is told from those whose occupation rests in delivering learning. Let us do a practice run.

8.1 Exercise: Telling a story that includes a process

- Think of a topic known very well, i.e., How to wash the car; How to sew a button; How to turn on a laptop/desktop; How to add an app to a mobile device; Drive to the movies and give directions.
- Tell the story out loud to oneself, sharing the steps and actions necessary to execute the process.
- Listen to how well the story becomes verbalized with the instruction given
- Time for critique
 - How many times to pause to think about the next step?
 - Would a demonstration make it sound better?
 - Was it challenging to recall the exact navigation or pathway without looking it up?
 - Would adding a suggestion for options, alternatives, or substitutions make the story more compelling?
 - Was the exercise completed without stopping entirely?
 - How long roughly did it take to complete entirely?
 - Rate the exercise from 1 to 5 (5 being Nailed It the first time—1 entirely stopped unable to complete)

Why request to complete an exercise without even knowing the purpose or expected outcome? Good question! Information rendering requires learning principles, and a methodology applied, regardless of how elementary or simplistic. Learning and development is not a fluke where anyone can transfer the most important information onto to other individuals, and the information become completely understood. Consider, then, the skillset to convey that information in a fluid and seamless manner that rolls off the tongue with sounds of perfection.

Hence the art of storytelling. Whether in the physical classroom or virtual learning environment, the conveyance of learning requires that each learning deliverer be a subject matter expert in a talent of learning and development to convey learning.

For learning and development professionals, like any other occupation, new tools and technology invoke expanding the ability into new methods or approaches. The above exercise is talking out loud; now, imagine having no practice doing that same exercise during the operation of a brand new virtual platform. Everyone will not likely deliver fluidly single-handedly for the first time, especially when not being familiar with the features of the virtual platform. Would there ever be an expectation that a newly hired employee could begin doing their new job proficiently from day one without prior training? Of course not. The proverbial expression “practice makes perfect” is not just an idiom but a means that practice helps you become excellent or proficient in a skill. Therefore, any deliverer within a virtual learning environment must convey better or the same as the physical classroom to deliver the benefit of virtual learning.

To become a subject matter expert in the delivery of virtual or online learning must apply practical knowledge and build the skills to continuously maintain the objective for the learning audience to feel they are receiving face-to-face instruction [43, 44]. The time has come to get acquainted and become educated in each virtual and online option for instructor-led virtual delivery. Can oneself acquire the proficiency to deliver with a fluid and seamless approach? Absolutely, but first, there is the matter of a clearly defining fluid, and seamless delivery.

8.2 Fluid and seamless learning delivery

What does it mean to deliver learning fluidly and seamlessly? The origin of seamless learning was first characterized in 1994 to support continuity across learning scenarios [45]. In a nutshell, fluid and seamless learning delivery from the instructor is how well to execute the transition from subject to subject using tools and references without skipping a beat. The learning topics flow without interruption from the moving parts of a PowerPoint slide change or animation, the view of a handout job aid, or the opening to a learning video from an outside website link. Transitioning begins in the classroom from topic to scenario to practice simulation [46]. For learning delivery in a virtual or online environment, even more fluidity (able to flow easily) is necessary, considering the multitasking using a virtual platform.

Without the fluid and seamless approach, the actions taken place by a learning deliverer can become a distraction within the conveyance of KSAs to the learners. Lack of fluid and seamless transitions directly impacts learning gaps. Learning and development professionals involved with creating learning materials need to consider the type of learning environment in the formation of those material builds. The outcome expectation of learner objectives is for the person to experience a continuous flow of knowledge transfer that bridges the multifaceted learning efforts within the individual's ability to learn seamlessly [47].

8.3 Online platforms features and benefits

Unable to describe all features from every built platform for online or virtual delivery, this section will cover the basics most often used by learning deliverers (view **Table 3** below).

Online Virtual Features and Benefits Table			
Feature	Purpose	Benefit	Connecting to or with
Microphone	To speak to participants and mute unnecessary background noise	Best when participants remain muted until it is time to speak	LP watches for learners who raise the hand icon Learners who mistakenly unmute themselves who have background noise the LP can deliberately mute/unmute participants as needed
Video camera	To display participants in a live mode view—to have the video camera off may display a profile picture or initials of the participant	Ideal to have the feeling of being in the physical classroom setting by being able to see other participants in the platform room	LP most often prefers to see the learners in a live view to see actions/reactions/responsiveness and attentiveness during learning sessions
Reactions	Use an icon or emoji to display agreement or feeling about the subject matter or seek a response.	Ideally, it allows for engagement by participants and LP to provide learner feedback.	Ideal for participants who want to raise their hand to join conversational dialog or ask a question
Screenshare	Opens a window to the computer device holding electronic versions of learning materials, other documents, or a plain whiteboard	Displaying the learning materials in full color equal to the device screen size allows for demonstration purposes from either LP or participant for two-way dialog	Sharing materials extends KSAs to each learning style, such as visual, audio, and kinesthetic learners. -Show and Tell -Demonstrate simulation -Assist participants with learning curves.
Annotation	While screensharing a document or whiteboard allows drawing or typing features to be used to point out critical topic content or for responsive learning	Either LP or participants can use the annotation toolbar during any instructional content displayed or using a blank whiteboard.	Responsive learning encourages engagement, feedback, and activities to drive individual and group learning.
Chat	Dialog engagement from all participants and LP in open or private conversations	Group announcements or information to read or send links or private 1-to-1 dialog with anyone within the virtual platform	LPs routinely use the chat for multiple purposes simultaneously to verbal connections. Participants enjoy the camaraderie among other learners. Feedback is a key, and saving chats in a file on a device LP constantly monitors the chat panel
Participant Panel	List each audience member by name or phone, and display their microphone and camera setting, including reactions when initiated.	LPs manage the learning session from the participant panel. Allows to see each audience member's engagement level visually	LP constantly monitors participant panel
Breakout Rooms	Arrange smaller group settings with all of the same main room session features, i.e., microphone, camera, participant panel, chat,	Perfect for activities, simulations, practice sessions, and private sessions	At least two or more learners can occupy a breakout room. Ideal for short times away from the main learning session. LP can join any

Online Virtual Features and Benefits Table			
Feature	Purpose	Benefit	Connecting to or with
	screenshare, annotations, and reactions		breakout room without closing the main learning session. LP sets time limits, assigns individuals manually, or allows the platform to auto-assign. Usually, up to six separate breakout rooms can occur at once
Whiteboard	Mimics a dry-erase board. The whiteboard allows for any text to be added and for annotation.	Perfect for activities, engagement, and participation, it feeds responsive learning.	Create a template in advance or use it at will.
Survey	Usually, multiple choice, but also some offer open ended question building	Icebreaker activity, pop quiz knowledge checks a question builder tool	Another form of learning engagement and responsive learning tool
Polling	Usually, a yes or no or true or false built questionnaire	Icebreaker activity, pop quiz knowledge checks a question builder tool	Rating usage primarily to acquire a percentage of feedback

Table 3.
Online virtual features and benefits table. Legend: LP = Learning Professional.

An essential factor from the table of descriptions is the learning deliverer’s ability to multitask across two or more of these features at a time. It is likely for the learning professional to manage several features at once or within a long time of the session. Using only two of the features at a time is of lesser effort in comparison with using five of the features at a time. The amount of skill is amazing to manage at different fluidity levels proficiently. A learning professional can masterfully execute fluidity and seamless transitioning using several features simultaneously. A glimpse provided in a scenario diagram from **Figure 5** displays how a learning deliverer manipulates several features simultaneously for a virtual learning session. For learning professionals to master these talents in a fluid and seamless manner have become experts in their trade.

Taking another look at the scenario image in **Figure 5** provides a high-level view into a virtual online platform multi-functional components between the facilitator and learning audience and/or audience members among themselves. The image displays to the several connections made during a learning session. Notice how many separate commonly used features are initiated at once; where the learning professional is to manage while delivering subject matter. It is reasonable for learning delivery to ensure that the learning professional can address everyone’s question simultaneously, sequentially, or immediately but in a timely, proper, and transitional fashion. Notice that there is a lot going on within the scenario image. It is essential to indicate with reasonable certainty that housekeeping rules are addressed at the beginning of the learning session to manage learning expectations, especially due to the potential abundance of communication avenues.

A slight comparison within a physical classroom environment remains the same when the learning deliverer manages their learning environment. However, within

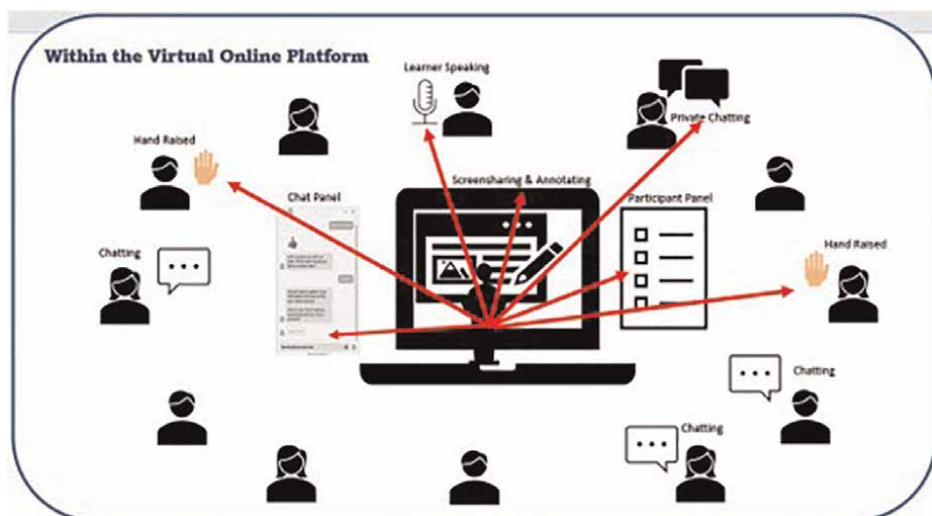


Figure 5.
 Virtual online platform multitasking learning delivery (hypothetical scenario).

the online virtual class environment, many essential tasks require extensive thought, planning, and organization, while using a single device keyboard and mouse operation. At the same time, speaking during platform operation is a proficient skill applied when in these online settings. Even if the learning deliverer addresses one question at a time, they have to be mindful of those who first initiated questions or chatted a comment and any subsequent inquiries. The learning professional must watch the actual learning deck PowerPoint slide show and recognize when someone raises their hand. In the traditional classroom, the learning professional often faces the class with the learning content to their back or side, whereas the learning professional needs to use at least two monitors for the online environment—one for screensharing and the other for managing the room. The head and eyes constantly move in the online environment while articulating the content, just like in a physical classroom but within a limited space. The online learning environment permits the interjection of questions and comments during lesson content and watching intently to avoid displaying a lack of interest in their learners' needs or a mishap of missing anyone.

8.4 Learning professionals' ratings in online environments

Most often, especially after a learning takes place, a short rating survey is given to the participants to score the learning professional's conveyance of subject matter and ability to manage the learning environment. The survey is a Likert scale rating, true or false, and sometimes open-ended responses. More recent years, since the global pandemic, more and more learning is taking place online or virtually. With that said, it warrants more studies to identify whether these online learning environments have what it takes to be effective in delivery and learning retention. A mixed bag of reviews stems from what the research informs and does not inform about online learning. Many studies focus on whether students retain knowledge differently after online learning than in physical classrooms. Many studies report that students who typically struggle will struggle regardless of the environment.

Interestingly, the basis of these findings relies upon whether the overall learning execution is engaging or if the learner has distractions interfering with their online environment. Some opinions from learning blogs weigh in on the latter: Surrounding distractions impact overall learning outcomes [48, 49]. Other results show that if the learning professional is not proficient, online users will likely fail the learning objective compared to their physical classrooms [50, 51]. Thus, the learning professional must become proficient users of the systems before they begin to deliver online or virtually. It is more challenging than it looks. However, again, proof in the pudding (another idiom) that those who make it look easy are the masters. The consistent measure of online virtual learning is that it has improved and increased in the past four years more than any other time since its conception for highly effective learning. More recent studies are concurring with higher than the average results. Therefore, an ongoing quest from learning institutions to business giants will continue to foster online and virtual learning opportunities.

8.5 A quick look at predictions and trends for online virtual learning

A brief look at the 2023 predictions from an online research firm [52] is displayed below. Ten online trends are up for grabs with a broad reach within education, business, government, and other worldwide organizations.

10 Online education trends for 2023 impacts/expectations

1. Higher Education institutions expand Online Learning Programs [53, 54]

- A steady climb from the current 63% enrollment
- Leveraging more learning solutions to include responsive web design
- Added was pedagogy expansions to 100% online as a complementary method, aka virtual K-12 schools

2. MOOCs Partner with Educational Institutions for focus on Micro-credentials [55, 56]

- A current-day measure of 644% increased from 2019 globally to come is adding more value with micro-credentials.

3. Learners Empowered through Mobile Learning and Microlearning [57, 58]

- Over 60% of learners prefer a self-serve learning approach, whereas upward of 56% from this measure use on-demand options
- The rise made to mobile from desktop/laptop usage
- Including short and small course content to meet microlearning objectives

4. AI provides Personalized Learning Pathways [59]

- Currently seen in manufacturing and healthcare industries, the rise will be in education, personalizing learning to prevent dropout rates with an estimated reach of \$6 billion by 2024

5. Learning Analytics help enhance Training outcomes [60]

- The education industry lags behind most other industries in adopting big data technology for learning analytics

6. Video-based learning expands to maximize the impact of Mobile Learning [61]

- As the most versatile learning medium Gen Z learners have invested the most in this option upward of 82% as preferred
- Goals are to attract a rise in Millennials having an interest currently at 67%

7. 5G stimulates Immersive Learning Experiences [62]

- South Korea, China, and the United States lead in 5G development
- Expect infrastructure to be placed more globally for online impact on education

8. OER (Open Education Resource) continues to gain widespread adoption [63]

- Due to rising college expenses, this digital alternative is bringing increased acceptance across both faculty and students

9. Gamification and serious games gain momentum in The Academe [64]

- With 97% of US and Germany youth playing video games of 20+ each week, this premise is being considered in traditional classroom settings to promote better face-to-face instruction alternatives

10. Technology-Powered Tools become the future of assessment [65]

- An expectation for integration of formative and summative assessments tools into pedagogy learning environments using more advanced technology

A strong statement is that socioeconomic factors have been pushing the demand toward a digital electronic climate for learning as a means for modern learning lifestyles. Higher learner pursuits to broaden mainstream job opportunities drive a need for better and improved on-demand learning types for life-work balance. Companies and education institutions are waking up to the need. However, the strategic partnerships between technology and government, and education become pivotal when ushering evolutions to online education [66].

Review the additional terms relevant to this section below.

Terms Online Virtual SME—Practical Application

Learning Delivery Style—fluid and seamless, smooth and flowing transitions

Online Platform Skillset:

- Learning professionals to become SMEs to manage a virtual platform
 - Understand the platform features and benefits to use in a purposeful manner
 - Practice makes perfect concept to becoming a master virtual learning deliverer and receiving high rating score
-

Terms to 8.

Becoming an Online Virtual SME (Part Two- Practical Application).

9. Chapter summary

A true attribute of learning professionals is the conveyance of knowledge, skills, and aptitude (KSAs). The KSAs lead learners through a process of learned behaviors and practices to gain experience with ongoing continued improvements. This chapter aimed to share and display that anything learned from a classroom environment can be delivered in a virtual environment, noting that this learning opportunity is for a better outcome and, thus, an excellent learning experience.

“There is nothing better than an excellent learning experience,” said no one, so as a take-away, this author professes to acknowledge the ownership of this statement.


The chapter outlines descriptive and practical applications in online virtual learning environments and those aspects of learning professional roles, that is, learning deliverers such as trainers, facilitators, and presenters. The material includes aspects relating to the engagement population of learners, students, and audience members. Within the content, the overall basis is that although some are new to the online learning and development arena, it is essential to recognize that online virtual options have been and are becoming vast and prominent. As technology grows, our learning resources need to grow within it.

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Perspective Chapter: Development of Mass Online Courses That Include Practical Work Based on the Home Laboratory

Peter A. Ukhov

Abstract

The chapter presents an approach to designing an educational program implemented in MOOC format. By the example of this approach, an educational program including the creation of a student's home laboratory in the areas of electronics, programming, and design is developed. It is demonstrated that the cost of creating a home laboratory is such that many students from developed countries have the opportunity to build their own home learning laboratory to perform practical work on the construction of complete technical devices. Safety issues in using the home lab and forming practical assignments are addressed. Assumptions are made about the development of such direction in the creation of educational programs.

Keywords: MOOC, home laboratory, 3D printing, engineering education, educational programs

1. Introduction

In 2020, the Moscow Aviation Institute was faced with the need to organize classes remotely due to the COVID pandemic. While for IT and humanities training areas the transition to online did not have a significant impact on the quality of training, for technical areas it became a serious challenge. A large amount of practical work of students was replaced by virtual laboratory work, in addition, some forms of industrial practice had to be canceled completely or significantly reduced. Under these conditions, the development of new technologies of practical training and effective methods has become a very urgent task.

The subject of the study was the technology of organizing practical work of students at home, as access to special equipment was significantly limited, and virtual laboratory work does not give a complete immersion in the subject area of practice-oriented courses. At the same time, it should be noted that there are a large number of works on the creation of technologies for remote control of research equipment [1–3], as well as on virtual twins of products, processes, and technologies [4–6]. In spite of

this, all the mentioned technologies do not allow students to get practical skills by working with their own hands taking into account the peculiarities of real equipment operation, conducting experiments, etc. Besides, there are more than 20,000 students at our university, which makes it impossible to organize individual formats of the educational process for economic reasons. On this basis, it was necessary to develop a current educational program for mass training, taking into account the practical work.

Currently, the mass format of learning using Massive Open Online Courses (MOOCs) has shown its effectiveness for training in various fields and areas of knowledge [7]. However, this format also has its drawbacks. For example, a small percentage of successfully completed courses and often the inability to organize practical activities using engineering equipment [8]. Currently, microelectronics and 3D printing technologies are actively developing, which makes many products available for home use and allow creation of very professional laboratories at home [9].

This chapter is devoted to the technologies of creating a home laboratory, which can be used in the process of training in technical and, first of all, engineering disciplines. When designing courses forming a home laboratory it is important to consider several aspects: the methodology of forming a laboratory by going through the appropriate stages of the educational process, the issues of possible technologies that are already available for mass application at home, as well as software and safety issues when organizing these activities. In addition, the MOOC format imposes certain requirements on the evaluation procedures for final projects or intermediate learning outcomes, which must be taken into account when developing content and putting it into popular systems such as OpenEdx or other MOOC software.

The considered term of online training programs refers to distance learning training programs, that is, mediated by telecommunication technologies of the Internet for organizing a two-way communication channel between students, teachers (mentors, experts), and other participants in the educational process. The terminology of distance learning [10, 11] has two main barriers: distance and time. In our case, an attempt was made to overcome the remoteness of students from the laboratories of an educational institution by organizing a specially structured educational program.

In the process of preparing materials for this chapter, a study of the 3D printing market was conducted, as well as the software and online services. To collect data on the cost of software licenses, from official portals of manufacturers and official requests for product prices to software vendors as of the end of 2022 were used. Data on the cost of 3D printers and other products were collected by analyzing the cost of standard representatives according to predefined criteria (for example, the volume of the printing area) from the most popular Internet suppliers by analyzing prices for different regions of the world and determining the average cost.

The choice of courses for the program and its structure was determined by an expert survey of representatives in aerospace enterprises and university teachers working on training schoolchildren at Moscow Aviation Institute (sample of 50 people), based on an analysis of publications on STEM training and working materials on CDIO initiative [12].

The analysis of the program's effectiveness was based on the analysis of the student's enrolment in the leading universities of Moscow. It is based on the results of the individual courses in the online format during the year 2020.

2. Practical activities in engineering courses

Currently, MOOCs are often used as part of the educational process in STEM (Science, Technology, Engineering, Mathematics) disciplines [13], taking place in a classical format. Moreover, if for IT technologies and mathematical disciplines this direction is quite well developed, then in terms of technology and engineering the number of courses on the most popular MOOC resources is not so many.

There are quite interesting solutions to organize practical activities online; however, they are mostly simplified models of real equipment. For example, there is a modeling environment Tinkercad [14] for 3D modeling and simulation of Arduino-based controllers [15]. In the mentioned environment you can assemble an electronic circuit and program an Arduino-based controller to perform certain operations with real equipment. However, with all these advantages, there are still quite a few issues that are important in real life, but you cannot simulate: chatter in the contacts, connections of conductors, variations in the parameters of real components, the scatter of servo parameters, and much more. In addition, in this environment, it is impossible to perform the assembly of the 3D model and the available electronics to perform a comprehensive project.

One of the most effective approaches to organizing hands-on activities in engineering education today is Conceiving–Designing–Implementing–Operating (CDIO) [16]. The CDIO initiative is an innovative educational framework for producing the next generation of engineers. The framework provides students with an education stressing engineering fundamentals set in the context of CDIO real-world systems and products. Throughout the world, CDIO initiative collaborators have adopted CDIO as the framework of their curricular planning and outcome-based assessment.

Of course, it is difficult to produce complex systems at home, so you can focus on fairly simple projects from available components and using easy-to-use technology. Nevertheless, this framework is optimal for use in shaping the structure of courses to form a home learning space for practice. Hereinafter we will call this space a home laboratory. From a psychological point of view, it is important that each student has his/her individual space, adjusted to his/her characteristics. This is why it is important to leave a place for creativity and imagination when carrying out practical activities. At the same time, we should not forget the basic steps that allow us to maintain the general direction of the educational process.

Returning to the form of implementation in the form of MOOCs it is necessary to decide on the model to be used in the construction of the educational program. Massive Open Online Courses have two models (Conole 2013; Daniel 2012); cMOOCs and xMOOCs. cMOOCs place heavy emphasis on knowledge production in network learning environments, while xMOOCs concentrate on repetition and presentation. Coursera, edX, and Udemy are the most popular xMOOCs platforms that offer courses on different topics. xMOOCs are used in a wide range of areas, especially computer engineering, philosophy, history, and nursing [17].

Obviously, in order to implement CDIO approaches in MOOC format it is more efficient to use a model in which new knowledge will be produced by students' projects, but this will lead to a high workload of mentors and online course supervisors, which is often unacceptable for economic reasons. Based on this, the organization needs to find a reasonable balance between independent practice and minimize consulting activities by maximizing the use of knowledge bases and already existing communities of professionals in the desired fields of practice.

3. Technologies for creating a home lab

The cheapest, safest, and most applicable technology for creating new products at home is 3D printing technology. In addition, this technology has a minimum of limitations when creating products at home, compared, for example, with the technology of milling (wood, metal) or laser cutting (phoner). These technologies require noise protection and ventilation, which is practically impossible when forming a home laboratory.

Of the 3D-printing technologies, the safest and easiest to use in terms of technological preparation of production is FDM technology. An FDM 3D printer works by depositing melted filament material over a build platform layer by layer until you have a completed part. FDM uses digital design files that are uploaded to the machine itself and translates them into physical dimensions. Materials for FDM include polymers such as ABS, PLA, PETG, and PEI, which the machine feeds as threads through a heated nozzle [18].

To create a home assembly laboratory, we prefer low-cost or DIY printers [19]. Each of the projects has its advantages and disadvantages, but the price of printers with a printable area of the order of $200 \times 200 \times 200$ is steadily approaching \$200 and, apparently, will soon reach the price of \$100 for a DIY kit. Prices for some kits and ready-made 3D printers as of the end of 2022 are shown in **Table 1**.

Moreover, for higher printing accuracy in projects, we recommend using printers with a direct extruder drive: this increases the accuracy of the printer along the line thickness on the layer, which sometimes may be essential for small products and fasteners.

Despite the fact that the cost of DIY kits is slightly less than a ready-made solution, in the end, the assembled printer will cost more. At the same time, the skills of designing a real object are mastered. The most optimal course for inclusion in the curriculum is a course on self-assembly of DIY 3D printer kit with consulting support, but this is possible only with a large number of similar kits offered as a part of the curriculum at a price below retail. In practice, these courses may appear in the near future, since 3D printing technologies are actively used in STEM teaching at school [20].

In addition to the printer, consumables will be required, so the price of Polylactic acid (PLA) plastic is about \$40 per 1 kg, plus \$20 for glue. This volume of consumables is enough for the practical development of FDM 3D printing technology.

Currently, there are a large number of slicing programs for preparing models for printing, however, the recognized leader in the FDM printing segment is Cura from Ultimaker (**Figure 1**), and so the main focus should be on exploring the possibilities of this program.

The specified program also contains a large number of profiles for printing on various 3D printers, which makes it easy to get into the specified technology. It is

3D printer model	Print field	Extruder drive	Price*, \$
Easythreed K1 Desktop Mini	100x100x100	direct	120
EasyThreed Nano 3d	90x110x110	direct	170
FUNASTIQUE Evo v1.1	125x130x160	bowden	230
QIDI TECH X-one2 3D Printer	140x140x140	direct	300
Anet A8	220x220x240	direct	250

**Prices may vary depending on suppliers and regions, the average value is given.*

Table 1.
Prices for some cheap DIY kits and 3D printers.

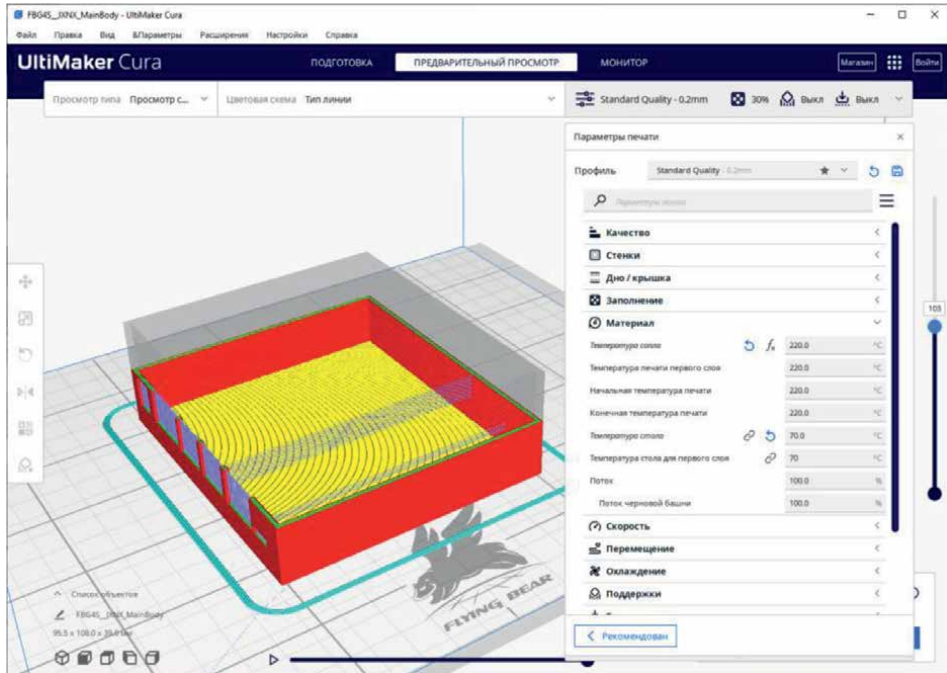


Figure 1.
 One of the parts (Case for electronic) in Cura.

possible to include other training solutions in the future, but the specified software as of 2022 is the most complete in terms of represented 3D printers and contains all the necessary features for rapid prototyping.

All indications are that the cost of this technology will continue to decline, and the 3D printing market will grow significantly over the next few years. The extrusion segment dominated the 3D printing construction market and accounted for more than 62% share of the global revenue in 2021 [21]. The personal 3D Printers Market is projected to reach \$5.44 billion by 2030 [22].

In addition to the availability of 3D printing technologies, the cost of equipment and consumables for prototyping and manufacturing electronic devices has decreased until 2022. First and foremost, we are talking about cheap electronic components and microcontrollers with a ready development ecosystem and often free software for developing application solutions.

Nowadays, almost all devices contain electronic components and control systems, so familiarity with the programming of microcontrollers and the development of devices based on them is one of the important elements of the education.

The most popular microcontrollers and microcomputers were chosen as equipment for the course implementation. Equipment and microcontrollers for building projects are the following:

- Arduino platform allows, depending on the project, using the following devices: Nano - \$7, Uno - \$10, Mega - \$25;
- Microcomputers Raspberry Pi - Zero W - \$50, Pi3 - \$95, Pi4 - \$140;
- Microcomputers with computers for neural networks: Nvidia Jetson Nano - \$ 210.

In addition, the price of tools and instruments that may be needed to create a home laboratory—screwdrivers, drill, multimeter, caliper, various testers electronic components, programmers, and even oscilloscopes and other equipment.

All of these aspects point to the possibility of forming a home laboratory at low basic costs. And it is possible to distribute this process in time and combine it with MOOC-based learning.

4. Course structure and composition of the home laboratory for prototyping simple electronic devices

To form a home lab through the learning process, we suggest the following approach. Each MOOC included in the program contains a project module. The formation of each course in it provides for the implementation of one or more practical projects, taking into account the time to purchase the appropriate equipment and components. The structure of the project is shown in **Figure 2**.

The algorithm of the project is as follows. Students receive a project topic and a basic set of possible solutions through the distance learning system. Projects in the program go from simple to complex. Depending on the level of the project, students are given more and more freedom of creativity. For example, at the initial stage, simple projects are carried out—from the field of electronics: the assembly of a simple DIY kit. And for the final stage, they design their own device to perform a given target function, for example: controlling indoor air quality.

After the project topic is approved, a project passport and all working materials are generated using various services. For example, Miro service can be used for architecture visualization, version control system, and Github service can be used for code placement and project description, and other software products depending on the level of training.

The next step is the demonstration and discussion of the project concept with the mentor and the discussion of the project concept. Peer review tools can also be used for evaluation.

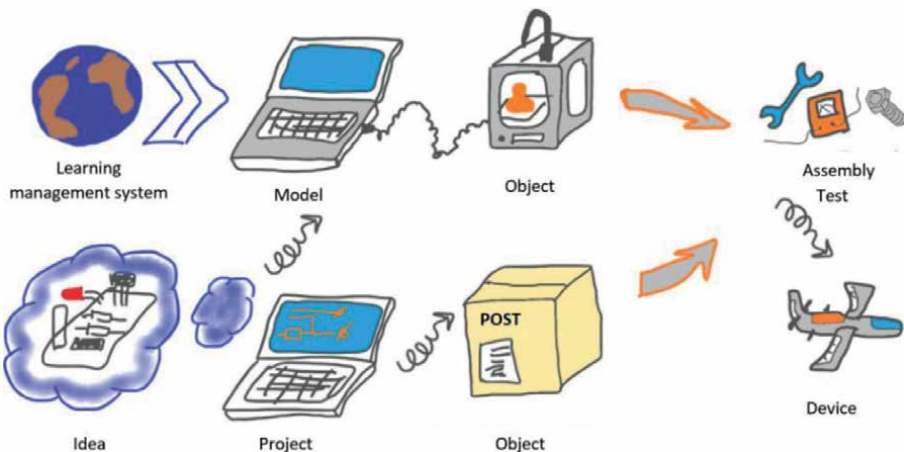


Figure 2.
Assembly diagram of the student's project.

After defending the concept and design passport, the process of assembling the device begins, which culminates in the finished product. It is important to realize that not all students will make it to the device assembly stage. Therefore, a video presentation of either the project or the experience gained during its implementation is used to evaluate the project activities. In this case the result of the project can be negative, but the experience is valuable.

Let us consider this approach in more detail with the example of a program for teaching schoolchildren. The main goal of this 2-year program is to prepare schoolchildren for studying in the design areas of engineering university.

The proposed program is aimed at developing critical thinking skills and designing technical objects. Proceeding from this, the main elements of the program are familiarity with modern approaches to design, programming, and development of electronic devices and technologies for their production. For training at the initial stage, we need a personal computer connected to the Internet. The structure of the program consists of the following online courses, each of which is supported by the student's practical work in the home laboratory, which is formed in the learning process:

1. Schematics and electronics (Circuitry and assembly of simple devices on a breadboard)—3 months.
2. Programming of microcontrollers—2 months.
3. 3D design software—3 months.
4. FDM technology for 3D printing at home—3 months.
5. Mechanical systems—3 months
6. Cost management (Designing objects with purchased components, taking into account the logistics of supplies and the cost of the project) —2 months.
7. Build compound projects—6 months.

4.1 Schematics and electronics

For courses in electronics, this is the first stage for the formation of a home laboratory through the study of work with breadboards, electronic components, and a minimum set of the necessary equipment in the form of a multimeter (tester to test electronic circuits and simple components).

This course introduces students to the practical application of simple components—buttons, LEDs, simple logic components of electronic circuits, resistors, diodes, and capacitors. In this course, students learn how to build circuits on a real breadboard.

At the end of the course, students acquire screwdrivers, wire cutters, a breadboard, a set of connectors, and a small set of electronic components for use in future projects.

In addition, students become familiar with typical phenomena such as contact bouncing, possible open circuits, and gain an understanding of some circuit engineering principles. It should be noted that some resources on programming



Figure 3.
The first set of equipment.

Arduino-based devices are flawed in terms of circuitry. It is at the initial stage that it is important to give a proper understanding of the circuitry solutions. For example, the correct connection of buttons and simple sensors, etc.

The cost of purchasing equipment at this stage ranges on average from \$40 to \$80, and this cost can be reduced to \$20 when purchasing in bulk and forming sets for trainees by course. Examples of possible equipment at this stage are shown in **Figure 3**.

Also, note that all projects should be based on a low-voltage power supply, ideally 5 V. This aspect is important for project safety reasons; besides, low-voltage components usually do not require special certification for use in the educational process.

4.2 Programming of microcontrollers

This module contains two optional courses: programming of Arduino microcontrollers in C is considered as a basic course, and Raspberry programming as a course of choice for a more advanced audience, taking into account the installation of the necessary libraries and familiarity with the operating systems of the Linux family.

At the same time, the study of the operation of microcontrollers can take place on real equipment (purchased based on the results of the previous module, including with a set of sensors), and in a virtual environment [23] to reduce the cost of training. As a virtual environment, we used TinkerCad system (**Figure 4**) from Autodesk, which is distributed free of charge and only requires an Internet connection and account in the Autodesk ecosystem.

The course structure is the following:

1. Introduction to microcontrollers and their architecture;
2. Programming the microcontroller for simple tasks;
3. Working with general-purpose input/output (GPIO) using the example of simple and programmable sensors (for example, color sensor);
4. Introduction to microcomputers.

The result of training in this module is a virtual prototype and a program of a simple typical electronic device. In this case, the circuits can be checked in TinkerCad and on emulators of the specified devices.

After debugging circuits on the virtual simulator, students receive the appropriate controller in the form of the following set of equipment for debugging projects. Based

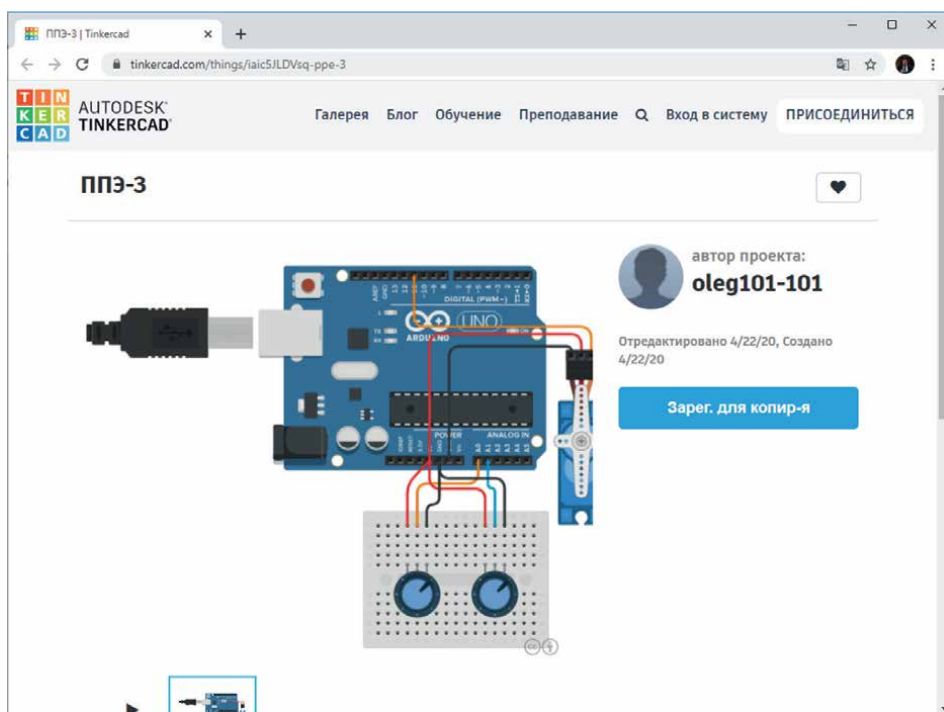


Figure 4.
Example of assembling and testing a circuit in Tinkercad.

on the results of circuit assembly on the breadboard using the controller, short videos are filmed, demonstrating the operation of a particular circuit with the logic of operation. These videos are evaluated by Peer Review in the MOOC learning system.

The main feature of projects at this stage is the expansion of the creative component, which allows students to create models of devices and implement students' own logic in completing the final assignment of the course.

As part of this course, students additionally receive a set of mechanisms to actuate mechanical systems—motors, servo mechanisms. This is important for the next stages of training, where an understanding of the principles of servomechanisms and their use in the construction of mechanical devices is required.

4.3 3D design software

The next course in the program is aimed at developing spatial thinking skills and acquaintance with various ways of representing models of real objects in the form of a 3D prototype. An important point in teaching a variety of software from the didactic point of view is not to lose the interest of students, because very often, while studying a tool (in this case, specific computer-aided design (CAD) packages), the purpose for which it is used in the future is lost: designing real objects.

The course structure implies:

1. Choosing an idea for designing an object: for this, students are introduced to existing objects that can be found using search engines, for example, yeggi.com, thingiverse.com, make-3d.ru, and other similar resources;

2. Familiarity with CAD programs: preferably at least two different CAD programs to show the differences and common features of these packages;
3. Design of the selected part: taking into account the capabilities of various CAD programs and the subsequent placement of this model on the resources for 3D models (selection of the most popular project as an element of the competition);
4. Designing an assembly of several parts: to get acquainted with the basics of mechanics, and assemblies can be stationary (for example, stationary parts of an object made in different colors).

We used various software for training. So, from the proprietary CAD packages, SolidWorks from Dassault Systemes, Fusion 360 CAD/computer-aided manufacturing (CAM) from Autodesk, and NX CAD from Siemens should be distinguished. The specified software requires the purchase of educational licenses; however, these packages are used for professional product development and acquaintance with them is the most interesting for further training at the university. As of May 1, 2021, the approximate license prices for this software are:

- DS SolidWorks – \$120 / year;
- Autodesk Fusion 360 CAD / CAM - one year for free for educational use, then \$495 / year;
- Siemens NX CAD – 1400 \$ / year (can vary widely).

Based on the pricing policy, we chose SolidWorks package, because the duration of the training program is more than 2 years, and the possibilities and approaches in modeling for all three solutions are relatively similar. In any case, the training program must include at least one proprietary package.

At the same time, free software is being trained. We have chosen two packages for training FreeCAD and OpenSCAD. The first allows getting acquainted with the installation of additional modules and workbenches (for example, for the design of gears), and the second with parametric geometry, which is important for the design of products with complex shapes.

All of the above three CAD programs should be selected depending on the projects and a small task is given for each of them. As a rule, programming skills are required to use OpenSCAD, but due to the fact that many schools are already learning Python as the main programming language, this does not cause problems for trained students.

An important point in organizing training is the need to borrow ready-made 3D models of objects to reduce the time for developing projects. For this purpose, it is necessary to use portals on which models of frequently used devices are assembled (electronics, typical housing parts, fasteners, drives, etc.). Examples of a few of them are the following: grabcad.com, 3dcontentcentral.com (Dassault systems), b2b.partcommunity.com, traceparts.com, etc.

During training, attention should be paid to interchangeability issues, since at the last stage of the project (assembly and testing), difficulties may arise caused by the use of 3D models of the same objects from different suppliers, but with minor changes. It is important when assembling several parts to use at least one standard (purchased) component and pay special attention to the issues of matching the

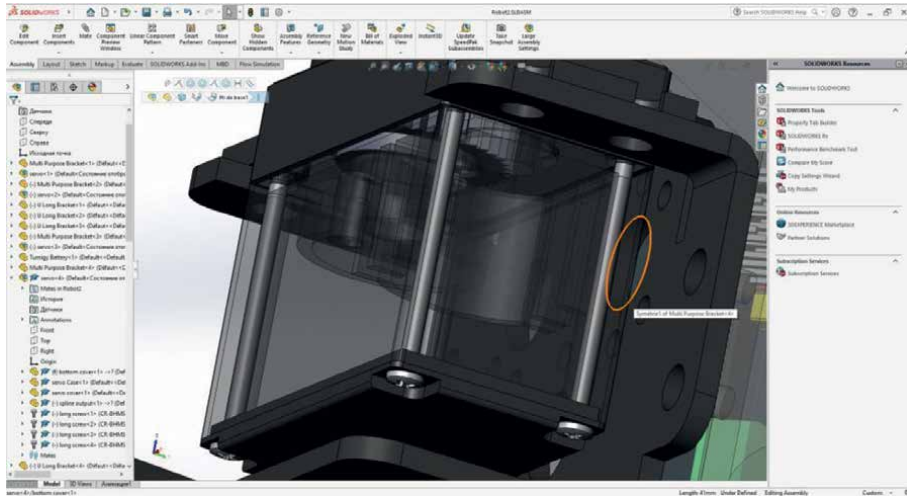


Figure 5.
Mounting holes on the bracket for servo MG966R.

model in the library of standard products and the model from a specific supplier (for example, specific manufacturer on AliExpress).

For example, the popular SG90 servo used in many simple projects can vary significantly from manufacturer to manufacturer, so it is important to study the change management process before ordering parts from suppliers or when sourcing components and evaluating project logistics. At the same time, students acquire the skills of making engineering decisions close to the real process of manufacturing products.

As an example, **Figure 5** shows a subtle problem: one of the projects used a servomotor, but the location of the mounting holes in the model was offset from the servomotor received from the supplier by 4 mm, which did not allow placing servomotors and led to the need to redesign body part. Similar examples can be used to acquaint students with real problems of interchangeability, when the supplied object may partially not correspond to the drawing or 3D model found in standard libraries.

To reduce the complexity of checking simulation tasks, we use generators of standard parts and check based on checking the position of the center of mass and moments of inertia of products, which will significantly reduce the complexity of checking the modeling tasks.

This course can be combined in time with a course on how to assemble your own 3D printer from a DIY Kit, as it takes a lot of time and involves logistical difficulties in delivering large components, even in disassembled form. The next course is just about getting a 3D printer and learning the basics of FDM technology.

4.4 FDM technology for 3D printing at home

After mastering the simulation programs, the next step is to get acquainted with the peculiarities of production technologies for specific products. For these purposes, the currently cheapest FDM printing technology has been selected. At the same time, there are a large number of DIY 3D printers that are not difficult to assemble from a kit. For deeper preparation, it is better to use such a kit, but there are faster solutions (pre-assembled compact printers). In this case, the decision must be made by the student.

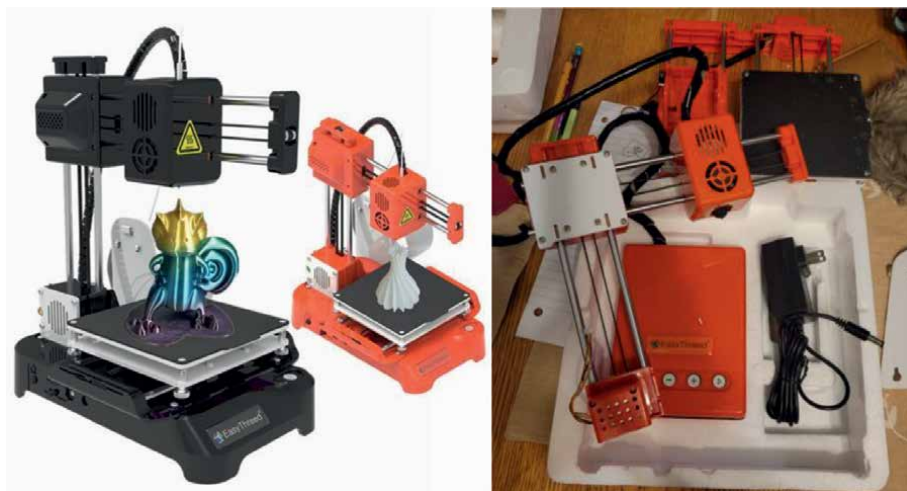


Figure 6.
3D-printer DIY Kit example (Easy Tread).

As an example, **Figure 6** shows a DIY Kit 3D printer with a 100x100x100mm print field for \$100. In principle, this is enough to do simple projects and print cases for Arduino (69x53mm) and Raspberry Pi (85x56mm) controllers.

Nevertheless, we recommend to use models with bigger print areas. In this case, everything is determined by the budget of the project. The optimal printing area of 200x200x200mm allows students to implement more interesting technical projects.

Based on the above, the course agenda will consist of the following sections:

1. Acquaintance with FDM printing technology—what are the main technological parameters that affect the quality, what are possible defects;
2. Device of 3D printers: various kinematic schemes of printers and their capabilities;
3. Slicer programs: familiarity with at least two programs, for example, Repetier-Host (overview 4 slicers) and Cura (emphasis on working in this program);
4. Questions of model strength and refinement of its geometry for 3D printing;
5. Independent practice of printing three models (differ in settings) and assembling them into a product.

During training, it is important to focus on issues related to setting up the printer, for example, setting high speeds of movement and checking the compliance of the production time of the product in the slicer and in reality (to explain the discrepancies by the limitations of the printer on maximum accelerations, etc.). In the case of using printers based on Arduino, a small additional material is possible: an excursion into the settings of the printer program for the more advanced part of the students.

In this module, it is also possible to automatically check tasks, for example, ready-made G-code programs in terms of temperatures and dimensions of the final product when using the same specifications.

This course supplements the home laboratory with a means of production—a 3D printer. At the same time in the course, it is important to consider safety issues when working with the equipment. Some parts of the 3D printer get very hot—nozzle and heating bed. Therefore, it is especially important to explain safety procedures to the students when changing the filament, cleaning the nozzle, and during the printing process. It is also important not to leave the printer unattended during the printing process, as it is not uncommon for cheap DIY Kit to have various kinds of emergencies that are not accounted for in the most popular firmware projects. For example: filament breakage (if the Kit does not contain a filament sensor), nozzle clogging, workpiece detachment from the bed, and other critical situations.

4.5 Mechanical systems

The next module of the program is designed to acquaint students with the design of mechanical objects without electronic components and their assembly. Moreover, the emphasis is placed precisely on the assembly of end products with mechanically moving parts.

Typical practical tasks include designing products with dimensions (maximum for one dimension) of 95 mm, which eliminates shrinkage and allows for easy production on a home 3D printer made of PLA plastic. It is possible to use ABS plastic, but then a large number of additional technological issues arise (primarily due to the shrinkage of materials). The course content is the following:

1. Flat mechanisms: assembly of a simple lever mechanism (lambda mechanism, mechanisms of walking machines, etc.);
2. Cam mechanisms: for example, designing and assembling a laser show on a cam mechanism [24] (**Figure 7**) or similar projects;

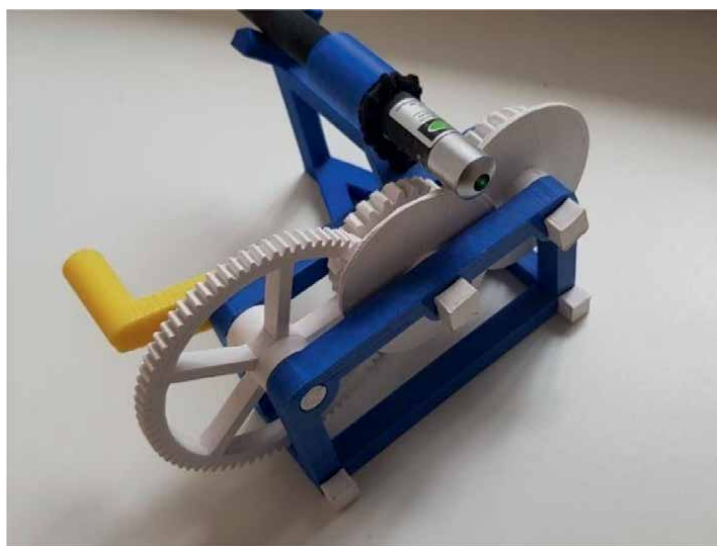


Figure 7.
Mechanical design example (need to design two cams to get 2D curve).

- 3. Gears: assembly of a simple gear mechanism;
- 4. Mechanism design.

Assembly technologies and structural elements of assemblies: discussion of various methods of fastening and the formation of typical elements (hinges, guides, etc., as well as assembly of large products from small parts with a given accuracy—introduction to dimensional chains).

There are a large number of mechanism designs on 3D printing portals for amateurs. To perform the final project, students are given full freedom of action—It is determined only that it should be a mechanism with moving parts. At the end of the project, a video report is uploaded into the MOOC system, that demonstrates how the mechanism works. These video reports can also be evaluated by Peer Review.

4.6 Cost management

The main aim of this course is to design objects with purchased components, taking into account the logistics of supplies and the cost of the project.

After getting acquainted with the technological features of product design, it is necessary to get acquainted with the design of more complex objects, as well as prepare the basis for mastering further courses, where projects and practical activities will require ordering additional purchased components within the project budget.

This course is not related to the development of design skills, but it is aimed at developing an understanding of the features of the implementation of technical projects. Contents of this module are the following:

- 1. Fundamentals of project management: Gantt chart, rolling planning, critical path of the project, Agile practices, and time management;
- 2. Calculation of the cost of the project with all the components and the logistics of project supplies (**Figure 8**);
- 3. Lean manufacturing: for example, loading equipment in the production of certain components in an amount of more than two;

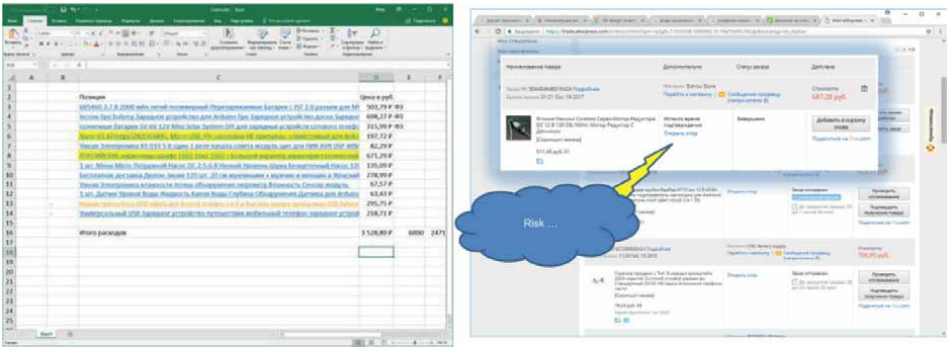


Figure 8.
Example of calculating the student project cost.

4. Risk management: tracking the progress of the project and correcting in case of changes;
5. Formation of a purchase on the example of a typical project for the complex project.

This course will allow in the future to more rationally plan the work on the project and will allow customizing the set of electronic components for the subsequent course (reduce the cost of the training program for the student in case of successful procurement). At the same time, controllers, fasteners, and peripherals (sensors, motors, encoders, etc.) are purchased.

It should be noted that when organizing self-purchase, students make many mistakes: up to not receiving the desired components, so it is recommended to use services with buyer protection (like Aliexpress, eBay, Avito, etc.) to reduce risks. The experience of conducting such a course has shown that students are not ready to plan the purchase on their own, so we always need to have a ready-made kit for the further implementation of the program.

4.7 Build compound projects

The final module of the program is the implementation of our own project, taking into account the previously studied modules. This part of the program is implemented in the form of consulting support from the leading teachers and mentors of the program on a mutually beneficial basis. Mentors from manufacturing companies receive promising future students or employees to implement their projects.

The cost of the final project is not limited, but all costs for its implementation are borne by the student. Proceeding from this, it is quite simply a formalized scheme for the implementation of the project as a reporting work.

A competition for final projects is mandatory with the receipt of appropriate awards in the form of educational subsidies or preferences for admission to higher educational institutions. The final projects can be robotic products (**Figure 9**) and

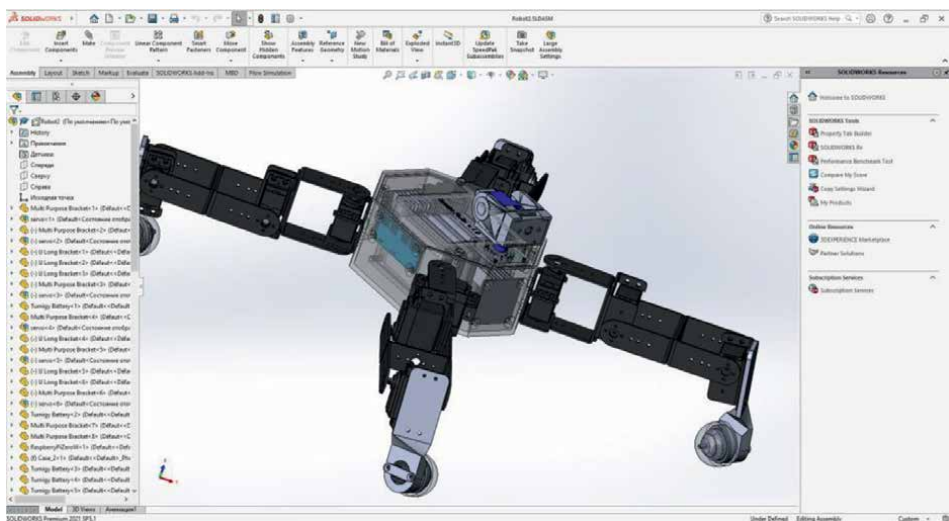


Figure 9.
Example of the final project in the form of robot.

simpler objects. A mandatory requirement is the presence of moving parts with a control system, which allows developing skills in the design of rather complex systems. Moreover, the project can be at any of the stages of implementation, because according to preliminary experience in the implementation of project work, only 15% of projects can be collected and fully implemented by students independently. Nevertheless, there must be a complete description of all subsequent stages of the project, including procurement logistics.

To assemble the final project usually requires additional equipment in the form of a soldering station (average cost \$50–\$100) and consumables. At the same time for those who will use soldering as an assembly technology, there is a small variation course on this technology, because it is important to understand its capabilities used components for device assembly (flux, solder paste, work with soldering station, temperature profiles of components, etc.). Among other things, when working with soldering equipment it is obligatory to follow safety procedures, to ventilate the room and to protect the eyes.

Based on the proposals made for the implementation of the program, the cost of hardware and software in the program will be \$ 800 for 2 years, including consumables for the implementation of project activities (which remain in the possession of the student).

With a constant contingent of students of about 100 people, the cost of a subscription to such an educational program can range from \$50 to \$140 per month, taking into account the provision of the student with all consumables within each of the modules, with the exception of the assembly of composite projects, when the price of the project can vary widely. The economic calculation takes into account the costs of program teachers, network infrastructure support, updating course content, and checking assignments. The final cost will be determined by the tax legislation of the country in which the program is being implemented and other factors [25]. Nevertheless, the subscription model is the most promising for this educational product.

Such programs, without the support of engineering and product development organizations, are very difficult to implement. Therefore, one of the important criteria for economic success is the participation of mentors from these organizations in the implementation of the last module of the program and the corresponding Public Relations promotion among potential consumers.

5. Peer review techniques and project contests as a method for evaluating MOOC activity

The main challenge for the MOOC format is a qualitative assessment of student achievement. In mass training, it is difficult to use a large number of mentors to assess the quality of project work and provide effective feedback on completed assignments. Therefore, the personal work of mentors is mostly applied either on the basis of additional payment for their time by the students or only for the best students selected on the basis of given criteria.

The most effective method for assessing a large number of creative assignments is Peer Review, but it has its drawbacks—the level of assessment is determined by the average level of student achievement in the course. To eliminate this disadvantage, we propose to use a blended assessment approach. In the first stage, the projects are evaluated by voting based on the Peer Review approach, and in the second stage, the

best projects receive detailed feedback from mentors and recommendations. This allows a rational use of the course mentors' time and to focus on the most interesting and creative students.

The experience of completing projects and recording videos to cross-evaluate them among course attendees has shown students' interest in this type of activity. **Figure 10** shows excerpts from a video presentation of projects from one of the courses in the programming curriculum, where students learn object-oriented programming (OOP) in a game form using the Kerbal Space Program game and the KSPython and kRPC libraries of the Python language.

At the end of the training, each student writes a presentation of his/her project, simulating one of the famous space missions: the first flight of Gagarin, the flight to the Moon, the flight to Pluto, the flights to comets, small bodies of the Solar System, etc. This allows not only to acquaint students with the history of astronautics and the

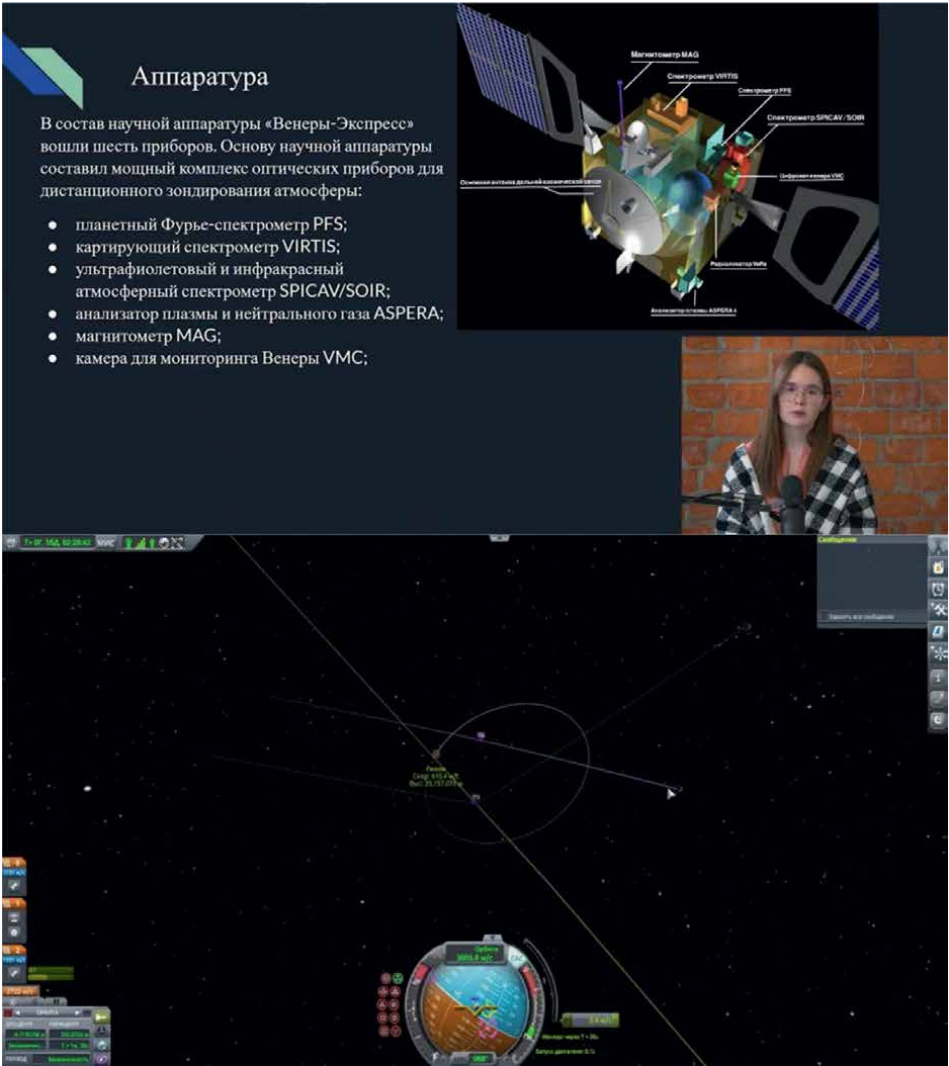


Figure 10.
Example of a software project presentation in the Kerbal space program.

basics of space mechanics but also to learn OOP in the process of writing a program to control space objects.

It can be used as free software for screen recording and video editing, as well as paid amateur software, for example: Logitech capture, Movavi Screen Recorder, OBS Studio, Faststone Capture, UVScreenCamera, Fraps, Bandicam, CamStudio, iSpring Free Cam, HyperCam, GifCam, etc.

In addition to the basic modules, we necessarily include a module on the presentation of their projects. As a rule, this is a small video lecture with examples of project presentations and links to popular projects in their program area.

6. Conclusion

The presented approach to MOOC development with the inclusion of practical work on the basis of home laboratory formation was tested at the training program for applicants of the Moscow Aviation Institute. The structure of the equipment makes it possible to create a basis for further project work of students and the implementation of technical projects based on CDIO technology. At the same time, digital twins are used in the program to get acquainted with the equipment, which is later replaced by real home lab objects.

Presumably with the cheapening of the considered technologies more and more technical MOOCs will be implemented with a practical component. At the same time, having their own equipment allows students to plan their time rationally and creates a platform for technical creativity.

Exposure to logistical issues in project execution provides a wealth of experience in cost management. In doing so, students begin to understand how to manage alternatives in engineering.

The developed program and composition of the home laboratory equipment closes the issues of teaching 3D modeling, construction, and basics of electronic device design. Similar programs can be developed for other areas of applied knowledge. However, it is important to take into account interdisciplinary links in this kind of program and the sequence of mastering technology from simple to complex.


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Perspective Chapter: Online Courses – An Antidote to Traditional Andragogy

Davison Zireva

Abstract

Andragogy is beset by socioeconomic challenges that stifle performance of the learner. Barriers to optimal performance should be unveiled, explicated, and exterminated by mitigating options like online courses. The barriers are heterogeneous since they are influenced by the thrust of the particular national curricula. The socioeconomic status of a nation state has some influence on the adherence to traditional andragogy, which cherishes the status quo. The face-to-face tuition dominated by the lecturer is generally considered to be virtuous in traditional andragogy. During times of no turbulence in education, online courses are the penultimate option. Providential education turbulence caused by contagious pandemics like COVID-19 has precipitated the need for online courses. The online courses should not be reactively considered but should be embraced as the contemporary ‘normal’ in andragogy.

Keywords: online courses, andragogy, traditional practices, national curricula, COVID-19 era

1. Introduction

In the contemporary technological era, didactics in andragogy should be devoid of stasis but responsive to global trends. Andragogy is the education of adult learners [1]. In this chapter, the focus of andragogy is on the modus operandi of adult education. Failure to move on with other nations in embracing contemporary didactical strategies is a recipe for curriculum redundancy. Thus, the national curriculum of any nation state should be adaptive to the changes that are providential and also influenced by technological development. The national curriculum is the set of all educational pursuits that a nation state engages in for the promotion of national development [2]. Thus, the national curriculum is conglomeration of all educational activities that a nation state partakes in for the holistic development of the learner. Some challenges in the development of higher education national curricula should be turned into opportunities. The COVID-19 pandemic caused a transient collapse of the traditional education modus operandi characterized by the face-to-face tuition. There was a dire need to refocus on other modes of offering tuition. In andragogic situations, there has been a ready intervention strategy, which is distance education. The turbulent situation caused by the COVID-19 pandemic could not have been felt as severely as it was

experienced in andragogy since there has been the age-old option, distance education, which needed very little transformations. The outcry caused by the pandemic is an indicator that something is not going on well in the andragogic situations. The stakeholders in andragogic situations should have readily fitted in the ‘new normal’ with the help of modern technology, but the situation was contradistinctive.

2. Background to the chapter

During times of no turbulence in education, online courses are the penultimate option. They have come to the fore only when providential education turbulence caused by contagious pandemics like COVID-19 has disrupted the tradition. The online courses should not be reactively considered but should be embraced as the contemporary ‘normal’ in andragogy. The efficacy of online courses has been acknowledged by some progressive stakeholders [3]. Thus, online courses should be the contemporary *modus operandi* in the provision of tertiary education when developments in technology are effectively capitalized. There should be efforts by all andragogic stakeholders to embrace online courses so as to move along with other domains of life in terms of exploitation of technology for development. The exploitation of technology in andragogic situations is merely reactive to turbulent situations rather than being proactive focusing on improvement. During the peak of the COVID-19 pandemic, which brought face-to-face tuition to a halt, online courses were taken as the only option for andragogy. Even though online courses served a hypercritical situation in the education domain, some sectors of the traditional stakeholders continued to vilify them. Thus, the acceptance of the online course becomes problematic [4].

3. Motivation of the chapter

There is a dearth of researches that have been carried out that point to the inefficacy of online courses. The denigration of online courses is seemingly speculative since it is rationalized on the traditional judgments of quality education in andragogy. Tradition is cultural and is hinged on what a people have and practice and how they think. Traditional andragogy has invested in infrastructure such as lecture halls and practices face-to-face tuition, which is thought to produce quality education. A breakaway from the traditions is atrocious to cultural vanguards, and a concerted effort is taken to extricate online courses.

The sociopolitical and economic statuses of a nation state have some influence on the national ethos. The national ethos *is the doctrine that is formed from the shared values and traditions through which a nation views its past present and future* [5]. The adherence to traditional andragogy that cherishes the status quo could have an association with the national ethos. One of the characteristics of traditional pedagogy is the face-to-face tuition dominated by the lecturer. The transition from tradition for some nation states, particularly the developing countries with limited infrastructure, was problematic [6]. Without the requisite materials, there is a tendency stick to tradition. Thus, the barriers to online courses that are influenced by traditional convictions should be unveiled and explicated for subsequent extermination.

A plethora of recent researches have been carried out about the barriers to online learning that are technological [7], material [8], didactical [9], psychosocial [10], and infrastructural [11]. There is a dearth of literature about traditional practices and

convictions as barriers to online courses. Literature about the sociocultural impediments of online courses needs to be accumulated. The traditions of a people could be very insidious to any changes that seem to challenge the status quo. Some insights about the extent to which traditions stifle the provision of online courses can be used in generating mitigating actions. The stakeholders in andragogy who are for the online course should be conscientized on that there could be a sheer waste of resources if a mind-set for online courses is not developed in the traditionalists. Effecting change to any social phenomenon requires that the interested parties consider ways of maneuvering around the obstructing traditions.

4. Developments leading to online courses

The employment of online learning and pursuit of online courses were expected to create a smooth continuation of learning in andragogic situations. Online courses should have been considered as a modification of distance education courses, which are not novel in andragogy. Distance education was first adopted as a correspondence program in the United States at the University of Chicago toward the end of the 19th century. It was reactive to the bottleneck education system of the in-person classes in preindustrial Europe. By then, andragogy was a preserve of males in the elite class. Correspondence study was a menace to the maintenance of the privileged status of the elite and was maliciously despised. Thus, correspondence courses were unfairly considered as inferior to education provided in face-to-face interactions of the educator and the learner [12]. Despite the chastisement of correspondence education by the elite, it continued to grow and became more organized. Following the developments, the International Council for Correspondence Education was established [13].

In 1982, the developments in offering correspondence education necessitated the change of name to International Council for Distance Education. One of the factors that influenced the change of name was the development of new technologies. Satellite broadcasts were a technological evolution that enabled some universities in the United States to offer a variety of distance-education courses. Distance education can be considered as the instruction through print and electronic communications media to learners, which involves well-structured learning done in spatial and temporal situations that are different from those of the educators [14]. In 1969, the British Open University in the United Kingdom spearheaded the use of technology to augment print materials in distance education [15]. The British model has been adopted globally by both developed and developing countries. Though distance education is offered contextually in different countries according to the availability of resources, the *modus operandi* is essentially the same. Technological developments are breaking the national physical boundaries when it comes to information about making distance education efficacious. Due to poor infrastructural development, some developing countries embraced distance education programs. By the early 1980s, a substantial number of students in developing countries were pursuing higher education studies through distance education [16].

The study materials for different courses offered in different countries can be accessed with ease via electronic media and other means. However the contextualization of the materials to suit specific national needs is a problem. In most developing nation states, there is a dearth of human resource for the production of materials. As such, the facilitators superficially adjust the course materials in an endeavor to make them relevant to their national goals, and they seemingly appear to have the capacity

of developing materials. Thus, when it comes to the provision of distance education, some educators showcase fictitious competency, while in reality, they do not have the intellectual and technical proficiencies. The pseudo capabilities of the educators in some countries in the provision of distance education have gone unchecked for many years and have fostered an assumption that all is going on smoothly. Thus, anchoring online education on shaky distance education structures begets a plethora of challenges in the provision of online courses in some countries.

The personal computer and the internet were significant inventions that contributed immensely to the revolutionization of distance education into online education. The first cases of online education started 1960 at the University of Illinois in USA. The students were learning from computer terminals that were interlinked and formed some sort of a network. The wholly online course was offered by the University of Toronto in 1984. Then, in 1989, the University of Phoenix launched the first wholly online scholastic institution that offered first and second academic degrees [17]. The Open University in the United Kingdom took online education further and became the first university worldwide to offer online distance education in the 1990s. The development of online courses has a very long history, and some of the challenges met with have been mitigated.

The outbreak of the COVID-19 pandemic was supposed to not have caused any turbulence in andragogic situations. The educators in developing countries should have taken recourse to the transactions of the online courses by higher education institutions in developed countries. Before the COVID-19 pandemic, provision of online education was optional in some developing countries and was like a form of edutainment. The lack of solemnity in provision of online education by such countries could have created complacency in capacitation of educators to become effective facilitators.

The provision of online courses is causing a revolution in the education sphere. It is breaking the age-old tradition of in-person classes. The paradigm shift is not readily welcome by some traditionalist stakeholders who allege that it is riddled with hosts of challenges that adversely affect the quality of graduates produced. The challenges are national, technological, and socioeconomic and are precipitated by intransigent traditions.

5. Online courses as mandatory during COVID-19 era

The COVID-19 pandemic came as a formidable force that disrupted the traditional *modus operandi* of providing education in andragogic situations. The traditional andragogic setup that had in-person classes for face-to-face interactions was totally abandoned in observance of the World Health Organization (WHO) COVID-19 protocols. The learning institutions were forced to migrate to full online learning [18]. Thus, online learning was taken to be the only means of teaching that was in line with WHO protocols [10]. The transformation was not welcome by the higher education students of even the developed countries like the United States. In a research carried out with college students in New York, about 77% preferred in-person classes to online learning [19].

Various governments worldwide were convinced that the COVID-19 pandemic had adversely affected their education systems. The governments were forced to make all education institutions cease face-to-face instructions in order to strictly observe physical distancing. The governments then launched education-crisis mitigating

measures, which, among others, were curricula redesigning, revision of policies on instructional strategies, and the shifts of academic calendar [20]. Most the governments had oversights about the human capital capacitation. It appeared like the provision of online education was more focused on creating an impression about moving along with others in this global trend.

6. Methodology

The learners' and lecturers' experiences and perceptions on online courses during the COVID-19 era were empirically explored. Data were generated through focus group discussions and interviews with learners and lecturers, respectively. Thus, the qualitative methodology was employed in the empirical investigation. Verbal data were generated through interactive methods, which are hinged on the efficacy of the researcher who is the major instrument [21]. The interactive nature of the qualitative research methods begets the use of the term 'data generation' in qualitative research rather than the term 'data collection'. Some critics with the quantitative research orientation posit that data generated in qualitative research are not valid and reliable since they could be riddled with researcher biases and cannot be replicated. Some issues in the critiques are valid but should not be taken to extremes. They should be considered as control measures that make qualitative researchers vigilant. The terms 'validity' and 'reliability' are not germane to the qualitative methodology, but the term 'trustworthiness' is, which is the degree of confidence in data, interpretation, and methods used to ensure the quality of a study [22]. The trustworthiness of data is influenced by the context of the research, which considers the proficiency of the researcher in interacting with the informants in particular situations. Thus, for enhancement of trustworthiness, there were triangulation of methods and triangulation of data sources. The data were generated from both lecturers and the tertiary education learners using interviews and focus-group discussions.

Informants in both categories were selected using the maximum variation sampling technique and subsequently the network reference sampling technique. Maximum variation sampling technique is also known as the maximum heterogeneity sampling. The technique is judgmental and identifies informants with extremely diverse traits [23, 24]. The express aim of maximum variation sampling is to gain comprehensive insights from various angles about the topic being investigated.

The network reference sampling technique is the second technique that was employed subsequently. It is also known as the snowball sampling technique or chain-referral sampling. The network referencing technique is a sampling technique in which the identified information-rich participant provides referrals to other informants with traits that are important for the research.

For the selection of the learners, two information-rich participants were initially identified; one had shown exceptional enthusiasm in online courses, and the other one had shown extreme acrimony of online courses. Each of the information-rich participants mentioned a participant with similar traits. The snowballing continued until four participants for each group were identified. The focus group discussions were carried out in two sessions of four students in each session.

The samples for the interviewees were also selected by employing firstly the maximum variation technique followed by the network referencing technique. Two lecturers with extreme heterogeneous traits about online courses were identified. Each of the two lecturers made referrals to participants who had similar traits. The referrals

continued until each group had four information-rich participants. The interviews were carried out with eight lecturers, four for each extremely polarized perception on online courses. The data generated focused on the descriptions of the participants' experiences and perceptions on online courses. The paradigm that guided the empirical part of the chapter is phenomenological pragmatism. The essence of phenomenological pragmatism is to describe the efficacy of the realities of life being interacted with. The descriptions of experiences and perceptions on the realities are presented in the informants' own words. The participants are coded as: student for online courses (SFOC), student against online courses (SAOC), lecturer for online courses (LFOC), and lecturer against online courses (LAOC). Each participant had a pseudonym, which was a digital subscript.

The focus group discussions and the interviews carried out were audio-taped in order to safeguard that there would not be any data lost. After the transcript of the data, the thematic approach was employed to analyze the data. Thus, themes were generated from the verbatim responses of the participants [25–27].

7. Tradition as an asphyxiant of online courses

Distance education courses have met with stiff resistance due to the disruption of the status quo. Breaking away from the tradition always causes some discomforts if the stakeholders are not well prepared for the transformation. There is a lot of skepticism about the relative worthiness of the online courses. The very key stakeholders do not want to break away from the traditional didactics.

8. National policy impediments

The policies on higher education credentials of some countries had not been supportive of online courses. The credibility of online credentials has been considered dubious by many developing countries. LAOC₁ postulated,

“How can I expend my energy on offering an online course which I know is not supported at national level?”

Some governments, especially of the developing countries, could be showing laissez-faire attitudes to online courses due to limited resources [6]. The governments lack both human and material resources for the online courses, but they have the resources for traditional education courses. Similar sentiments were posited by LAOC₂,

“Engagement in online courses is sheer waste of time - has the government changed its position concerning accrediting of online courses. I have a colleague who did an online doctoral degree with a certain university in the United States. His doctoral degree could not be accredited in this country. Thus pursuit of online courses is putting one's career aspirations in jeopardy.”

The policy issues concerning the online courses are a major determinant of the credibility of online courses in a nation state [28]. Some policy issues that are imbedded in tradition are not readily adaptable to changes that are brought about by technology.

Further corroborative remarks were echoed by LAOC₃, who explained,

“If the responsible ministry was serious about online courses, we should have been capacitated in ICTs. There is a lot of window dressing about the so-called ‘new normal’. How can we be in a ‘new normal’ when I am in sub-normalcy? When the Ministry is serious about online courses they will make appropriate interventions for human resource capacitation.”

The ‘new normal’ came abruptly and was not rehearsed [29]. The lecturers were forced to adapt to the provision of online courses without the indispensable guidance. Most of them were resistant to adopt it. Reversion to the traditional andragogic didactics was the comfortable option.

Informant LAOC4 further confirmed the national barrier to online courses:

“If the Ministry was serious about the credibility of the online courses, they could have circulated some policy statements about the parity of online courses and those offered through face-to-face interactions in lecture halls.”

According to the informants, there should be some andragogic adaptive strategies that should be put in place to capacitate all the active stakeholders to be engaged in online courses. The traditional andragogic practices could be miseducative in the current practices of online courses. Thus, the migration to online courses needs a breakaway from the traditional andragogic practices [30].

In the focus group discussions, informant SAOC1 discoursed,

“Online courses are simply reactive to the COVID 19 protocols. The government is not showing any commitment to accredit online courses. I see with the same lens as the government. Some students can hire some other people to do online courses for them.”

There is a lot of skepticism about the credibility of online courses. The argument of the informant seems valid, but even for courses offered in the face-to-face interactions with the lecturers, the unscrupulous students can also hire some people to write assignments for them. The vilification of online courses is predominantly influenced by the traditional practices.

In corroboration, informant SAOC2 explained,

“Online courses are not credible in this country. If they were, the state sponsored media could have been awash with encouragements to the citizenry to partake in online courses.”

The sentiments of the learners are in line with the findings of some researches that were carried out. About half of the students who were studied alleged that the traditional andragogic practices were far more effective than the online learning platforms [14].

In substantiation of the government’s lack of commitment to online courses, informant SFOC1 remarked,

“The government is playing down the importance of online courses. There should be a lot of advocacy about their worth. The online courses are the way to go.”

In the provision of higher education during the turbulent times, some governments, especially in developing countries, are conservative in the *modus operandi*

of offering higher education courses. They are implicitly skeptical of the strategies that are reactive to situations. These governments maintain the status quo since they lack the requisite resources that are used by the developed countries. Thus, the rigidity in offering online courses is an indication of having a safe haven in traditionalism.

The learners who are engaged in online courses in the andragogic situations need the psychosocial support [10]. The learners and the educators are moved to new practices in andragogy, which could be stressful without the requisite knowledge, skills, and attitudes. These stakeholders could be haunted by traditional practices, which are not readily transferable to contemporary didactic practices that are technological. There is need for the psychosocial and technological support during the initial stages of the transition [11].

9. Traditional didactics' influences on online courses

The traditional education, which is characterized by the teacher-centered, monological didactics, has critical influences on online courses. Informant LAOC2 postulated,

“Online courses are mainly precipitated by reactivity to disturbing situations so they should not disturb the tradition of face-to-face education interactions.”

The lecturer has traditional methodological concerns. The concerns are in line with the findings of a study that was carried out among the Ghanaian students who were found to have maligned online courses due to lack of physical-social interaction among the students [9]. Online courses can have the learners interacting with their course-mates in the Google class, but relatively, for a traditionalist, the interactions cannot be matched with the physical interactions.

Corroborative remarks were given by informant LAOC3, who explained,

“Online courses are riddled with a lot dubious results. Some students can have some other people to do the work for them. The lecturer plays a crucial role in the traditional in-person classes, he or she can monitor the learning situation and minimize on cheating.”

The physical absence of the lecturer and the course-mates obviates the sense of seriousness of the online courses. The physical absence of the lecturer, according to some adherents of traditional andragogy, is tantamount to lack of monitoring of progress in learning and could be a recipe for procrastination of indispensable tasks and gross cheating [10, 31].

On the contrary, the physical absence of the lecturer could produce more trustworthy results. It was found that the physically attractive female university students received lower marks when lecturers moved online during the pandemic [32].

The physical-social presence of the lecturer could breed double cheating. Both the lecturer and the student could be vulnerable to cheating. Thus, the allegation that students pursuing online courses produce more counterfeit work than those engaged in the traditional in-person classes is not valid.

Informant LAOC4 expounded,

“A home is a home and not a school. It’s nonsensical to say that when learners pursue online courses, they learn in the comfort of their homes. Not every home has comfort which is conducive to effective learning.”

According to the informant, the traditional andragogical space is immutably the lecture hall and not any other spaces. The traditional space for andragogy renders credibility to the courses being undertaken. The change of the education space to a home begets dubiousness to the courses. The learning environment is one of the major challenges of online courses in the developing countries [4]. The home environment could be overcrowded, and hence, there could be some distractions such as noise [33]. Thus, the lecturers who have the experiences of distractions that could be found in the home are for the traditional learning space, which is the lecture hall.

In backing, informant LAOC3 enlightened,

“The technological gadgets that the lecturers and the students use should be functional to the demands of online courses. If they do not measure up to the expectations of the pursuit of online courses then nothing is going to materialize. The only option would be reverting to our teaching strategies with little hassles.”

The informant’s line of thinking is confirmatory to that the participants of online courses require gadgets with strong internet connectivity [15]. Without that, all efforts will never come to fruition. The lecturers with such sentiments could be making references to their experiences. Their evaluations of the lecturing done using internet connectivity would make them go for the traditional mode of lecturing. Internet connectivity could be a formidable challenge to some developing countries that experience erratic supplies of electricity. The internet connectivity was a challenge in the pursuit of online courses among medical school students in Saudi Arabia [28]. The situation could be the same as the one in some developing countries.

Informant LFOC1 explained how lecturers stifle online courses:

“Some of the lecturers always want to use the methods which were used when they were students. They are very technophobic.”

In further explanation, informant LFOC2 postulated,

“Some lecturers feel threatened by the online courses. They think that their job is at stake when they are made redundant by the use of technology. Thus the lecturers want to maintain the status quo.”

The lecturers who experience technophobia are adherents of a postfigurative culture in education. They think that the way they were taught was the best and should be maintained. Thus, reference to traditional education is an obstacle to online courses.

Students who are for online courses also perceive some lecturers as obstacles to online courses. Informant SFOC2 posited,

“Some lecturers vilify online courses. We look up to them for advice but they are not offering good advice. I think that technophobic lecturers should be forced to resign. They are no good to contemporary education systems.”

In support, informant SFOC3 advanced,

“When it comes to online courses, some lecturers have become redundant. Those who dictate notes are doing us more harm than good. During the COVID 19 era we were forced to submit hard copies of assignments. These lecturers have out lived their span in this technological era.”

Informant SFOC4 postulated,

“The traditional ascriptions of the lecturers haunt most traditional lecturers. The lecturers who are traditionalistic do not want to be pushed into online courses which are a zone of incompetence to them.”

The traditional lecturer is no longer valuable in the contemporary technological era. Such a lecturer no longer has the respect from the learners. According to the informants, the traditional lecturer is the major obstacle to the online courses. The acquisition and use of education technological skills is no longer optional. The skills are indispensable to all lecturers in the contemporary education era.

10. Technophobia as an adversity to online courses

Online courses are closely intertwined with technological development. Technophobia is one of the adversities of online courses, especially when it has gripped some lecturers. The lectures who are technophobic are adherents of traditionalism. They do not want changes to their traditional beliefs and practices. According to them, stasis guaranties stability in education. Informant LAOC3 emphasized,

“The use of the computers brings about turbulence in education - not everything got on the internet is well researched. I am afraid that online course learners do not get the knowledge they would get from in-person classes.”

Supporting remarks were given by informant LOAC2:

“Lecturers should not waste time learning how to employ technology in lecturing, what is important is the researched knowledge from the lecturer.”

Informant LFOC2 posited,

“Some of my colleagues in lecturing are hyper-technophobic. They do not want to use even the simplest gadget in the facilitation of learning.”

Supportive remarks were given by LFOC1:

“Technophobic lecturers are very rigid when it comes to the implementation of changes which are brought about by technological development. You still find a lecture during this era of technology reading notes he or she made more than ten years ago.”

Informant LFOC4 further illuminated,

“Some lecturers are so much afraid of technology that they eschew any educational interactions that prescribe the employment of modern technology.”

The technophobic lecturers are insidious to the pursuit of online courses. With such a caliber of lecturers, the online course will continue to be denigrated. There is a risk that the very valuable engagements of students in online courses will be under threat.

11. Conclusions

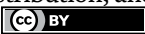
Online courses are a developed mode of distance education. Before the COVID-19 pandemic, their worth was blurred. The stakeholders were obsessed with the traditional in-person classes, which are characterized by the physical-social interactions of the lecturers and the learners. During the COVID-19 era, online courses became mandatory but were offered ritualistically by some traditionalistic stakeholders. Traditionalism is the major barrier to online courses. The finer nuances of the obstacles, which are national, socioeconomic, and technological, are all hinged on maintenance of the status quo. The major players in the education, the lecturers and the students, have diverse evaluations of the credibility of online course. The players who are against online courses are traditionalistic and are resistant to learn about technologies that are requisites for online courses. In the technological era, the technophobic lectures have lost the respect that they should be accorded by the learners. Some governments of developing countries are mum about the credibility of online course. The main reason is that they are still obsessed with tradition.

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Section 3

Teaching and Learning

Understanding the Needs of Online Learners for Successful Outcome

Phillip C. James

Abstract

Online learning represents a departure from the normal face-to-face teaching, and hence, it presents unique challenges for institutions, instructors, and online learners. Successful outcome for learners engaged in the e-learning process is not guaranteed, so an understanding of the factors that drive success is critical. This chapter outlines the important factors required by online learners to help in providing the foundation for successful outcome from the e-learning environment. Factors regarded as crucial for successful outcome include instructor characteristics, learner characteristics, institutional support, course structure and design, and finally, the need to build a class community. Any failure by the dominant parties driving the e-learning process, that is, the institutions and the instructors, to fully understand their responsibilities will negatively affect the successful outcome from the e-learning engagement.

Keywords: E-learners' success, instructor characteristics, course structure, class community, learner characteristics, institutional support

1. Introduction

The COVID-19 pandemic has brought about a significant and most likely permanent change to the teaching/learning process. Schools, colleges, and universities were forced to transition to an e-learning platform to continue their operations of educating students with little or no prior notice. This transition to an e-learning model presented major challenges to both learners and institutions. Institutions struggled with the problem of arriving at an e-learning platform that is most effective for its learners, while learners, most of whom had no prior experience navigating an e-learning architecture, found themselves trying to understand and make sense of a system that could at times be described as impersonal and difficult to comprehend depending on learners' unique characteristics.

E-learning has now become a way of life for most schools, colleges, and universities, and it is conceivable that the teaching/learning methodology will never return to that of the pre-COVID-19 pandemic model. Given this fact, institutions have begun to market themselves in terms of comparative advantage with respect to their e-learning platform and design features. Institutions offering e-learning need to be cognizant that successful outcome of the e-learning engagement requires more

than just a well-designed e-learning platform. Successful outcome as defined by the learners' ability to understand the material and achieve and maintain their academic performance as they would in a face-to-face teaching/learning environment requires a complex interplay of several factors. The transition from face-to-face instruction to the virtual classroom was made possible by the use of applications such as ZOOM, Moodle, Google Classroom, and Blackboard [1].

Some studies [1–4] have looked at aspects of e-learning and have highlighted how e-learners can be assisted during the e-learning engagement. One of the deficiencies of those prior studies is that they fail to present a comprehensive discussion of what are the critical factors that must be examined to ensure the success of e-learners. It is this missing link that has motivated the writing of this chapter. It is the hope that this chapter will be a reference point to provide guidance for all parties engaged in the e-learning environment. This chapter provides an outline of some of the key factors that institutions offering e-learning as an alternative to face-to-face instructions, or a combination of both, need to be aware of as prerequisites for successful outcome for online learners. The chapter is organized under major headings, each explaining why a failure to incorporate specific key success factors can significantly affect learners' ability to achieve successful outcomes in their course of study. It is the hope that a better understanding of the needs of online learners from the institutional perspective will lead to a course design and delivery paradigm that is geared toward the success of online learners. Any failure on the part of institutions to embrace, appreciate, and ultimately incorporate the recommendations outlined in this chapter in their e-learning model will be a disservice to the students they are trying to serve. Let us now examine some of the key success factors.

2. Learner characteristics

The success of an e-learning engagement goes beyond institutions providing excellent learning management system (LMS), ensuring high-speed internet availability to students, and even providing access to the use of their computer devices. The ultimate success is underpinned by a thorough understanding of the unique characteristics that are innate to the online learner. Each learner brings to the e-learning environment his or her own set of learner characteristics, which have a significant bearing on whether the learner will be successful in achieving the objectives as outlined in the course schedule.

Learner characteristics represent a complex interplay of factors that schools, colleges, and universities need to be aware of. While institutions may not have direct control over all these characteristics, they should nonetheless strive to gain a better understanding of these learner characteristics and the role they play in contributing to a successful outcome of the e-learning engagement. The learner characteristics that have been identified as relevant to the successful outcome for online learners include: the level of technical or computer skill of the learner, the learner's preparedness or readiness for undertaking online learning, the learner's prior experience with online LMS, the age of the learner, and finally, how motivated is the online learner. Learner characteristics therefore represent concerns that need in-depth focus and understanding.

2.1 Learner readiness for online learning

There is the general misconception that because we are all operating in what is called the "digital age," it is assumed that all learners enter the e-learning

environment in a state of readiness. E-learning readiness can best be defined as skill, knowledge, affective, social, and psychological characteristics and physical opportunities that are required for learners to make optimum use of e-learning engagements [5, 6]. Understanding the concept of e-learning readiness from the learners' perspective is a major factor in determining the success of the e-learning engagement. A learner's e-learning readiness embodies the learner's total orientation to e-learning. Questions such as what is the learner's understanding of e-learning, was the learner socialized in an environment that sees e-learning as an alternative to face-to-face instructions, what are the expectations of instructors in an e-learning engagement, and how does the learner make sense of a learning engagement that is impersonal and isolated must be examined.

Institutional understanding of e-learning readiness plays a significant role in explaining the extent to which learners are ready to participate in and accept the e-learning model as an alternative to face-to-face instruction. One of the problems that schools, colleges, and universities that offer online instructions struggle with is the low participation rate of their learners. Generally, learners enroll into a course and as the course progresses, there is tapering-off the course participation and course access by the learners; sometimes students are missing for a week or two. This tapering-off in terms of course involvement and course contact is normally a sign that there are underlying problems regarding the learner's state of e-learning readiness. A frequent complaint by students is that the e-learning environment places additional demands on them, in terms of their need for motivation, time management, and organizational skills. Given the importance of the learners' e-learning readiness state, the task at hand is: how does an institution assess the e-learning readiness of its learners? The evidence has shown that most institutions have embraced the false notion that once learners are technologically savvy, they are ready to participate in the e-learning engagement. A better approach would be for schools, colleges, and universities to engage their learners prior to the implementation of an e-learning engagement, to solicit responses as to the learners' general understanding of the requirements of an e-learning engagement, and the additional demands such an engagement would place on them. Institutions could use the students' feedback to construct an e-learning readiness hierarchy that could be used as a scale to determine the extent to which a student is ready for the e-learning process.

2.2 Is the learner adequately motivated?

To achieve an objective without being coerced is possible only when one has the inner drive; this is what is loosely referred to as motivation. Learner motivation is a key factor in determining the outcome of an e-learning engagement. The e-learning environment presents numerous unexpected challenges for the learner. The learner is suddenly placed in an environment where he/she is isolated from both friends and the instructor, class interaction becomes difficult, and the learner, depending on his/her level of cognitive maturity, must embrace this learning model, which now requires time management and organizational skills. This new learning model now places additional stress on the learner, and the extent to which the learner can overcome these challenges and achieve a successful outcome depends on the learner's level of motivation. It is this intrinsic drive that will allow learners to overcome their challenges and achieve their course objectives. Learners who are adequately motivated will be able to be engaged in self-regulated activities, without external direction, that help them to achieve their goals [7].

Motivated learners are more inclined to spend more time being engaged with the LMS, and their level of course participation tends to be very high [8, 9]. Those students who neither are adequately motivated nor possess the innate self-regulatory skills required for the e-learning engagement may require more time to complete assignments, which are normally late and of poor quality [10]. Motivated learners are self-driven; they require little or no external encouragement to be fully engaged in the e-learning process. However, those learners who are not adequately motivated view the e-learning environment as a burden, and most times, they struggle to keep pace with the course schedule, which results in late submission of assignments, missed exams, and ultimately poor course performance.

The issue that institutions must now address is what can be done to help motivate online learners. The fact is that institutions tend not to see this as a requirement on their part when considering e-learning instruction. Interestingly, the design of an e-learning course should be viewed as one similar to the budgeting process in an organization. Organizational budgets require the input of line staff in arriving at attainable departmental objectives. This level of involvement from line staff and departmental heads is necessary for ownership of the budget, meaning the workers see the objectives as goals they help to set; hence they are prepared to work toward achieving these goals, as against having unattainable targets imposed on them from the top management. Schools, colleges, and universities need to find creative ways of getting students' input in the design and structure of online courses. This input from learners would result in them having a pseudo-ownership of their courses, and they would be more motivated to be engaged with the e-learning process.

2.3 Learner prior interaction with online LMS

Most learners encountered the e-learning environment for the first time when schools, colleges, and universities made the rapid transition from face-to-face instruction to online instruction because of the COVID-19 pandemic. It is true that most institutions never had the time to carefully consider the impact this hasty transition would have on learners. The COVID-19 pandemic is now behind us, and the evidence shows that institutions have now adopted a strategy to reinforce and embolden their online LMS. This attempt by institutions to strengthen their e-learning architecture is being undertaken without any meaningful consideration (in most cases) as to how successful the learners will be in navigating the e-learning environment.

Learners are expected to quickly navigate the e-learning system and become competent in using the system in minimum time. Problems and challenges arise for learners who have no prior experience with an online system. The challenges that learners who have no prior experience with online systems face can determine to extent to which they are successful in their e-learning engagements. The time taken for an inexperienced learner to navigate the system to a point of comfort normally results in the learner struggling to keep up with the class schedule and with the other students who have prior experience with online learning systems. A frequent complaint advanced by non-traditional students (adult working students who may have been away from the educational system for a few years) is that they experience great difficulty in understanding and navigating the online learning management system.

Some learners simply lack the level of technical skills required to function effectively in an e-learning environment, which makes acceptance of the technology difficult [11, 12]. Institutions therefore need to understand that successful outcome from the learners' perspective will be dependent to a large extent on learners' prior

experience with online systems and the level of their technical skill. To resolve this problem requires institutional creativity. It is very unlikely that a learner will be offered a course for the first time at the advanced level; most courses or subjects begin with a lower-level introductory course or subject, then move to the intermediate and finally the advanced level. A similar approach could be adopted by institutions, whereby they offer an introductory course on the basics of online learning. This introductory course would be institution specific, based on the LMS in use at the institution. The aim of this course would be to ensure that all learners would understand the LMS before they are required to be engaged with the system in a formal e-learning program. This course could be made available to all learners via a YouTube link. The significant role that learners' prior experience with online LMS have on the successful outcome of an e-learning engagement cannot be over-emphasized.

3. Instructor characteristics

One of the most important variables in the e-learning success equation is the instructor. Most institutions fail to appreciate the significant role instructors play in determining the success of learners and ultimately the retention of learners in an e-learning engagement. While the list of instructor characteristics may include several items, the following are some key ones that need to be examined:

- Instructor availability to learners
- Level of interaction with learners
- Timely response to learners' concerns
- The level of experience of the instructor regarding online teaching
- Instructor's flexibility to accommodate learners' unique problems such as illness or other emergencies
- Instructor's attitude toward online learning: does the instructor willingly embrace online teaching or resist it because it is seen as a burden?

The discussion of these factors is critical to an understanding of the role instructor characteristics play in determining successful outcome for online learners.

3.1 Instructor availability and level of interaction

Face-to-face teaching presents little or no problem in terms of instructor interacting with learners and the availability of the instructor. Significant challenges regarding instructor availability and the level of instructor-learner interaction can now be experienced when the face-to-face learning has transitioned to an e-learning environment. Learner-instructor interaction can be defined as the interaction that exists between the instructor and the student, which includes activities such as visiting the instructor during office hours and obtaining help for subject-specific problems [13]. The challenge in an e-learning environment is for the instructor to devise an instructor-learner interaction model, which will ensure that his/her presence will be maintained during the

e-learning engagement. Online learning can be lonely and isolated for the learner, and the last thing online learners would want to experience is a feeling of abandonment by their instructors.

Learner abandonment by instructor, which is a state of feeling experienced by the learner when the e-learning instructor is periodically absent from the e-learning engagement and re-appears after a few days or weeks, can negatively affect learners' connection with the course and ultimately a successful outcome. Each instructor must develop an instructor-learner interaction model for his/her online course. The instructor-learner interaction model must be one that allows the instructor to maintain a high level of visibility and presence during the e-learning engagement. The instructor-learner interaction model should be designed to address the issue of instructor availability to online learners.

The advantage of face-to-face instruction is that the learner can receive immediate on-the-spot response from the instructor, which is not possible in an e-learning environment. Instructors therefore need to understand that their availability to online learners must be underpinned by a timely response to learners' concerns. The question of what is regarded as timely response is debatable and could be a matter of one's perception. The benchmark for determining what is a timely response should be viewed against a similar question put forward by a face-to-face learner to the instructor during a class session. For those of us who have spent many years teaching, hardly anyone would agree that a timely response to a face-to-face question would be one where the instructor takes three or more days to provide the learner with an answer or some form of response. The instructor-learner interaction model, when designed properly, should ensure that each learner in the e-learning engagement gets the feeling that he/she is the only learner participating in the e-learning engagement, based on the timely response from the instructor.

Schools, colleges, and universities should assist instructors in developing the instructor-learner interaction model. Training should be provided for instructors who are struggling to maintain acceptable levels of online visibility and interaction with learners. Failure by institutions to recognize the importance of the instructor-learner interaction model will result in dissatisfied and frustrated online learners, and course retention rates will decline.

3.2 Instructor flexibility and attitude toward online learning

The e-learning engagement is a partnership between three parties: the institutions, the instructor, and the learner. Unfortunately, most institutional management focus on only two of the three parties, that is, the institution and the learner, and assume that the instructor is onboard and is a willing participant; this is a dangerous assumption to make. The instructor's willingness to embrace the e-learning engagement will determine the level of success learners achieve from the e-learning engagement. An instructor who views e-learning as a burden will not be adequately motivated to ensure that learners achieve successful outcome. The instructor who resists the transition to e-learning or participates reluctantly out of a fear of losing his/her job cannot make any meaningful contribution to a positive and rewarding experience of learners in the e-learning engagement.

One of the misconceptions of institutional management is the assumption that all faculty are innately designed or equipped to be involved in the e-learning engagement. This is not correct. There are instructors who would, if given the opportunity, decline to teach in an e-learning environment. These instructors see e-learning as a

burden and incongruent with their teaching model; the result is that they participate in the e-learning engagement under duress. Instructors who experience e-learning participation duress (EPD) should be covertly identified and removed from all e-learning engagements. The continued inclusion of instructors suffering from EPD leads to a defective e-learning product and adverse outcome for learners participating in the e-learning engagement.

The online learning community is a complex mix of learners. This mix of learners consists of the traditional learner and the non-traditional learner. It is due to this complex mix of learners that it becomes vitally important for the e-learning instructor to adopt a flexible approach to accommodate the unique problems that the learners may experience during the e-learning engagement. The face-to-face learner has the advantage of speaking directly with the instructor when there is a personal problem. During this face-to-face interaction, the instructor can assess body language and emotions, which are normally considered in arriving at a decision (whether these should be influencing factors or not). Learners engaged in the e-learning environment do not have the opportunity of face-to-face interaction with the instructors; hence, in most cases, they interact by using an email message. It is situations like these that an instructor in the e-learning engagement is required to be flexible in handling learners' request.

Experience has shown that online learners tend to encounter more problems affecting their study than face-to-face learners. Problems encountered by the online learner are numerous and include issues such as electricity power failure, computer failure, loss of internet service, family-related problems, unexpected illness, and one that I recently encountered, the construction of a building close to the residence of a learner, which prevented the taking of an exam at the specified time due to the excessive noise. It is in instances like these that the flexibility of the online instructor becomes the most important for the successful outcome of the e-learning engagement.

4. Institutional support for learners

The e-learning engagement is a complex interplay between the institution, the instructor, and the learner. It is difficult to determine whose role is more important of the three parties to ensure a successful outcome. One thing is certain, and that is both institutions and instructors directly influence learner outcome. It is my view that institutions are the drivers of the e-learning engagement. Institutions eventually develop and present an e-learning model that includes both instructors and learners. The ultimate product, the e-learning experience that instructors aim to deliver and learners consume, has its genesis with the institutions. Institutions need to understand their role in the e-learning engagement.

It is argued that institutional support is a major factor in the development and implementation of an innovative e-learning system [14]. Institutional support has no end point; once there is an e-learning engagement being offered, the support is required. The preparation and management of the online program is a requirement for institutions to ensure a quality e-learning experience for learners [15]. Institutional support can be observed in many ways. Online learners will experience technical problems, and thus, institutions must have an established and efficient system to respond to the learners' problems. The e-learning engagement is executed in a tight time schedule; therefore, institutions must have an official response

benchmark policy, which is the standard response time for all requests for assistance. This standard response time should be an institutional policy standard, which should be used as one of the performance measures used to evaluate the performance of the institution. Response time should not be based on the availability of technical staff or case load at a particular time. Online learners expect timely and effective institutional support when they are experiencing technical problems. The ease with which learners can get technical support from institutions is vital for successful outcome in an e-learning engagement. Periods of long wait, which at times include days, and the unholy re-routing of calls and emails across departments and personnel are not only frustrating to the e-learner but also an indication that the institution does not have an effective and efficient response model.

Institutional support for e-learners can also be evaluated in terms of the level of training provided by institutions to learners in navigating the LMS. There have been instances where institutions have rolled out upgraded LMS, and after learners have been enrolled into the system, their training sessions are held. Ideally, adequate training in using the system should be provided prior to learners engaging with the system in terms of course delivery. The adequacy of the training will determine the extent to which learners use the LMS. E-learning systems that are perceived by learners as difficult to navigate, which means they have a low ease-of-use index, will be a deterrent to successful outcome for learners engaged in the e-learning environment. In a similar way that institutions need to have an official response mode to address learner request for technical assistance, institutions need to have a structured mechanism designed to provide continuous training for learners engaged in the e-learning environment and potential learners who may subsequently become engaged in the e-learning environment. The opportunity for learners to access continuous technical training is important because there are always new learners entering the e-learning environment at different times during the academic year. One of the ways in which institutions can ensure that access to continuous training is available to all learners, both current and potential, is to provide training videos on their institutions' websites.

The importance of effective, efficient, and continuous institutional support for learners engaged in the e-learning environment cannot be over-emphasized. Schools, colleges, and universities need to understand that institutional support has a starting point but no end point. Once an e-learning engagement has started, institutions must provide the required resources to maintain a robust support architecture for online learners. Any failure by institutions in proving this level of support will certainly negatively affect the outcome for online learners.

5. Course structure and outline

The structure of the online course has unfortunately received very little attention as a significant factor in determining the level of success e-learners achieve on the e-learning engagement. Individual course structure and outline are a responsibility of the instructor. Instructors have the leverage to structure their courses as they see fit. However, that two- or three-page course outline can determine how successful e-learners will be on the e-learning engagement. Careful thought and planning must be used in developing a good course outline to assist e-learners to achieve their objectives.

Having taught on several e-learning engagements, I have observed that one of the things learners appreciate in a course outline is the dates for all exams and assignments being made available at the start of the course. E-learners use the course outline as a

planning tool, as a blueprint to help them organize their personal responsibilities, both job and family obligations, to ensure successful outcome on the e-learning engagement. It is important that instructors understand that not all e-learners are the typical high school students. Most e-learners are non-traditional students with family and job responsibilities; thus, a course outline with exam and assignment dates given at the start of the course allows learners to make the required planning from their end to accommodate these course requirements. Instructors should avoid course outlines that include exams and assignments but no due dates. This approach not only is ineffective but also presents serious problems for learners, especially the non-traditional learners who must juggle both family responsibilities and job commitments. A frequent complaint from non-traditional students is that there are instructors who would make an announcement that there will be an assignment at the end of the week or an exam will be administered in few days. Instructors who adopt this approach, that is, course outline with no exam/assignment due date at the start, should be aware that it presents unnecessary stress for the e-learner and could affect the successful outcome from the e-learning engagement.

Two other course structure-related issues are diversity in assessment and the consistency in the course layout. The layout of the course on the e-learning platform happens to be one of those issues that have not gained much attention, and it is difficult to understand why. The course layout should be consistent as the learner moves from module to module. It should not be that each module or topic has a different layout; this will result in confusion for the learners, especially those for whom the ease-of-use index for the LMS is very low. While it is the norm for instructors to determine their course structure and layout, it may be advisable for the institutions to provide a general oversight as a means of ensuring that instructors adopt a structure that is more friendly for learners.

The e-learning environment is not perfect; institutions try as much as possible to take the face-to-face experience and replicate it via the use of technology to reach multiple learners in remote locations. The successful outcome of the e-learning engagement will be influenced by the assessment method and the types of assessment that the instructor employs. Given the inherent limitations of e-learning, it is recommended that instructors plan their course assessment method carefully. The general recommendation is that there should be diversity in the assessment structure. The course structure should give learners the opportunity to be assessed using a varying combination of assessment types or formats. Learners should not be assessed using a single method because it is convenient for instructors, or the method allows for ease of grading. A mix of assessment methods should be considered by instructors, which would present learners with the opportunity to demonstrate their understanding of the material in different ways. The performance of learners engaged in e-learning normally improves when they are given the option to respond to questions in different ways, as against being restricted to communicate their understanding of the course material by using a single method.

The final area critical to achieving successful outcome for online learners is building class community among the learners. Most instructors tend to ignore class community.

6. Creating a class community

The e-learning environment can be a lonely and isolating engagement. Learners attend face-to-face classes not only for the academic information from instructors but also for the in-class interaction with their peers. Without this normal social

interaction among learners, the learning process can be negatively affected. It is well documented that one of the major concerns with the e-learning engagement is the feeling of isolation by students, which results in higher dropout rates compared with face-to-face instruction [16]. Creating a class community among e-learners is a very important mechanism, which instructors need to ensure is present in their courses.

The class community is an interacting learning model, where there is constant two-way communication between learners and learners and between instructors and learners. The main objective of the class community is to prevent learners from feeling isolated; in addition, the class community among learners also serves as a means of social network for learners. Online learners can use the class community as a means of creating study groups, where learners are able to meet and discuss course-related material online.

The challenge that instructors face is: how to design their online courses to create an effective class community? Creating a class community involves any activity that allows learners to interact or communicate with each other. Instructors can ask students to introduce themselves at the start of the course and share their areas of interest such as sports or other hobbies. The aim should be to get the students to begin talking, so that no one thinks he or she is the only person taking the course. As the course progresses, instructors can introduce discussion questions. One of the mistakes instructors make is using discussion questions as a means of assessment; this should not necessarily be the case. Remember, the aim of the class community is to allow the learners to experience the feeling of being part of a close social group and prevent the feeling of isolation, which is a real problem for e-learners [17–20]. Therefore, a discussion question could be one that asks learners to give their views on a typical issue being discussed in the public domain. The format of the discussion should be one where students can give rebuttals to comments made by their peers. Instructors could use this approach to award extra points (and we all know how students like extra points) for those who participate.

Structuring the online course to ensure that it creates a class community requires creativity on the part of instructors. The problem with an effective class community model is that the “community feeling” by online learners must be sustained or experienced for the duration of the e-learning engagement. Class community should not be present at the beginning of the course and should taper off by the middle of the course. Instructors should always encourage learners to form study groups, as one way of ensuring that the class community remains for the duration of the course. Institutional support is useful in helping inexperienced instructors who have no prior involvement in online teaching, to develop a class community interaction model. It is an unfortunate assumption of most institutions that the e-learning instructor is adept in all aspects of e-learning and all that is required is a supercharged LMS to deliver course content. Building an e-learning class community remains a very important factor in determining the success of learners engaged in online learning.

7. Conclusion

E-learning is here to stay. The pre-COVID-19 teaching and learning process has undergone a seismic shift in methodology, with e-learning becoming a main staple of the new teaching/learning model. The quicker we all embrace the inevitability of e-learning, the better it will be for all parties involved in the e-learning engagement, namely, the institutions, the instructors, and the learners.


This chapter has presented an overview of the key factors that determine a successful outcome for learners who are engaged in the e-learning environment. It is important that institutions understand their role in helping to shape the e-learning environment. Institutional responsibility extends far beyond the provision of robust, advanced learning management systems. Instructors also have a critical role to play in ensuring that the e-learning engagement is successful. Instructors are the agents of the institutions, interacting with the online learners, and thus, their effectiveness will determine the success of the institutions in attracting and retaining online students. Learners should also understand their responsibilities in helping to ensure that the e-learning engagement provides the successful outcome they are expecting. It is my hope that this chapter will provide a practical framework for all parties engaged in the e-learning environment, to better understand their role and responsibilities in creating a new paradigm for success in e-learning as we all move forward.

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The Perceptions of Primary School Teachers of Distance Education during the Pandemic Period: A Mixed Method Research

Ozgul Mutluer and Mine Celikoz

Abstract

This study aims to determine the views of classroom teachers about distance education during the pandemic period, to understand how distance education was applied in Turkey, and to determine whether the findings can be generalizable. For this purpose, the study was designed with the exploratory sequential mixed research design. In the qualitative dimension, teachers' opinions were collected through a semistructured form, and in the quantitative dimension, the scale was developed using these data. The scale was applied to a total of 719 classroom teachers throughout Turkey. Descriptive statistics were used to determine teachers' characteristics, opinions, and suggestions; a t-test, one-way analysis of variance was used to determine whether there was a difference between teachers' opinions according to some personal characteristics. The Scheffe test was used to determine the source of the differences. As a result of the research, it is found that 11.68% of all teachers believe that distance education practices are suitable for primary school students. Further, it is observed that there is a significant difference in some sub-dimensions such as experience, class size, place of duty, and the region where they work. But, there was no significant difference in terms of suggestions.

Keywords: classroom teacher, distance, education, exploratory, mixed

1. Introduction

Education has been seen in structuring distance education with modern methods.

There are various definitions in the literature on distance education [1–5]. When describing distance education, Moore and Kearsly [3] refer to a formation in which electronic or non-electronic systems are used as well as special education methods, techniques and practices, various communication ways, and normal teaching activities are carried out in different environments. In other words, while the objectives of teaching do not change with distance education, the method applied and the teaching environment actually change with the technique [6]. Distance education has several advantages as well as disadvantages. Among its advantages, there are features such as

providing education without time and place limits, providing equal opportunities, providing the opportunity to benefit from technological tools, and providing every learner with the opportunity to learn at their own pace [7, 8], however, it has disadvantages such as negatively affecting social skills, not being able to carry out studies that require practice, creating an addiction to information technologies, and difficulty in motivating learners [6, 9].

Although distance education has become a common teaching approach thanks to the development of information and communication technologies, it is known that it is actually a much older concept [10]. Distance education, which was first discussed as a concept in the annual catalog of the University of Wisconsin in the late 1800s, was only introduced in Germany and the United States after the mid-1900s. It has become applicable in France [11]. In Turkey, while the first distance education applications were made through television and by letter, which was implemented in 1961, the capacity of using information technologies in education was developed over time [12]. EİN (Education Informatics Network), which was introduced as the online social education platform of the General Directorate of Innovation and Educational Technologies in 2012, following the Fatih Project [13] implemented by the Ministry of National Education (MEB) to adapt technological developments to education. It aims to provide access to reliable information for teachers, students, and parents [14].

Distance education studies, which have a relatively long history in Turkey and all over the world, were most prevalent during the pandemic period [15]. Because face-to-face education has been suspended in many countries [16] due to the COVID-19 pandemic, which has started to affect the whole world since the first months of 2020, and educators all over the world switched to distance education in this period, and their designs were adapted to the changing needs required by the COVID-19 pandemic. They had to be adapted accordingly [17]. Distance education has been the only solution to prevent learning loss and ensure the continuity of education [18]. Many countries, including Turkey, have tried to prevent the disruption of educational activities with various measures [19]. Within the scope of the measures taken in Turkey, it was decided to switch to distance education as of March 23, 2020 [20]. While distance education allows a large number of learners to receive education services in the place where they live, the fact that the educational content and applications are provided and controlled from the center [21] has enabled it to offer an alternative way to the school during the period when education is suspended within the scope of pandemic measures. In the planned distance education process, it has been decided that the education will be carried out over the Education Informatics Network and via a national TV channel [22]. In the process of returning to school in September 2020, priority is given to first-grade students at the primary school level.

Hybrid education was gradually adopted, but with the increase in the number of cases across the country, full-time distance education was started again [23]. Due to the fact that the 2019–2020 academic year was spent in the shadow of the pandemic, most of the hybrid education was carried out with distance education tools. Although it can be said that studies on distance education started in Turkey in the early period, most of these studies are studies for higher education [12]. Based on this, it cannot be said that there is no distance education experience for primary school children in the context of Turkey. In younger age groups, it does not seem possible to quickly adapt to distance education. For this reason, the roles of classroom teachers, who undertake the education of students at the primary school level, have also changed and their responsibilities have increased significantly. Obtaining the opinions of classroom

teachers on distance education practices and the prevalence of these views throughout Turkey will give important clues about the process at the country level.

As the related literature is examined, it is seen that the research on distance education in general before the pandemic and the attitudes, opinions, and perceptions of the instructors-teacher candidates toward distance education [1, 6, 24–30] conducting distance education with different methods [31]; students' attitudes toward distance education [32]; distance education applications [33–35], and the developmental aspects of distance education processes [36–38]. With the pandemic, a large increase in the number of studies on distance education has been observed as a reflection of the massive transition to distance education [15, 39]. In these studies, it is seen that concepts such as emergency distance education are used in relation to distance education, especially during the pandemic period [40, 41]. It is argued that this definition differs from the classical distance education approach, especially in terms of planning, being sustainable, and being systematic [42, 43]. However, although the pandemic process of distance education practices have differences in terms of lack of planning, systematicity, and sustainability, it has given practitioners the experience of applying distance education and it is a way of applying distance education. In the current study, the literature review was carried out within the framework of the basic concept of distance education, including these concepts. It is seen that qualitative research methods are preferred more frequently in the research originating from Turkey that address the opinions of classroom teachers on distance education [44–54]. Likewise, studies conducted in Turkey that deal with the views of teachers in all branches of distance education (including classroom teachers) as a broader denominator [55–57] and the views of different stakeholders (including classroom teachers) [39, 58–61], it is seen that the qualitative research method is frequently adopted. It is seen that quantitative research methods are preferred relatively less in studies in which teachers (including classroom teachers) are selected as samples for distance education applications during the pandemic period [60, 62, 63].

The implementation of distance education applications in basic education and secondary education on a full-time basis has increased the need for the opinions of teachers, who are the main executives of the process and about the process. The opinions of these practitioners, who are at the center of the process, are to prevent disruptions before they cause significant problems and to help them in the future.

It will also provide enlightening information on how the distance education process, which is expected to be used as a non-formal education model, should be developed. Unlike the studies on distance education in the literature, in this study, the views of classroom teachers on distance education practices were examined with a mixed research paradigm, in other words, it is examined whether the views received from teachers in the qualitative dimension can be generalized across Turkey in the quantitative dimension. Since the distance education application, which started to be implemented on March 23, 2020, is the largest distance education application in the history of Turkey, the views on the process will also provide the opportunity to compare with the previous research data on this widespread application. In this context, the aim of the study is to develop a scale based on the opinions of teachers in order to determine the views of classroom teachers on distance education practices during the pandemic process, and to clearly reveal the similarities and differences between the views of teachers regarding the practices carried out in Turkey as a result of the application of the scale. It is thought that the use of exploratory mixed design in the current study is important in reaching the conclusion by using the qualitative and

quantitative dimensions of the research together. During the development of the scale, it is important to take as a reference the opinions of the classroom teachers working in the distance education applications during the pandemic period in Turkey as a reference. In line with the purpose of the study, answers to the following research questions are sought:

1. What are the views of primary school teachers about the distance education process?
2. Can the views of primary school teachers on the distance education process be generalized?

2. Methods

2.1 Model of the research

This study was designed in accordance with the exploratory sequential design, which is one of the mixed research methods. In the study, first of all, the views of basic education teachers on the distance education process were tried to be determined in detail. With the quantitative data collection tool prepared in light of the findings obtained as a result of the interviews, the exploratory sequential design was preferred in order to determine whether these views were accepted by other classroom teachers, in other words, whether the findings were generalizable. Teddlie and Tashakkori [64] define mixed methods research as integrated research that provides a depth of meaning by using qualitative and quantitative research methods together. Yıldırım and Şimşek [65] mention that mixed methods research has two functions. The first of these is to reveal the truth in a holistic and rich framework, while the second is to strengthen the credibility of the research results with the data collected by different methods. When the mixed research method is chosen in accordance with the purpose of the research, it eliminates the disadvantages of the two methods (qualitative and quantitative) and combines the advantages of these two methods [64]. In the exploratory sequential mixed design, the data obtained by qualitative methods provide the opportunity to determine the generalizability of the obtained data by being a source for the creation of the measurement tool to be used in the quantitative method [66]. In the research process, first of all, qualitative data were collected through a semi-structured interview form in order to determine the opinions of classroom teachers about distance education. It was used to design and develop a quantitative scale resulting from the analysis of qualitative data. As a result of the application of the quantitative measurement tool, it is aimed to test the qualitative findings and measure their generalizability. The use of quantitative and qualitative methods in the research process is symbolized as “QUAL → quan”. The research process is schematized in **Figure 1**.

2.2 Universe and sample

2.2.1 Qualitative working group

In the qualitative aspect of the research, the study group consists of 10 classroom teachers who work in public primary schools in Yalova, Istanbul, Ankara, and

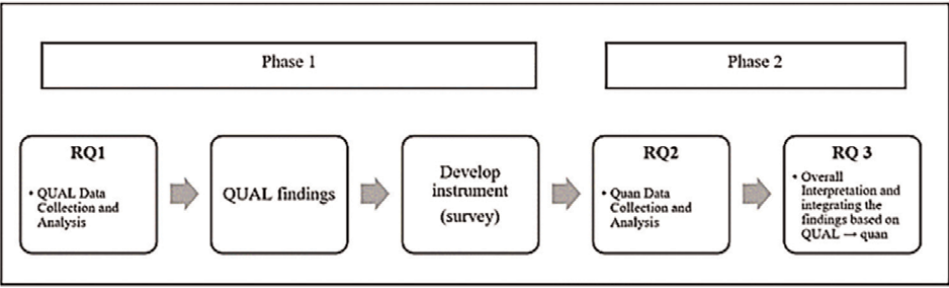


Figure 1.
Diagram of the research process structured in accordance with the exploratory sequential design.

Eskişehir and carry out distance education studies with easy accessibility and purposeful sampling method (**Table 1**). In order to determine the opinions of classroom teachers about distance education, teachers working in different provinces and at different grade levels and with at least 5 years of professional experience were included in the study group. In addition, attention was paid to equal representation of the class level variable of the participants.

2.2.2 Sample of quantitative dimension

The universe of the study consists of classroom teachers working in state primary schools throughout Turkey. According to the 2020 data from the Turkish Statistical Institute (TSI), the number of classroom teachers working in state primary schools throughout Turkey is 275,733. The sample size to collect quantitative data was calculated as 384, taking into account the 95% confidence level and 5% sampling error [67]. From this point of view, 719 classroom teachers were included in the study as a sample group with a simple random sampling method. Demographic characteristics of the sample group from which quantitative data were collected are presented in **Table 2**. While forming the sample group, attention was paid to the inclusion of classroom teachers from all geographical regions in the research.

Code	Gender	Class level	Class size	Professional experience
P1	F	3	24	25 years
P2	F	2	25	32 years
P3	F	2	18	10 years
P4	M	1	30	18 years
P5	F	3	22	9 years
P6	M	4	33	10 years
P7	M	4	19	14 years
P8	M	1	20	10 years
P9	F	4	25	12 years
P10	F	3	33	28 years

Table 1.
Information on participants in the qualitative working group.

Gender	F	%
Female	434	60.36
Male	285	39.63
Experience	F	%
1–5 years	94	13.07
6–15 years	245	34.07
16–25 years	219	30.45
26 years and more	161	22.39
Working Area	F	%
Marmara	115	15.99
Aegean	67	9.31
Central Anatolia	33	4.58
Mediterranean	60	8.34
Black Sea	54	7.51
Eastern Anatolia	20	2.78
Southeastern Anatolia	58	8.06
Working Place	F	%
Provincial center	197	27.39
District center	144	20.02
Village	66	9.17
Class Size	F	%
15 persons and below (1)	133	18.49
16–25 people (2)	250	3.47
26–35 people (3)	260	3.61
36 people and above (4)	76	10.57

Table 2.

Information on demographic characteristics of the participants in the sample from which quantitative data were collected.

2.3 Data collection tools

2.3.1 Qualitative data collection tool

A semi-structured interview form was used in order to determine the participant's views in the qualitative dimension. In the interviews, not only the questions in the interview form but also different numbers and content according to the course of the interview were included.

Interviews were made via video over an online communication program and during the interview, the conversations were recorded with a voice recorder, while research notes were kept at the same time. Interview durations varied for each participant, but lasted approximately 30–45 minutes. In the process of preparing the interview questions, first of all, a form was created by scanning the relevant literature by one of the researchers, and then it was presented to the opinion of the other

researcher who is an expert in the field of educational sciences and mixed research. After the comments were received, the form was rearranged. Then, a pilot interview was conducted with two teachers who were not included in the study group. As a result of these studies, a data collection tool consisting of four questions and related drilling questions was obtained.

2.3.2 Quantitative data collection tool

In order to collect the quantitative data for the research, the scale of “Teacher Opinions and Suggestions on Distance Education Applications of the Ministry of National Education for Primary School Level” and “Personal Information Form” prepared by the researchers were used. The data collection tool used was (1) Teacher, (2) Student, (3) Parent, (4) Plan, (5) Environment, (6) Participation, (7) Method (8) Assessment, and (9) Suggestions. It consists of 9 subscales, 28 of which are negative and 18 of which are positive, a total of 46 items. The personal information form, on the other hand, consists of 14 questions including gender, years of service, grade level taught, frequency of meeting with parents, and the number of students.

In the scale development process, in the first stage, an item pool was created based on the themes reached in line with the qualitative data analysis of the research. In the creation of the item pool, attention was paid to including the common views expressed by the participants, the typical situations experienced during the distance education process, the opinions that the participants insistently emphasized, and the remarkable statements. After the item pool was created, the scope and consistency of the scale items in terms of qualitative findings were examined by two experts. In addition, two classroom teachers were evaluated in terms of face validity by applying the scale. As a result of the arrangements made, the scale consisting of 64 items was made ready for pilot application. Scale development studies were carried out in line with the data obtained as a result of the pilot application.

2.4 Process steps

In the process of analyzing the quantitative data, first of all, validity and reliability studies of the measurement tool were carried out. In order to determine the content validity, a specification table was created and the items written for each dimension were reviewed. KMO (Kaiser-Meyer-Olkin = ,903) and Bartlett Sphericity test ($X^2 = 6155,47$, $sd = 1275$, $p = .000$) were made. The obtained KMO coefficient showed that the sample size was “very good”, and the Bartlett Sphericity test result showed that there was a correlation between the scale items and also there was a sufficient relationship between the variables for factor analysis since it had a p-value less than 0.05 significance level. These obtained values prove the suitability of the research data for exploratory factor analysis (EFA) [68, 69].

According to the factor analysis results, when the suggestions dimension of the scale is excluded, the total variance explanation rate of the scale consisting of 39 items for measuring 8 factors is 61.55%, and factor loading values vary between 0.21 and 0.73. There are five items in the scale with a load value below 0.30. Since these items were not considered appropriate to be removed from the scale in line with expert opinion, they remained within the scope of the scale. In addition, the “Suggestions” dimension, which is among the scale dimensions, was analyzed independently from other dimensions, since it did not provide a significant value in terms of the total score of the scale. As a result of the factor analysis made for this dimension, it was

determined that the total variance explanation rate of this dimension, which consists of 7 items, varied between 0.35 and 0.52.

In line with the reliability study of the scale, the consistency of the items in the scale was examined by using the Cronbach Alpha and split-half method. The Spearman-Brown reliability calculated by the split-half method was found to be 0.91 for the whole scale, while the Cronbach Alpha reliability was found to be 0.93. For the suggestions dimension, Cronbach Alpha reliability was found to be 0.81 and Spearman-Brown reliability was found to be 0.72. In **Tables 3** and **4**, factor analysis results for the scale and Cronbach Alpha reliability coefficients for general and sub-dimensions are given.

In the analysis results of the scale's total variance explanation rates, it was seen that the first factor explained 14,842% of the total variance. Afterward, the total variance of the second factor was 11.04%, the third factor 7.31%, the fourth factor 6.79%, the fifth factor 6.76%, the sixth factor 6.53%, the seventh factor 4.64%, and the eighth factor 4%, It is seen that adding 0 contribution increases the total variance explained to 61.56%. **Table 5** shows the total variance explanation rates of the scale.

Dimensions	Items	Factor loadings	Total variance explanation ratio	Cronbach Alpha confidence
1. Teacher	Teacher 4	,443	40.81	,71
	Teacher 5	,447		
	Teacher 7	,267		
	Teacher 8	,510		
	Teacher 9	,419		
	Teacher 10	,363		
2. Student	Student 1	,484	51.92	,62
	Student 2	,429		
	Student 4	,704		
	Student 5	,683		
	Student 7	,534		
	Student 8	,468		
	Student 9	,334		
3. Parent	Parent 1	,237	49,22	,78
	Parent 2	,519		
	Parent 3	,586		
	Parent 4	,596		
	Parent 5	,477		
	Parent 6	,538		
4. Plan	Plan1	,583	50.68	,51
	Plan2	,486		
	Plan3	,452		

Dimensions	Items	Factor loadings	Total variance explanation ratio	Cronbach Alpha confidence
5. Environment	Environment 9	,435	50.63	,84
	Environment 1	,383		
	Environment 2	,589		
	Environment 7	,639		
	Environment 8	,428		
	Environment 3	,721		
	Environment 4	,435		
6. Participation	Participation 1	,645	58.05	,74
	Participation 2	,734		
	Participation 6	,259		
	Participation 3	,684		
7. Method	Method 1	,729	72.93	,63
	Method 3	,729		
8. Assessment and evaluation	Assessment 1	,212	41.69	,52
	Assessment 2	,624		
	Assessment 3	,612		
	Assessment 4	,219		
Total (8 Dimensions)			61,55	,93

Table 3.
Factor analysis results regarding the scale.

Dimension	Items	Factor loadings	Total variance explanation ratio	Cronbach Alpha confidence
Suggestion	Suggestion 1	,445	46.48	,81
	Suggestion 2	,489		
	Suggestion 3	,350		
	Suggestion 4	,486		
	Suggestion 7	,507		
	Suggestion 8	,454		
	Suggestion 9	,522		

Table 4.
Factor analysis results regarding the recommendations dimension.

As a result, it was decided to use the scale as a data collection tool in this study, since the validity and reliability analyzes of the “MoNE’s Teacher Opinions and Suggestions Scale on Distance Education Applications for Primary School 1st Level” showed that the scale is valid and reliable. The fact that the total score of the scale, calculated without including the suggestions dimension, is high, indicates that the

Dimensions	Contribution to the explained variance	Total variance explained
1	14,482	14,482
2	11,038	25,520
3	7,313	32,833
4	6,789	39,622
5	6,755	46,377
6	6,535	52,912
7	4,636	57,548
8	4,006	61,554

Table 5.
Explanation ratios of the total variance of the scale.

views of the teachers on distance education practices in primary school 1st level are positive, while the low ones indicate that they are negative. Scoring of the scale items created in 5-point Likert type was scored from 1 to 5 from “Strongly Disagree” to “Strongly Agree”.

2.5 Data collection and analysis

2.5.1 Qualitative data collection and analysis

Before collecting the data, necessary research permission was obtained from the relevant units of the Ministry of National Education. The data collection process was carried out to cover the months of November and December for the 2020 fall semester. The interviews recorded during the research process were transcribed and combined with field notes. The transcripts were read again by the researcher and the coding process was carried out. During the coding process, attention was paid to the causal relationship between the answers, not the order of answers given to the questions. The coded data were categorized by considering the cause-and-effect relationship, the categories were associated with each other, and themes were determined in line with the purpose of the research. Content analysis was used to interpret the data. While the themes determined as a result of the content analysis constitute the sub-dimensions of the scale created for the collection of quantitative data. The codes obtained were used in the process of creating the item pool.

2.5.2 Quantitative data collection and analysis

First of all, ethics committee permission was obtained for the application of the prepared scale to the determined sample. After obtaining permission, the scale was applied to classroom teachers working in primary schools affiliated with the Ministry of National Education throughout Turkey via Google Forms. In the process of reaching the sample, support was received from the provincial and district national education directorates. Participants were included in the data collection process on a voluntary basis. The quantitative data collection process covers the spring term of 2020–2021. This process took place in a period of approximately 5 months between January and May 2021.

In the analysis of the data of the research, firstly the distribution and homogeneity of the data were tried to be determined. For this, the Skewness (skewness), Kurtosis (Kurtosis), and Kolmogorov-Smirnov values of the total teacher opinions variable were examined. The skewness coefficient was -0.49, the kurtosis coefficient was -1.72, and Kolmogorov-Smirnov 0.18. It was understood that the distribution of the data was normal and homogeneous because the skewness and kurtosis values were between +2.58 and -2.58 [70] and the Kolmogorov-Smirnov value was $p > 0.05$ [67].

In order to determine the opinions and suggestions of teachers regarding their personal characteristics and distance education applications, the descriptive statistics frequency (f), percentage (%), arithmetic mean (\bar{X}_{LD}), and standard deviation (ss) are used to determine whether there is a difference between teachers' opinions according to some personal characteristics. The t-test, one-way analysis of variance, and the Scheffe test were used to determine the source of the difference. A significance level of 0.05 was used to test for differences.

2.6 Ethic

In the research process, permission was obtained from the relevant institutions before starting the data collection phase. Prior to the semi-structured interviews, the participants were included in the study with their informed consent. In order to collect quantitative data, the statements and explanations at the beginning of the scale were provided to the participants to have information about the research and their consent was obtained. No information about the identity of the participants and their place of duty was given, and private information about the participants was kept confidential.

2.7 Ethics committee permission certificate

This research was approved ethically by Yıldız Technical University Social and Human Sciences Research Ethics Committee with meeting number 2021/01 on 21.03.2021.

3. Results

The findings obtained in this part of the research are discussed under two separate headings. First of all, the findings related to the qualitative data, and then the findings obtained from the quantitative data are included.

3.1 Findings obtained from qualitative data

The data obtained in the research were analyzed by content analysis. As a result of the interpretation of qualitative data with content analysis, 9 themes emerged. These are "teacher", "student", "parent", "plan", "environment", "participation", "method", "assessment-evaluation" and "recommendations". The codes obtained in line with these main themes were used as data in the creation of the quantitative data collection tool.

The codes reached within the teacher theme show that the distance education process has some physical and psychological effects on teachers. Regarding this, K2

used the following statements: “... it certainly does not hold a classroom environment. It’s also really tiring for me. I don’t remember ever being this tired when I was in class ...”.

The codes reached within the student theme show that some students enjoyed this process, developed their individual learning skills and had an efficient learning process; shows that some students face problems such as emotional deprivation and reluctance. An example of the negative reflections of distance education on students

K1 used the following expressions as: “... At first, they were all very excited while talking on video. Then they got bored too. They are tired of this process too ...”.

Within the parent theme, codes showing that distance education has some advantages and disadvantages for parents have been reached. According to the participant’s opinions, parents should spare time for their children and be involved in teaching activities during the distance education process.

While he/she could find the opportunity, he/she also had some problems in using technological tools. At the same time, the participants stated that the parents could be uninterested in this process and that they could find the distance education applications useless. Regarding this, K5 states the following: “...The child does not sit alone and say I should study a little bit, send a message to my teacher. Many do not have enough awareness. The children of the concerned parents make more returns. There is no response from my parents who are uninterested or have a low education level and who are not in touch with technology ...”

The codes reached under the theme of the plan show that classroom teachers enter into a rapid transformation and adaptation in order not to disrupt teaching during the planning process. Regarding this, K8 said, “...I benefited from my monthly and annual plans in regular education ...”

when using expressions; K1 said, “...I also watch EBA TV course topics and give homework on the same subject ...”.

Within the environment theme, codes showing that online environments have negative effects on the teaching process have been reached. Participants draw attention to the equipment and connection problems, as well as the lack of social interaction as a result of distance education. As an example, K4 used the following expressions: “... Being a teacher means love, especially in primary school, and warmth means one-to-one communication. Here we lack that excitement ...”.

The codes reached within the participation theme show that there are some problems in the distance education process regarding student participation. Participants state that students cannot participate in distance education activities regularly, and students who participate cannot be active in the lessons. For example, K7 states the following: “...I think that live lessons for distance education are teacher-centered. The student becomes passive and listening. It only becomes active when it wants to ask questions ...”

Within the method theme, codes were found showing that classroom teachers benefited from various online tools and applications in distance education, but they did not find them sufficient. The codes reached within the measurement-evaluation theme also show that it cannot perform adequate measurement with the tools used in distance education. As an example, K2 used the following statements: “... But for example, it can be done as an online test for fourth graders. I think the online test will also have many disadvantages. You don’t know if your parents are telling you the answers. You can’t tell if you’re measuring correctly ...”.

The codes reached within the theme of suggestions show that suggestions are put forward regarding providing financial support, strengthening infrastructure and communication, enriching content, parent education, and providing printed material. For example, K2 used the following statements: “...I think it would be more fair for

everyone if these opportunities were provided to children who do not have an internet connection or computer at home ...”

3.2 Findings obtained from quantitative data

In the quantitative dimension of the study, after descriptive analyzes of scale scores were included, findings according to variables and correlation findings were included. **Table 6** shows the descriptive statistical results of the opinions and suggestions of the classroom teachers regarding distance education practices at the primary school level.

The descriptive statistics data in **Table 6** show the level of participation of classroom teachers in the views on distance education practices at the primary

Factor	Queue	Matter	n	\bar{x}	ss
Teacher	4	My motivation to teach is lower than face-to-face education	719	2,97	1,47
	5	I'm mentally exhausted	719	1,93	1,19
	7	I enjoy my lessons very much	719	3,56	1,15
	8	I feel bad because there is no emotional interaction like in face-to-face education	719	2,50	1,29
	9	I have communication problems with students and parents	719	3,18	1,32
	10	Constantly staring at the computer screen hurts my eyesight	719	1,75	1,05
	Total		719	2,65	,79
Student	1	Cannot get efficiency in the distance education process	719	2,78	,77
	2	They perceive this process as a holiday.	719	2,86	1,33
	4	Interested and curious	719	3,59	1,08
	5	They enjoy the lessons	719	3,72	1,01
	7	Reluctant to participate in events	719	3,21	1,27
	8	Developed individual learning skills	719	3,53	1,09
	9	They experience emotional deprivation because there is no physical contact	719	2,04	1,14
	Total		719	3,10	,62
Parent	1	They have difficulty using distance education tools	719	2,63	1,30
	2	Generally satisfied with the training provided	719	3,93	1,03
	3	They are not interested	719	3,42	1,25
	4	They can give their children the support expected of them.	719	3,52	1,18
	5	They spend more time with their children	719	3,49	1,22
	6	They find education useless	719	3,71	1,27
	Total		719	3,45	,84
Plan	1	I can implement my plans without any problems.	719	3,72	1,10
	2	I run my classes in parallel with EBA TV.	719	3,51	1,26
	3	I can't reach high level gains	719	2,67	1,28
	Total		719	3,30	,86

Factor	Queue	Matter	n	\bar{x}	ss
Environment	1	My students cannot obtain the necessary equipment (computer, internet, etc.) to attend the course.	719	2,68	1,29
	2	My students have frequent access issues	719	2,49	1,20
	3	I'm having access problems	719	3,00	1,33
	4	I have difficulty interacting with students	719	3,08	1,38
	7	I have difficulty concentrating on students	719	2,83	1,31
	8	I can't create synergy in my lessons	719	3,13	1,34
	9	My students do not have enough social interaction in the lessons	719	2,23	1,25
	Total		719	2,78	,92
Participation	1	My students do not follow events regularly	719	2,94	1,26
	2	They have a low level of participation	719	2,95	1,41
	3	I find it difficult to get student participation	719	2,80	1,36
	6	The time is not enough for my students to be active in the lesson	719	2,73	1,37
	Total		719	2,86	1,02
Method	1	I cannot use effective methods and techniques that I want to use	719	2,57	1,22
	3	It is not possible to discuss in class	719	2,45	1,28
	Total		719	2,51	1,06
Assessment and Evaluation	1	I can have one-on-one interviews with students who cannot do their homework.	719	3,71	1,14
	2	I'm having trouble checking homework	719	2,59	1,39
	3	I cannot make a reliable measurement and evaluation.	719	2,46	1,24
	4	My students have not forgotten their learning in the face-to-face education process	719	3,87	1,13
	Total		719	3,16	,79
Suggestions	1	Financial support should be provided to students who do not have the necessary equipment.	719	4,73	,67
	2	Infrastructure should be strengthened so that distance education can be carried out simultaneously for all students.	719	4,69	,75
	3	The content in the EBA application should be enriched.	719	4,66	,71
	4	Fun activities should be done that will attract the attention of the students.	719	4,75	,60
	7	Parents should be informed about distance education.	719	4,61	,75
	8	It should be ensured that teachers and parents are in constant communication.	719	4,52	,79
	9	Printed materials should be provided for students.	719	4,63	,73
	Total		719	4,65	,49

Table 6.
Descriptive statistics results of teachers' opinions and suggestions on distance education applications for primary school level.

school level. When the arithmetic averages of the sub-dimensions of the scale are examined, it is seen that the primary school teachers are teacher ($\bar{x} = 2.65$), student ($\bar{x} = 3.10$), plan ($\bar{x} = 3.30$), environment ($\bar{x} = 2.78$), participation ($\bar{x} = 2.86$), moderately agreed with the opinions put forward in the dimensions of measurement-evaluation ($\bar{x} = 3.16$); they highly agree with the opinions put forward in the dimension of parents ($\bar{x} = 3.45$). Regarding the suggestions ($\bar{x} = 4.65$) dimension, it is seen that they have a very high level of participation. Regarding the method ($\bar{x} = 2.51$) dimension, it is understood that the classroom teachers have a low level of participation. It has been observed that there is a high level of participation in the views that both students ($\bar{x} = 3.72$) and teachers ($\bar{x} = 3.56$) enjoy the lessons in distance education. Teachers are highly unanimous on suggestions for improving distance education practices. In **Table 7**, the results of the one-way analysis of variance, which includes the comparison data between the views of teachers on primary school distance education practices on the basis of different geographical regions throughout Turkey, are given.

As can be seen in **Table 6**, there was no significant difference between the geographical regions in the suggestions dimension of the opinions of the classroom teachers about distance education at the primary school level. However, in teacher dimension ($F = 2.19$; $p < .05$), student dimension ($F = 2.89$; $p < .05$), parent dimension ($F = 3.47$; $p < .05$), plan dimension ($F = 2.67$; $p < .05$), medium dimension ($F = 7.16$; $p < .05$), participation dimension ($F = 6.65$; $p < .05$), method dimension ($F = 2.93$; $p < .05$), one-way analysis of variance on the scores according to the geographical region variable in the measurement-evaluation dimension ($F = 2.17$; $p < .05$) and the total scale dimension ($F = 5.35$; $p < .05$). As a result, it is seen that there is a statistically significant difference between the

Dimensions	Region	n	\bar{x}	ss	F	p	Meaning
Teacher	Marmara	115	2,49	,72	2,192	,043*	SE-M, SEA-E, SEA-K, EA-E, CA-E
	Aegean	67	2,59	,68			
	Central Anatolia	33	2,33	,70			
	Mediterranean	60	2,34	,78			
	Black Sea	54	2,47	,61			
	Eastern Anatolia	20	2,33	,86			
	Southeastern Anatolia	58	2,20	,62			
Student	Marmara	115	3,08	,60	2,885	,009*	SEA-E, SEA-M, SEA-K, SEA-EA, SEA-Md, E-CA, E-Md
	Aegean	67	3,27	,56			
	Central Anatolia	33	3,03	,45			
	Mediterranean	60	3,05	,68			
	Black Sea	54	3,19	,54			
	Eastern Anatolia	20	3,10	,57			
	Southeastern Anatolia	58	2,85	,69			

Dimensions	Region	n	\bar{x}	ss	F	p	Meaning
Parent	Marmara	115	3,44	,75	3,474	,002*	SEA-M, EA-M, SEA-E, SEA-CA, BS-Md, SEA-Md, K-EA, SEA-K, SEA-EA
	Aegean	67	3,51	,78			
	Central Anatolia	33	3,48	,81			
	Mediterranean	60	3,33	,77			
	Black Sea	54	3,64	,74			
	Eastern Anatolia	20	3,42	,71			
	Southeastern Anatolia	58	3,03	,93			
Plan	Marmara	115	3,22	,76	2,666	,015*	SEA-BS, SEA-Md, SEA-E, SEA-M, EA-E, CA-E, E-M
	Aegean	67	3,48	,83			
	Central Anatolia	33	3,10	,77			
	Mediterranean	60	3,28	,81			
	Black Sea	54	3,27	,81			
	Eastern Anatolia	20	3,07	,62			
	Southeastern Anatolia	58	2,94	,92			
Environment	Marmara	115	2,85	,81	7,157	,000*	M-SEA, E-SEA, CA-SEA, Md-SEA, BS-SEA, E-CA, E-Md, E-BS, CA-M, M-Md, EA-M, E-EA, EA-CA, EA-Md, EA-BS, EA-SEA
	Aegean	67	2,93	,92			
	Central Anatolia	33	2,54	,84			
	Mediterranean	60	2,56	,83			
	Black Sea	54	2,64	,89			
	Eastern Anatolia	20	1,92	,76			
	Southeastern Anatolia	58	2,21	1,00			
Participation	Marmara	115	2,82	1,02	6,646	,000*	EA-SEA, EA-BS, EA-Md, EA-CA, EA-E, EA-M, SEA-BS, SEA-Md, SEA-CA, SEA-E, SEA-M, CA-M
	Aegean	67	3,04	,94			
	Central Anatolia	33	2,49	1,04			
	Mediterranean	60	2,68	,92			
	Black Sea	54	2,71	1,08			
	Eastern Anatolia	20	1,86	,61			
	Southeastern Anatolia	58	2,21	,97			
Method	Marmara	115	2,55	1,04	2,933	,008*	SEA-M, SEA-E, SEA-CA, SEA-Md, EA-Md, EA-E, EA-M, CA-E
	Aegean	67	2,58	1,05			
	Central Anatolia	33	2,33	1,04			
	Mediterranean	60	2,52	1,08			
	Black Sea	54	2,25	,90			

Dimensions	Region	n	\bar{x}	ss	F	p	Meaning
Assessment-Evaluation	Eastern Anatolia	20	2,10	,94	2,165	,046*	SEA-BS, SEA-M, SEA-E, EA-E, EA-M, Md-E
	Southeastern Anatolia	58	2,01	,84			
	Marmara	115	3,17	,69			
	Aegean	67	3,25	,77			
	Central Anatolia	33	3,04	,65			
	Mediterranean	60	2,99	,86			
	Black Sea	54	3,16	,77			
	Eastern Anatolia	20	2,89	,91			
	Southeastern Anatolia	58	2,85	,79			
Total	Marmara	115	3,53	,61	5,354	,000*	SEA-BS, SEA-Md, SEA-CA, SEA-E, SEA-M, EA-BS, EA-Md, EA-E, EA-M, CA-E
	Aegean	67	3,66	,62			
	Central Anatolia	33	3,37	,51			
	Mediterranean	60	3,42	,66			
	Black Sea	54	3,50	,55			
	Eastern Anatolia	20	3,18	,49			
	Southeastern Anatolia	58	3,12	,65			
Suggestions	Marmara	115	4,65	,54	,332	,920	-
	Aegean	67	4,60	,47			
	Central Anatolia	33	4,62	,62			
	Mediterranean	60	4,63	,44			
	Black Sea	54	4,68	,46			
	Eastern Anatolia	20	4,74	,36			
	Southeastern Anatolia	58	4,68	,42			

$P > 0.05$

Table 7.
One-way analysis of variance results on the comparison of teachers' opinions and suggestions on distance education applications at primary school level by geographical regions.

averages. In **Table 8**, the results of the one-way analysis of variance, which include the comparison of primary school teachers' views on distance education practices at the primary school level, according to the variable of years of service are given.

According to **Table 7**, there was no significant difference in terms of years of service in the dimension of suggestions made by classroom teachers for distance education

Dimensions	Experience	n	\bar{x}	ss	F	p	Meaning
Teacher	1–5 years (1)	94	2,48	,76	13,444	,000*	1–4
	6–15 years (2)	245	2,46	,73			2–3
	16–25 years (3)	219	2,73	,76			2–4
	26 years and more (4)	161	2,91	,85			
Student	1–5 years (1)	94	2,85	,64	7,672	,000*	1–2
	6–15 years (2)	245	3,08	,58			1–3
	16–25 years (3)	219	3,19	,63			1–4
	26 years and more (4)	161	3,16	,61			
Parent	1–5 years (1)	94	3,16	,87	15,121	,000*	1–3
	6–15 years (2)	245	3,27	,89			1–4
	16–25 years (3)	219	3,61	,76			2–3
	26 years and more (4)	161	3,69	,75			2–4
Plan	1–5 years (1)	94	2,82	,82	22,121	,000*	1–2
	6–15 years (2)	245	3,15	,87			1–3
	16–25 years (3)	219	3,54	,78			1–4
	26 years and more (4)	161	3,48	,81			2–3
Environment	1–5 years (1)	94	2,24	,88	27,227	,000*	2–4
	6–15 years (2)	245	2,58	,83			1–3
	16–25 years (3)	219	3,01	,93			1–4
	26 years and more (4)	161	3,08	,87			2–3
Participation	1–5 years (1)	94	2,32	,97	17,108	,000*	2–4
	6–15 years (2)	245	2,73	,98			1–3
	16–25 years (3)	219	3,07	1,02			1–4
	26 years and more (4)	161	3,08	,95			2–3
Method	1–5 years (1)	94	2,14	,99	9,602	,000*	1–3
	6–15 years (2)	245	2,38	1,00			1–4
	16–25 years (3)	219	2,63	1,09			2–4
	26 years and more (4)	161	2,76	1,05			
Assessment-Evaluation	1–5 years (1)	94	2,97	,81	7,995	,000*	1–3
	6–15 years (2)	245	3,03	,78			2–3
	16–25 years (3)	219	3,33	,82			
	26 years and more (4)	161	3,23	,71			
Total	1–5 years (1)	94	3,21	,63	23,118	,000*	1–3
	6–15 years (2)	245	3,42	,62			1–4
	16–25 years (3)	219	3,72	,67			2–3
	26 years and more (4)	161	3,75	,62			2–4

Dimensions	Experience	n	\bar{x}	ss	F	p	Meaning
Suggestions	1–5 years	94	4,70	,43	1,604	,187	-
	6–15 years	245	4,66	,49			
	16–25 years	219	4,68	,42			
	26 years and more	161	4,58	,59			

Table 8.
One-way analysis of variance results on the comparison of teachers' opinions and suggestions on distance education applications for primary school level by year of service.

practices at the primary school level. In the teacher dimension ($F = 13.44$; $p < .05$), the student dimension ($F = 7.67$; $p < .05$), the parent dimension ($F = 15.12$; $p < .05$), the plan dimension ($F = 22.12$; $p < .05$), the medium dimension ($F = 27.23$; $p < .05$), the participation dimension ($F = 17.11$; $p < .05$), the method dimension ($F = 9.60$; $p < .05$), in the measurement-evaluation dimension ($F = 8.00$; $p < .05$) and in the total scale dimension ($F = 23.12$; $p < .05$), the opinions of the primary school teachers differ according to their professional seniority. Classroom teachers whose professional seniority is between 1 and 5 years have the lowest average in all sub-dimensions. The results of the one-way analysis of variance, which includes the comparison of primary school teachers' views on distance education practices at the primary school level, according to the variable of a place of employment are given in **Table 9**.

When the data in **Table 9** are examined, no significant difference was found according to the teachers, students, parents, and suggestions dimension of the views of the classroom teachers regarding the distance education practices, and according to the variable of the place of duty. When the opinions of the classroom teachers

Dimensions	Working Place	n	\bar{x}	ss	F	p	Meaning
Teacher	Provincial center	197	2,44	,69	,816	,443	—
	District center	144	2,44	,73			
	Village	66	2,32	,72			
Student	Provincial center	197	3,07	,59	2,502	,083	—
	District center	144	3,16	,63			
	Village	66	2,96	,61			
Parent	Provincial center	197	3,42	,73	2,088	,125	—
	District center	144	3,47	,82			
	Village	66	3,23	,93			
Plan	Provincial center	197	3,26	,76	6,649	,001*	Provincial center - Village District center - Village
	District center	144	3,31	,88	6,649		
	Village	66	2,89	,75	6,649		

Dimensions	Working Place	n	\bar{x}	ss	F	p	Meaning
Environment	Provincial center	197	2,73	,90	12,105	,000*	Provincial center
	District center	144	2,72	,90			- Village
	Village	66	2,14	,82			District center - Village
Participation	Provincial center	197	2,70	1,00	4,204	,016*	Provincial center
	District center	144	2,76	1,02			- Village
	Village	66	2,34	1,02			District center - Village
Method	Provincial center	197	2,44	1,00	3,942	,020*	Provincial center
	District center	144	2,47	,97			- Village
	Village	66	2,08	1,09			District center - Village
Assessment-Evaluation	Provincial center	197	3,08	,75	3,924	,021*	District center
	District center	144	3,19	,81			- Village
	Village	66	2,88	,71			
Total	Provincial center	197	3,47	,60	6,833	,001*	Provincial center
	District center	144	3,53	,63			- Village
	Village	66	3,19	,62			District center - Village
Suggestions	Provincial center	197	4,61	,55	1,573	,209	—
	District center	144	4,67	,44			
	Village	66	4,72	,34			

Table 9.

One-way analysis of variance results on the comparison of teachers' opinions and suggestions on distance education practices at primary school level by position.

working in the city and district centers and the classroom teachers working in the villages were compared, a significant difference was found in the total scale dimension ($F = 6.83$; $p < .05$). At the same time, plan ($F = 6.65$; $p < .05$), setting ($F = 12.11$; $p < .05$), participation ($F = 4.20$; $p < .05$), method ($F = 3.94$; $p < .05$), and assessment-evaluation ($F = 3.92$; $p < .05$)

There was also a significant difference between the views according to the variable of the place of duty in the dimensions. In **Table 10**, the results of the one-way analysis of variance regarding the comparison of teachers' opinions and suggestions regarding distance education practices for the primary school level are given.

As seen in **Table 10**, there is no significant difference between the views of classroom teachers on distance education in terms of classroom size, according to the results of a one-way analysis of variance in the dimensions of teacher, student, method, and measurement-evaluation. In terms of suggestions, there was no significant difference between the opinions according to the number of students. However, parent ($F = 4.16$; $p < .05$), plan ($F = 9.73$; $p < .05$), environment ($F = 6.19$; $p < .05$), participation ($F = 4.67$; $p < .05$), and total scale ($F = 5.29$; $p < .05$) dimensions, a significant difference was found between the views according to the variable of the number of students. Classroom teachers with a class size of 15 or less have the lowest

Dimensions	Classroom Size	n	\bar{x}	ss	F	p	Meaning
Teacher	15 persons and below (1)	133	2,58	,77	1,103	,347	—
	16–25 people (2)	250	2,61	,79			
	26–35 people (3)	260	2,71	,80			
	36 people and above (4)	76	2,67	,82			
Student	15 persons and below (1)	133	2,98	,59	2,586	,052	—
	16–25 people (2)	250	3,11	,60			
	26–35 people (3)	260	3,13	,63			
	36 people and above (4)	76	3,21	,66			
Parent	15 persons and below (1)	133	3,25	,78	4,155	,006*	1–3 1–4
	16–25 people (2)	250	3,44	,83			
	26–35 people (3)	260	3,53	,85			
	36 people and above (4)	76	3,60	,89			
Plan	15 persons and below (1)	133	2,98	,85	9,729	,000*	1–2 1–3 1–4
	16–25 people (2)	250	3,28	,85			
	26–35 people (3)	260	3,46	,80			
	36 people and above (4)	76	3,39	,94			
Environment	15 persons and below (1)	133	2,54	,90	6,185	,000*	1–3 1–4
	16–25 people (2)	250	2,74	,88			
	26–35 people (3)	260	2,85	,91			
	36 people and above (4)	76	3,06	1,02			
Participation	15 persons and below (1)	133	2,61	1,01	4,665	,003*	1–4
	16–25 people (2)	250	2,87	1,02			
	26–35 people (3)	260	2,89	,97			
	36 people and above (4)	76	3,13	1,07			
Method	15 persons and below (1)	133	2,39	1,05	1,849	,137	—
	16–25 people (2)	250	2,47	1,02			
	26–35 people (3)	260	2,55	1,06			
	36 people and above (4)	76	2,72	1,16			
Assessment-Evaluation	15 persons and below (1)	133	3,08	,79	1,937	,122	—
	16–25 people (2)	250	3,12	,82			
	26–35 people (3)	260	3,25	,77			
	36 people and above (4)	76	3,09	,76			
Total	15 persons and below (1)	133	3,38	,63	5,289	,001*	1–3 1–4
	16–25 people (2)	250	3,54	,65			
	26–35 people (3)	260	3,63	,66			
	36 people and above (4)	76	3,68	,73			

Dimensions	Classroom Size	n	\bar{x}	ss	F	p	Meaning
Suggestions	15 persons and below (1)	133	4,62	,60	1,013	,386	—
	16–25 people (2)	250	4,66	,48			
	26–35 people (3)	260	4,68	,41			
	36 people and above (4)	76	4,59	,53			

Table 10.

One-way analysis of variance results on the comparison of teachers' opinions and suggestions on distance education applications for primary school level by number of students.

Dimensions	Gender	n	\bar{x}	ss	t	p
Teacher	Female	434	2,71	,78	2,546	,011*
	Male	285	2,55	,81		
Student	Female	434	3,17	,62	3,689	,000*
	Male	285	3,00	,61		
Parent	Female	434	3,55	,84	3,716	,000*
	Male	285	3,31	,83		
Plan	Female	434	3,39	,86	3,350	,001*
	Male	285	3,17	,84		
Environment	Female	434	2,87	,93	3,447	,001*
	Male	285	2,63	,89		
Participation	Female	434	2,99	1,02	4,430	,000*
	Male	285	2,65	,98		
Method	Female	434	2,55	1,06	1,311	,190
	Male	285	2,45	1,04		
Assessment-Evaluation	Female	434	3,25	,79	3,916	,000*
	Male	285	3,02	,77		
Total	Female	434	3,64	,67	4,426	,000*
	Male	285	3,42	,64		
Suggestions	Female	434	4,68	,45	1,880	,061
	Male	285	4,61	,54		

Table 11.

Independent t-test results on comparison of teachers' opinions and suggestions on distance education applications for primary school level by gender.

average in all sub-dimensions. In **Table 11**, the results of the independent t-test for the comparison of the opinions and suggestions of the classroom teachers regarding the distance education practices at the primary school level according to the gender variable are given.

As can be seen in **Table 12**, female classroom teachers are teacher ($X_{LD} = 2.71$), student ($X_{LD} = 2.71$), parent ($X_{LD} = 2.71$), plan ($X_{LD} = 2.71$), environment ($X_{LD} = 2.87$), participation ($X_{LD} = 2.99$), measurement-evaluation ($X_{LD} = 3.25$), and total scale ($X_{LD} = 3.64$) dimensions, higher participation than male classroom teachers

Opinion of The Teachers	F	%
Yes	84	11,68
No	256	35,6
Partially	379	52,71

Table 12.
Teachers' opinions on the appropriateness of distance education for primary school level, frequency, and percentage values.

shows. The opinions of primary school teachers on distance education practices at the primary school level do not differ significantly in terms of methods and suggestions according to gender (method dimension ($t(719) = 1.31$; $p > .05$), suggestions dimension ($t(719) = 1, 88$; $p > .05$).

The data obtained regarding the suitability of distance education applications for the primary school level shows that more than half of the classroom teachers find distance education partially suitable for primary school students. In **Table 11**, the percentage and frequency information regarding the teachers' opinions on the suitability of distance education for the primary school level are given. As seen in **Table 11**, 52.71% of the classroom teachers participating in the research found distance education partially suitable for primary school students, while 35.6% did not find distance education appropriate for primary school students. A total of 11.68% find distance education suitable at the primary school level.

4. Conclusions

It is preferable to include a Conclusion(s) section which will summarize the content of the book chapter. In this study, the COVID-19 pandemic throughout the world, together with distance education at the elementary school level who practices a wide range of applications found in the opinions of classroom teachers about how the process is executed and investigated whether these views differ according to certain variables taken up throughout Turkey. As a result of the research, it is understood that the vast majority of classroom teachers do not consider the distance education applications of the epidemic period suitable for the primary school level.

Only 11.68% of the teachers participating in the research consider distance education suitable for primary school students. In the same way, Altintas Yüksel [45], Arslan and DemirOz [46], Kurt and friends [51], Yurtbakan and Akyıldız [54] also stated that distance education is not suitable for primary school students according to the research results. On the contrary, it is thought that distance education lessons are enjoyable for both students and teachers. It was revealed that the parents were satisfied with the distance education studies carried out in this process and found them insufficient or useless. At the same time, there was high participation in the opinions that parents are disinterested and are able to devote more time to their children. It can be assumed that the reason for reaching conflicting statements in this way is that the parent profile varies throughout the school, city, and region. However, there was no significant difference in the views of teachers regarding the size of the parent in terms of working in the village, provincial, or district centers. However, in terms of the geographical region where the task was performed, a significant difference was found between the views of teachers in the size of parents decisively. In the

research conducted by Yurtbakan and Akyıldız [54], it was concluded that parents found the distance education activities implemented during the COVID-19 pandemic process sufficient, but found the course duration insufficient. In parallel with these research results, Fidan [50] concluded that parents are more interested in their children's education in distance education. On the other hand, there are studies that reach the views of parents that distance education does not achieve its purpose [19].

As a result of the research, it was seen that the classroom teachers agreed with the opinion that they had communication problems with students and parents in the distance education process at a moderate level. However, a high level of participation was observed in the opinion on strengthening teacher-student communication in the dimension of suggestions. Based on this, it can be concluded that providing communication in the process is seen as an important issue and serious problems are not encountered in providing this communication. According to the results of the research conducted by Başaran et al. [58], Cakın and Akyavuz [55], Kavuk and Demirtaş [56], communication problems between teachers and students are seen as one of the important problems affecting distance education. In addition, in the qualitative dimension of the research, it was concluded that the distance education process is both physically and psychologically tiring and has negative effects on teachers' eye health, but this view is not widely accepted. Altıntaş Yüksel [45], on the other hand, revealed in his research that long-term exposure to the computer screen causes health problems for teachers.

It has been concluded that classroom teachers do not encounter serious problems in the planning of the distance education process. There are some problems in the execution and measurement-evaluation stages of distance education. The problems experienced in the conduct of distance education become evident in the dimensions of environment and participation.

Issues related to the media dimension are primarily the problem of access and the inability to interact with students. It is seen that there is a moderate level of participation in the opinion that the students do not have the necessary equipment to attend the lesson. According to the 2020 monitoring and evaluation report published by the Ministry of National Education, 7.1% of the students who participated in the research stated that they could not attend the distance education courses and that they did not have access to the internet. However, in the distance education research conducted by Karadağ and Yücel [71] in which 17,939 university students participated, it was concluded that 63% of the students did not have the internet at home to participate in distance education. Likewise, Basaran et al. [58] draw attention to the fact that students do not have the necessary tools to participate in distance education and this situation violates the principle of equal opportunity in education. Regarding participation, it is also possible for students to attend distance education courses at a sufficient level.

It was concluded that they did not participate in the study and that the participating students were still not active enough. Similarly, according to the results of the research conducted by Demir and Özdaş [47], low participation in distance education courses is suggested as a problem. Kurnaz et al. [72] also stated in their research that students could not find the opportunity to discuss in the lesson. This result suggests that the number of students is effective in the dimension of participation. Likewise, according to the class size variable, a significant difference was found between the views of teachers who have 15 or less students and those who have 36 students or more.

In the 2020 monitoring and evaluation report of the Ministry of National Education regarding the educational activities during the epidemic process, 76% of the

students participating in the research and 80% of the parents stated that their children participated in live lessons [73]. Regarding the method, the teachers who participated in the research showed low participation in the opinion that they could not use effective methods and techniques. In other words, it is thought that there are no serious problems in using effective methods in the conduct of distance education. However, Bakioglu and Cevik [74], Erbil et al. [48], Kavuk and Demirtaş [56], Uyar [75] concluded that teachers continue to benefit from traditional teaching methods in the distance education process. While it is observed that there is a high level of participation in the views that one-to-one interviews are made and the learnings in face-to-face education are not forgotten in distance education. A low level of participation was observed in the opinions about the difficulty of homework control and the lack of reliable assessment and evaluation. Kurt et al. [51], on the other hand, primary school teachers think that measurement and evaluation in distance education are insufficient. Although it is thought that the number of students is also an effective variable in the measurement-evaluation dimension, no significant difference was found between the opinions of the teachers in the measurement-evaluation dimension according to the class size variable.

As a result of the research, it was concluded that classroom teachers working in different geographical regions have different views on distance education at the primary school level. It can be thought that geographical regions in Turkey have different socioeconomic characteristics as an effect on this result. According to the variable of the place of duty determined as the province, district, and village, although there is no significant difference in the dimensions of teacher, student, and parent between the views of the classroom teachers participating in the research on distance education, a significant difference was observed regarding the processes of planning, conducting, and evaluating distance education. According to Text et al. [76] no difference was observed between the opinions of teachers about distance education regarding the variable of the place of employment. According to another research result, it was concluded that the teachers working in the province and district have a more positive attitude toward distance education [72]. It is thought that village schools, especially in rural areas, are more disadvantaged in the distance education process due to hardware and infrastructure problems [77]. In addition, a significant difference was found between the views of teachers according to the variable of years of service, which is seen as a factor that shapes the perceptions of teachers about the distance education process. Similarly, according to the results of the research conducted by Kocayigit and Uşun [60], it has been determined that there is a significant difference between professional experience and teachers' views on distance education; differently, Karaca et al. [62], Kurnaz et al. [72], Metin et al. [57] concluded that teachers' perceptions of distance education did not show a significant difference according to their seniority. In addition, although there are widespread criticisms around the world that distance education negatively affects students' social interaction [78], this finding is supported in the qualitative dimension, but in the quantitative dimension of the research, primary school teachers agreed with this view at a low level.

The teachers participating in the research are largely in agreement with the suggestions put forward regarding the improvement of distance education practices. According to the variables of gender, place of duty, class size, years of service, and geographical region, there was no significant difference between the opinions of teachers in terms of suggestions. Accordingly, providing financial support to students who do not have the necessary equipment, strengthening the infrastructure so that distance education can be carried out simultaneously for all students, enriching the

content in the EBA application, organizing fun activities that will attract the attention of students in distance education, informing parents about distance education, teacher-parent. It is stated that communication channels between students should be strengthened and printed materials should be provided for students. Erbil et al. [48], Demir and Ozdaş [47], Kurnaz et al. [72], Şahan and Parlar [79], it was stated that EBA contents should be developed in a similar direction. Arslan and DemirOz [46], Bakioglu and Cevik [74], Fidan [50], Can [80], Ozdogan and Berkant [39] similarly drew attention to the necessity of improvements in infrastructure and technical equipment. There are also studies that point out that the situation of students without technology or reliable internet access will cause psychological problems and call this situation “operational distance” [81]. In the monitoring and evaluation report of the Ministry of National Education for the year 2020, it was emphasized that in case the distance education process continues, it is necessary to support the students who do not have enough equipment. In this direction, the Ministry of National Education continues to provide tablets to students with insufficient economic means in 2021 [82].

In the whole scale dimension, a significant difference was determined according to the gender variable in the views of the classroom teachers participating in the research on the distance education practices applied at the primary school level. Differently, Karaca et al. [62], Kocayigit and Usun [83], Kurnaz et al. [72], Mocoşoglu and Kaya [63], Metin et al. [57], there is no significant difference between teachers’ views on distance education, depending on gender. However, Karaca et al. [62] and Kurnaz et al. [72] concluded that female teachers showed more positive development than male teachers in adapting to distance education.

One of the limitations of the study is that only primary school teachers working in primary schools affiliated with the Ministry of National Education are included in the sample. The inclusion of primary school teachers working in private schools in the research may provide both the opportunity for comparison and the acquisition of more comprehensive data. In addition, in this study, the perspective of a single stakeholder group in the process was evaluated by referring to the opinions of classroom teachers on distance education at the primary school level. It is possible to obtain different data in a more comprehensive study including primary school students, parents, and administrators.

5. Suggestions


The distance education studies implemented during the pandemic period revealed the necessity of using technology-based tools in education. For this reason, constructive steps should be taken to update teacher knowledge of educational technology and to solve technological infrastructure problems, especially in disadvantaged schools. Parents, who have become more active members of education and training activities with distance education, have been able to have more information about the process than in the past. It is clear that this will also have benefits in the face-to-face education process. Therefore, in order to provide time and space flexibility, parent education through distance education should be emphasized and active roles should be offered to parents in the education process at school.

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Teachers Transformation Role in Distance Learning Conditions

Gordana Zoretić and Ondina Čižmek Vujnović

Abstract

A modern society should base its development on investing in the quality of human resources. Teachers are the bearers of change, they have a great responsibility to implement the teaching process, to choose the approach to teaching, which will ultimately affect the students' achievements. That is why it is important to invest in the development of teacher competencies. They should be ready to adapt to change, to be the bearers of change themselves, and to change their roles accordingly. It was distance learning during the pandemic that required teachers to take on a new role, leadership style, and a different approach to teaching. Teachers Zoretić, Čižmek Vujnović, and Ilić, conducted research among teachers of higher education institutions, the topic was work in pandemic conditions during the 2020/2021 academic year, and the goal of the research was to show that, in a distance teaching conditions, by increasing the need to apply teachers' digital competencies, it reduces the needs to apply teachers' social competencies.

Keywords: teacher, teacher competency profile, teacher competencies, teacher leadership style, teachers function

1. Introduction

Investing in the quality of human potential and in knowledge strongly determines the future of humanity. The fact is that the personal and professional development of an individual is significantly affected by the education system, therefore developed countries strive to modernize their education systems to create quality conditions for everyone who joins the world of education (teachers and students).¹ Human capital is the individual property of an individual, and the results of investment through education are visible after a long period. Education plays a fundamental role in personal and social development, so in a dynamic and changing environment, accepting the concept of lifelong learning is a necessity. Therefore, those countries that were not satisfied with the efficiency of their educational systems-initiated reforms, introduced innovations, and adapted to today's requirements. Current global social, economic, and technological changes have placed new expectations and complex demands on educational institutions regarding stronger support for the development of teacher

¹ In the context of this work, we will talk about university teachers and students, although people of other age categories are also educated.

competencies, through formal education, as part of lifelong learning. Human capital is the property of the individual, and the results of investment through education are visible after a long period. Education plays a fundamental role in personal and social development; therefore, in a dynamic and changing environment, accepting the concept of lifelong learning is a necessity. This is the reason why states, which were not satisfied with the efficiency of their education systems, initiated reforms, introduced innovations, and adapted to modern requirements. Current global social, economic, and technological changes have set new expectations and complex demands on educational institutions regarding stronger support for the development of teacher competencies, through formal education, and as part of lifelong learning.

The spread of knowledge is accelerated, and human ability should enable it to be adopted as successfully as possible. That is why it is necessary to learn how to learn, but also to accept the fact that job security can no longer be guaranteed on the labor market. The level of development of learning competence (“learning how to learn”) affects social inclusion and personal and professional development. This competence is not new in the teaching field and until recently it mainly meant learning how to learn independently from books.

In the twenty-first century, this concept implies the ability to learn from books, newspapers and other printed materials, radio, and with the help of new information media, such as cable or satellite TV and the Internet (includes text, sound, and images). It also includes awareness of one’s own learning process, motivation, self-confidence, knowledge of different learning strategies, criticality, solving work and life problems, and the ability to self-assess the learning process [1]. The teacher has a very important role in the process of education and learning because he participates in the formation of the personality and moral values of those he teaches. He has the role of a change agent and a great responsibility for the entire teaching process, which consists of several phases: pre-planning, planning, organizing, motivating, communicating, and evaluation. The teaching process is complex; therefore, it is important to take care of the quality of teaching, and thus the quality of the teachers work. Also, the teacher should consider the possibilities and ways of learning of the students. The most important student’s attitudes toward learning, as well as self-image, are formed in the early phase of basic education. For this reason, a teacher must have a wide range of teaching competencies, but also human qualities, such as empathy, patience, self-awareness, self-control, and consistency, along with highly developed social skills. Social skills, Goleman, include the ability to create the desired reactions in others and include influence, communication, conflict solving, leadership, encouraging change, creating connections, cooperation, and teamwork skills [2].

Considering the new conditions caused by the COVID-19 epidemic, new challenges in the teaching profession have arisen. The demands that are placed on teachers in these new conditions are very high, and the responsibility for the achieved learning outcomes is also high. In distance learning, the role of the teacher has changed for which it was necessary to adapt the approach to teaching and the methodological framework in a short time. In the European educational context, an important contribution to changing the understanding and approach to the implementation of the teaching process is the establishment of a system of external and internal evaluation of educational institutions, as well as modern knowledge of educational sciences. These empirically based findings have significantly guided the definition of quality standards related to learning outcomes, curriculum planning, and the process of learning, teaching, and evaluation of outcomes within the system of external evaluation of educational institutions [3]. In addition to changing the curriculum, it is also

important to adapt the management of the educational institution, which includes several areas: development, service, administration, and finance [4].

The COVID-19 epidemic affected changes in educational processes, and it can be assumed that it accelerated the implementation of some of the strategic goals determined by educational strategies. The fundamental purpose of the teaching profession is the upbringing and education of pupils/students/participants (regardless of the ratio in which upbringing and education/teaching are represented in the teaching process). Although the approach to teaching is an expression of the personality of the teacher himself, *the approach of encouraging the discovery of meaning* is more acceptable to today's lifestyle, compared to the *approach of information transmitting*. With the first approach, the teaching process is focused on forming the student's experience, which is *student-oriented teaching*², and with the second approach, the teaching process is focused on the transfer of content, which is *teacher-oriented teaching*.

Gordana Zoretić, univ. spec. oec., lecturer at the university, and Ondina Čižmek Vujnović, univ. spec. oec., professor advisor in a vocational high school, are supporters of the student-focused teaching approach and apply collaborative learning methods during their work. Due to the new conditions of conducting the teaching process caused by the COVID-19 pandemic, teachers were no longer able to organize live classes in the classroom. In these circumstances, their opportunities to apply collaborative learning and direct communication with students (face-to-face) were reduced during classes, where it was not possible to observe the student's reactions and nonverbal communication. The new situation prompted them to choose the topic they wanted to cover for the 22nd International Scientific and Professional Conference "Accounting and Management", which was to be held on September 9–10, 2021. They determined the topic of the professional work and decided to conduct research related to teacher functions and competencies, which in the atmosphere of the mentioned epidemic are determined by the digital transformation for distance learning.

The intention was to determine whether and to what extent some of the teacher's functions have changed due to distance teaching, compared to classical teaching (live, face-to-face in the classroom). Also, this research should have provided guidelines for shaping the teacher's role and associated functions with desirable competencies, to create an image of a successful teacher in new circumstances. The collection of primary data during the research was carried out using a survey questionnaire that included the following:

1. Assessment of personal competencies required for distance learning (12 questions).
2. The functions that the teacher normally deals with, which are the function of pre-planning (choosing the teaching content of the course - 4 questions), the function of planning the teaching of content (preparation of the teaching program and the teaching plan - 7 questions), the function of organizing the teaching process (conducting the teaching - 10 questions), the function of motivating and communicating during the teaching process (8 questions), and the function of checking the adopted teaching content and achieved learning outcomes (evaluation of student achievement - 7 questions).

Mr.sc. Mladen Ilić joined in conducting the survey, as a lecturer at a university.

² In this paper, instead of the term "pupil-oriented teaching", the term "student-oriented teaching" will be used because it is about the competences of teachers at higher education institutions.

2. Competency profile of a successful teacher in distance learning conditions

During the teaching process, the teacher has a significant influence on the development of the student's competences, so it is very important to take care of the teacher and the development of his competences. The authors Wardoyo, Herdiani, and Sulikah [5] define the competence profile of teachers, which consists of groups of competences: pedagogical, personal, social, and professional. Also, they believe that the teacher's way of thinking about the profession, the reasons why they should be professionals, and how they should behave and use their knowledge and skills related to their profession can also be included in that competence profile.

In this context, it is important to mention the project Educa-T (emphasis on developing and upgrading of competencies for academic teaching), within the framework of which in 2017 the "Analysis of the situation and activities at higher education institutions in the Republic of Croatia" was carried out, with the aim of improving the quality of learning and teaching (available at: <http://educa-t.hr/wp-content/uploads/2018/01/recenzija-izvjestaja.pdf>). This analysis confirmed the tendency to neglect the training and development of teachers for teaching work due to other obligations and pressures, especially due to the conditions for advancement in the profession, which neglects the teaching aspect. There is also a lack of awareness and knowledge about the complexity of the modern context of learning and teaching, especially student-focused teaching. The Ministry of Science and Education initiated this project, the results of which showed the importance of investing in the quality of learning and teaching, and accordingly the competence profile of teachers in higher education was set, as well as the framework for the systematic development of teacher competences in the Croatian higher education system. Within the framework of the basic competencies listed in this project, the necessity of developing digital competencies was also mentioned, adapted according to [3].

The introduction of new technologies into the teaching process has advantages and disadvantages. New technologies can make teaching and learning in the classroom (classic live teaching and face-to-face) more effective, but also make the student passive, if his activity is focused only on memorizing what was shown and spoken. Teaching and learning at a distance, with the use of digital technology, can facilitate access to knowledge and skills for everyone and everywhere. However, for the individual development of students, especially those who have not yet developed independence in learning and found their own learning style, the teacher's support is crucial. The teacher's support prepares them for independent learning, encourages them to research, and find solutions to given problems, thus helping them to create personal attitudes and develop personal responsibility.

In June 2021, teachers Zoretić, G., Čižmek Vujnović, O. and Ilić, M. conducted research among teachers of three higher education institutions in Zagreb, the topic was work in pandemic conditions during the 2020/2021 academic year, and the goal of the research was to show that, in a distance teaching conditions, by increasing the need to apply teachers' digital competencies, it reduces the needs to apply teachers' social competencies. 55 teachers participated anonymously in the research, and the structure of the respondents is shown in the following **Table 1**, edited by Zoretić and Čižmek Vujnović (2021). The results of the research were presented by Zoretić and Čižmek Vujnović at the 22nd International Scientific and Professional Conference "Accounting and Management", 9–10 September 2021, and were published in

Gender structure (%)		Work experience in the teaching profession structure (regardless of status – employment in the institution, or engagement in the role of an external associate) in %	
Male	54,7	Up to 5 years	18,2
Female	45,3	From 6 to 10 years	10,9
		More than 10 years	70,9

Table 1.
Structure of respondents by gender and years of work experience in the teaching profession.

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In the first part of the survey, teachers assessed the importance of competences in the conditions of distance learning compared to traditional learning. The selected competencies are communication and related components: oral expression and persuasiveness, written expression, presentation of work, conflict prevention, conflict solving, planning, self-organization, implementation of goals/achievement of learning outcomes, student orientation, initiative, teamwork, and analysis. Competence descriptions are adapted according to [6] the authors classified these competences into groups of competences that include the teacher's competence profile: personal, social, professional, and methodical.

Communication, as a key competence, can be classified in the group of social competences, as a prerequisite for the fulfillment of personal, professional, and methodical competences. Good knowledge of the professional field is an important prerequisite for the success of the teacher, and in addition, one should possess the already mentioned human qualities and the skill of choosing the right approach in establishing, developing, and maintaining relationships throughout the dynamic teaching process. *Student orientation* competence, which can be classified in the group of methodical competencies, is particularly emphasized. The teacher designs various activities, which activate the student's senses for listening, seeing, and creating (making) with hands, in order to facilitate practical experiential learning and long-term memory, which in other words means to make the teaching interesting, dynamic, and effective, in accordance with the student's needs and expectations. Therefore, in addition to continuous improvement in the professional field, teachers must be trained and continuously improve in the field of psychology and pedagogy, with an emphasis on didactics and methodology. In distance learning conditions, the methodological competence "student orientation" is significantly influenced by the level of development of digital competences. *Planning* competence is important in the entire teaching process, from beginning to end, and it can be classified as a group of professional, as well as personal competences. It is learned and perfected through practice. It is also necessary for success in the methodological area, for example, for evaluating and planning the duration of an individual activity while using the chosen teaching method. *Self-organization* is a necessary teacher's personal and methodical competence. It affects the level of preparation of the teacher for the teaching process, which in other words means that it is important for the implementation of the set learning goals/outcomes. *Implementation of set goals/learning outcomes* can be classified into the group of professional and methodical competencies.

In distance learning conditions, when teaching methods and appropriate work materials need to be adapted, digital competences are important, but so are *initiative* (as a personal competence) and *teamwork* (as a social competence). The teaching process is teamwork, which includes the cooperation of teachers, students, and all others who are directly and indirectly involved in the process. The *analysis* determines the achieved results in relation to the planned, why there were deviations, what is their significance (positive or negative), and what and how can be improved in the future in the entire teaching process. This competence can be classified into the group of personal and professional, but also methodical. For example, no group of students is completely homogeneous, just as interest in a particular topic is not completely homogeneous, and the motivation of teachers and students is not always at the same level. The interdependence of students and teachers during the lesson is monitored through interest and reactions, and they can change several times, from passive to dynamic cooperation. **Table 2** shows the results of the conducted research, edited by Zoretić and Čižmek Vujnović (2021).

The teaching process is actually a process of leading and managing the teaching and learning of those who do not know, and they are led (managed) by those who should have developed groups of competences: personal, social, professional, and methodical. The use of the teacher's competences for the purpose of improving the student's achievements is also illustrated through the adapted Ferguson and Ramsdell model, shown in **Figure 1** [7]. According to this model, three "powerful tools" in the hands of the teacher are crucial for the successful improvement of the student's achievements: professional knowledge, methodical skills, and social skills. Each of these components is extremely important for the success of the teaching process. It is important that they are mutually coordinated because if one of them is not adequately applied, it will affect the effectiveness of the teaching, as well as the satisfaction of everyone involved in the teaching process.

Through the conducted research, the mutual satisfaction of teachers and students during distance learning was also evaluated, where the difficulties experienced by the respondents are emphasized. According to the answers of the interviewed teachers, the objectivity of the student's assessment of the teacher's work and commitment (answered by 56.4% of the respondents), the possibility of expressing the teacher's expertise and knowledge (answered by 52.7% of the respondents), the possibility of fulfilling the teacher's expectations in a professional sense during distance learning (answered by 69.1% of respondents), and self-assessment of teacher work during distance learning (answered by 50.9% of respondents) was difficult.

The teaching process is two-way, it is a constant interaction between teacher and student, the goal of which is mutual satisfaction. Unfortunately, according to the results of the survey, some of the components of this interaction were missing in distance learning. Therefore, the respondents' satisfaction during such classes was reduced. In this context, the teacher's task is to continuously invest efforts in the development of their own competences, especially social ones, with the aim of achieving mutual trust and a positive influence on formatting the student's behavior.

3. Application of teacher management functions as a challenge in the conditions of distance learning

Teachers, as initiators and creators of changes in educational practice, must be an example of the change they want to see in their students. Therefore, only when they

Competencies	Group of competences	The importance of distance learning compared to traditional learning (live and face-to-face) in %		
		More important	Equally important	Less important
Communicating				
• oral expression and persuasiveness	social	41,8	56,4	1,8
• written expression	social	23,6	63,6	12,7
• presentation of work	social	49,1	38,2	12,7
• conflict prevention	social	10,9	52,7	36,4
• conflict solving	social	10,9	63,6	25,5
Student orientation	methodical	36,4	54,5	9,1
Planning	personal/ professional	32,7	67,3	0
Self-organization	personal/ professional	36,4	61,8	1,8
Implementation of goals/ achievement of learning outcomes	professional/ methodical	16,4	81,8	1,8
Initiative	personal	40,0	60,0	0
Teamwork	social	20,0	58,2	21,8
Analysis	personal/ professional/ methodical	23,6	74,5	1,8

Table 2.
Results of the assessment of the importance of selected teacher competencies.

really realize the necessity of improving personal and professional development, when they start living and working in accordance with the principles of the modern approach to “*student-oriented teaching*”, then they will be able to influence the development, change, and improvement of the teaching process. Managing the teaching process requires making quick and efficient decisions in the new circumstances caused by the COVID-19 epidemic (distance learning conditions). A teacher of a higher education institution is expected to successfully combine and develop managerial knowledge and skills, such as technical/professional, social, and strategic/conceptual. Conceptual skills include the ability to coordinate, direct, organize and supervise existing activities, to see a big picture, analyze the environment, and making solutions for the purpose of quick and successful adaptation to changes. Acceptance of changes in the educational institution is expected not only from teachers but also from all participants who are directly or indirectly involved in the teaching process. Many see a good educational institution as a place where students like to stay, where the climate is stimulating and encouraging, and the physical environment supports a sense of comfort (e.g. availability of necessary equipment, lighting, ventilation, heating, arrangement of rooms and furniture .). Therefore, it is necessary to encourage all those who are interested in improving the teaching process to become involved in the structured care of the quality of the educational institution.

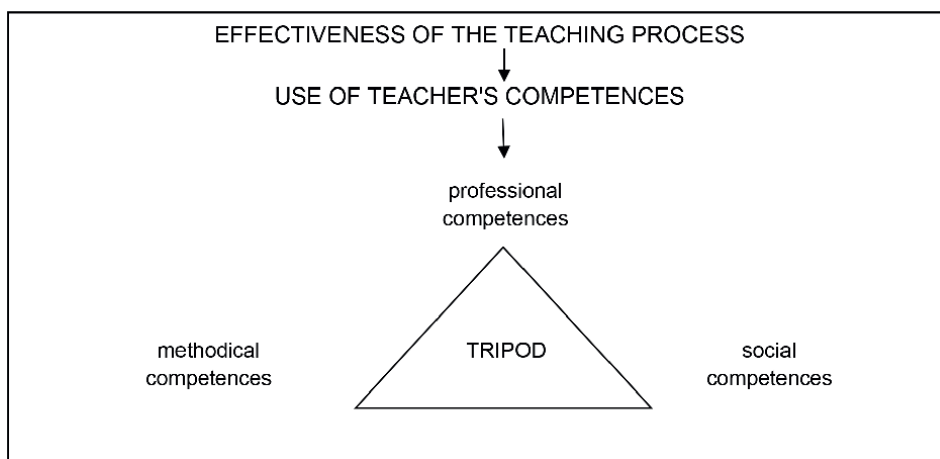


Figure 1.
Tripod conceptual model.

The use of ICT in work requires the acquisition and continuous improvement of digital competences. In distance learning conditions, this improvement process also affects the development of teachers' management functions in the preparation, organization, and conduct of classes: pre-planning/selection of teaching content; teaching planning; preparation of the curriculum; organizing the teaching process; leading – motivating and communicating; and valuation. In this context, appropriate changes are necessary within each teaching function. As part of the conducted research, the teachers evaluated the resulting changes in individual elements in the performance of teaching functions.

Changes within the teaching function “pre-planning/selection of teaching content” are reflected in the following elements: technical and content adaptation and theoretical and practical part of the course content. For example, according to the results of the survey, before the start of distance learning, 47.3% of the surveyed teachers stated that they would consult with colleagues who have experience working remotely regarding the use of digital tools, and 58.2% of the surveyed partially adapted the content of the course. Even 63.6% of the respondents did not change the proportion of the practical form of teaching as part of their course, but instead allowed the students to process it independently with consultation with the teacher. Changes within the teaching function “teaching planning/preparation of the teaching program and curriculum” are reflected in the following elements: goals and outcomes of learning and teaching; contents to be taught; teaching strategies, methods, forms and tools that will be used; activities that students should perform, tasks for evaluating students' achievements and progress. For example, 87.3% of the surveyed teachers answered that the educational institutions where they work provided them all forms of help in using new technologies for distance learning (written instructions, organized workshops, and availability of technical support by call center). Due to distance learning, 50.9% of the surveyed teachers had to upgrade their computers, most of the surveyed planned to adapt the teaching methodology, and 52.7% of them planned to introduce other forms of collaborative learning. Changes within the teaching function “organizing the teaching process” are reflected in the following elements: structuring the time allocated for teaching; prediction of teaching methods; creation of an interactive working atmosphere and preconditions for independent work of students, their

active involvement, cooperation and free presentation of their ideas, opinions, and examples. For example, distance learning requires working in conditions of reduced duration of the lesson, less than 45 minutes, and is usually organized in block classes. It is interesting that this kind of work is good for 61.8% of the surveyed teachers, who immediately successfully adapted to it, but 52.7% of the surveyed agree that remote teaching requires more time to prepare teaching content, and 69.1% of them does not agree with the fact that during distance learning they use the time allocated for teaching better than during traditional learning. Regarding the possibility of applying teaching methods during distance learning, 74.5% of respondents believe that they can not apply all teaching methods equally as during traditional learning, while 78.2% of them believe that it is difficult for them to monitor students' activities in distance learning conditions. Changes in the framework of the teaching function "leading – motivating and communicating" are manifested in the following elements: the application of social competences of teachers (through, for example, setting challenging goals aligned with the assessed capabilities of students); designing tasks for students in accordance with their specific interests; consideration of their remarks and suggestions related to the improvement of teaching; and the possibility of empathic communication between teachers and students and their mutual enthusiasm during distance learning. For example, 52.7% of the surveyed teachers believe that distance learning reduces their ability to set challenging goals for students, 50.9% of the surveyed teachers believe that when designing assignments, they were not able to fully consider the specific interests of students, and 78.2% of the surveyed teachers claim that during distance learning students are less involved and participate less often than during traditional learning. The reduced possibility of applying social competences during distance learning also affected the reduction of empathy, that is, mutual enthusiasm in interactive communication. 78.2% of the respondents agree with this, also 92.7% of them stated that they miss live interacting with students (in the classroom). Changes within the teaching function "evaluation" are manifested in the following elements: evaluation of student activities or the results of activities in the teaching process; monitoring of their interests, independence, creativity, and responsibility expressed in their activities; and determination of the achieved level of student competencies in accordance with certain learning outcomes. Based on the results of the survey, it can be concluded that during distance learning, the entire evaluation process is extremely difficult. Although 56.4% of the surveyed teachers introduced new methods of checking the acquisition of knowledge and the development of skills, 61.8% of them believe that distance learning does not allow them to perform a high-quality and comprehensive check of the acquired knowledge and developed skills of students, nor a high-quality assessment of the student's progress (60% of respondents). Also, during the evaluation, teachers should pay special attention to the objective assessment of student achievements. However, it is obvious that in the conditions of distance learning, according to the opinion of 63.6% of the surveyed teachers, the knowledge and skills of students cannot be objectively assessed.

From all of the above, it can be concluded that the introduction of distance learning started the process of changes in the field of implementation of teaching functions. But, unfortunately, in practice, in distance learning conditions, due to the intensive application of digital competences, the successful application of social competences did not come to the fore. It is obvious that teachers still need a longer period to fully adapt to the changes, to successfully focus on the stronger development of student competencies, such as critical and argumentative reflection, research and problem-solving, and responsible and independent preparation and management of projects.

In the following period, some other research in this area was carried out, which confirmed most of the obtained results of the conducted research. For example, a comprehensive and more extensive research entitled “university teachers and the pandemic: academic and psychological challenges” was conducted by the Agency for Science and Higher Education, in cooperation with the University Computing Center of the University of Zagreb and the Department of Psychology of the Faculty of Philosophy of the University of Rijeka, and the results were presented on March 15, 2022, in Zagreb. A summary of the presentation is available at [Predstavljени rezultati istraživanja "Visokoškolski nastavnici i pandemija"](https://predstavljениrezultati.istraživanja.gov.hr/visokoškolski-nastavnici-i-pandemija) (azvo.hr) and the full results of the research are available at [Visokoškolski_nastavnici_i_pandemija_akademski_i_psihološki_izazovi_AZVO_Srce_UNIRI.pdf](https://predstavljениrezultati.istraživanja.gov.hr/visokoškolski-nastavnici-i-pandemija-akademski-i-psihološki-izazovi-AZVO_Srce_UNIRI.pdf),

A significant progress in research into the development of digital competences of teachers was also made within the framework of the European project coordinated by the Faculty of Economics in Zagreb, entitled DIGI4Teach (“Challenges and practices of teaching economic disciplines in the era of digitalization”), at the end of 2021. The extensive results of this research were published in a special issue of the Business Systems Research magazine, entitled “digitalization in the teaching of economic disciplines: past, present, and future”. In the published works, the influence of digitization in the teaching of economic disciplines in higher education and secondary schools was analyzed and presented. A survey was conducted among students and teachers in four partner countries (Croatia, Germany, Poland, and Serbia) on the use of digital technologies in teaching, where the advantages and disadvantages of their application in teaching were primarily highlighted. In this special edition, emphasis is placed on digital competences, quality of e-learning, e-exams, digital tools, gamification, and digital and mobile technologies used in the teaching process in the field of economics and business, adapted according to [8].

4. The transformational role of the teacher in managing the distance learning process

The teaching process is a series of mutual activities of teachers and students during its duration, aimed at achieving learning outcomes. In accordance with the developmental changes in the teaching process, the role of the teacher also changed. The teacher leads and directs the teaching process in which the student, with his support, explores and builds his own knowledge. In this context, the teacher needs a good “formula” for the effective organization of the teaching process, which largely depends on his organizational and leadership competencies.

According to Brajša [9], in addition to knowledge and expertise, a teacher must have all the characteristics of a quality and successful leader. Various theories about leadership styles in teaching confirm the fact that leadership is a very complex and comprehensive phenomenon, and each teacher, by gaining experience, builds his own leadership style. For leadership to be as effective as possible, it should rely to a large extent on the cooperation of teachers and students. For a quality teacher to manage students “liberally”, first, it is necessary to create a quality atmosphere, include motivation, quality communication, and joint formation of goals. It is considered that the process of leadership is an influence on one or more people, with the aim of changing their point of view or behavior. Teachers can choose whether to influence students based on fear or trust [10].

During *student-oriented teaching*, teacher leadership relies heavily on cooperation and trust, where the teacher strives to create a motivational atmosphere and partnership relations with students. In a theoretical and practical sense, several styles of leadership can be distinguished, from autocratic, which completely ignores democracy in decision-making, to democratic, in which everyone participates in the decision-making process and in which the opinion of everyone is respected [11]. Therefore, about the use of authority in teaching, four styles of leadership in the teaching process are distinguished: autocratic, democratic, emotional, and laissez-faire, adapted from [12].

Numerous experts have dealt with the topic of the existence of a cause-and-effect relationship between leadership style and the effectiveness of the teaching process. The fact that emerges is that the teacher, by choosing the appropriate leadership style, simultaneously chooses the behavior that will influence the relations with students, the working atmosphere, as well as the realization of the set learning outcomes. Therefore, choosing the right leadership style is of key importance for the success of the teaching process, and largely depends on the teacher's personality, the characteristics of the student group and the situation in which the teaching process is carried out. For example, the dominant personality traits of teachers such as consistency, positivity, cordiality, sincerity, emotional stability, and communicativeness will significantly influence the behavior of students. However, the style of leadership will certainly depend on whether they are younger students, who have chosen regular studies, or older students, who are studying while working. Also, the conditions for live learning in a traditional classroom and distance learning are not the same, and each of these situations will require appropriate styles of teacher leadership (teacher roles). For example, according to the results of the research, distance learning encouraged teachers to make changes. 72.7% of the surveyed teachers saw themselves in a motivator role during live learning in a traditional classroom, 9.1% in a leadership role, and 18.2% in an authoritative role. In the new distance learning conditions, 23.6% of the surveyed teachers aspire to an authoritative role, 20% to a managerial role, and 56.4% of the surveyed teachers aspire to student-oriented teaching and a motivating role. The teacher's role in teaching and the influence on formatting the student's role after teaching is determined in accordance with the teacher's personality and his approach to teaching. This is shown in **Table 3**.

As can be seen from **Table 3**, there is a difference between the transactional and transformational roles of the teacher. According to Bass [14], in the first role, the teacher bases his behavior toward students on a transaction that takes place so that the teacher explains to his students what is expected of them in terms of learning and the realization of assigned tasks, and for the completed task, the student receives a kind of compensation (reward or punishment), depending on whether the task was completed or not. A teacher who manages the teaching process in a transformational sense is focused on achieving positive changes in students. In doing so, he uses key tools such as inspiration, enthusiasm, empathy, charisma, and flexibility. The tendency to adapt to new situations, which is characteristic of this role, is very important in accepting the changes that have arisen in the conditions of distance learning caused by the COVID-19 epidemic. Therefore, in these new conditions, one should strive more for a transformational role, which is characterized by multidirectional communication, and in which, with great confidence, students are offered content that they should independently prepare and creatively present using the offered tools, while creating new ideas and solutions. For this reason, it is particularly important that

	Teacher-oriented teaching, adapted from [1, 13–15]	Student-oriented teaching, adapted from [1, 13–15]
Higher education teaching approach according to Ramsden, P.–description, adapted from [1, 13–15]	Teaching as transfer of information - teaching focused on content transfer; one-way transfer of knowledge, teaching is a lecturer-reactive approach.	Teaching is like encouraging the discovery of meaning, it is aimed at formatting the student's experience; the teaching content is important, but an active attitude toward learning and the possibility of applying the content is more important – a proactive approach.
The role of the teacher in teaching	The teacher is superior to students, knows the professional field well and is in the centre of attention, uses rewards and punishments to motivate students, uses his authority, and emphasizes his relationship with students – authoritative and transactional role.	The teacher encourages the student to independently create knowledge and meaning, tries to recognize and remove obstacles in understanding the content by giving the student clear and complete corrective remarks/feedback with encouragement and motivation; believes that one learns from mistakes, supports the position that he is a partner with the students (the student is in the center of attention); uses charisma and enthusiasm to motivate students to new ideas and solutions, emphasizes values, ideals, morals, and needs of students – motivational and transformational role.
Student's role after teaching	During classes, students are passive recipients, focused on consuming content and a lot of facts, and are responsible for their success/failure; they need encouragement and control from outside; this approach creates an expert with a lot of knowledge in the professional field, who routinely performs the work.	This approach creates an expert capable of solving problems in the professional field, providing creative ideas and solutions, and who is ready for lifelong learning.

Table 3.
Higher education teaching approaches.

the teacher dedicates himself to self-motivation to work with students, that teaching is always a challenge and an opportunity to stimulate the personal and professional development of the students, and an opportunity to create quality interpersonal relationships, from which new experts will emerge, who can create new values and are ready for lifelong learning.

How do teachers approach the learning process, how do they create the teaching process, are they guided by the principles of imparting or creating knowledge, and do they apply approaches that engage and motivate students, these are all issues that directly affect learning outcomes and the development of competencies for all participants in the teaching process [16].

5. Conclusion

Modernization of the education system is not possible if there is no investment in the use of ICT, and all of this would not be possible without the professional

development of teachers, which implies the development of their competencies (digital and other). The balance between teacher competencies, the continuous strengthening of personal and social competencies, as well as the improvement of professional and methodical competencies, will significantly affect the overall development and well-being of students. In the new conditions of distance learning caused by the COVID-19 pandemic, and due to the new possibilities of communicating with students, the need to invest in the development of digital competences of teachers dominates. According to the results of the research, it is evident that in distance learning, due to the intensive use of ICT, the use of social competences is difficult, and that there is a need to achieve balance in the application of these competencies. Prerequisites for the development of the teacher's motivational role and quality interaction with students have been made difficult, and the fulfillment of the teacher's professional expectations in distance learning is largely impossible. Therefore, it would be useful for teachers, to continue applying some of the methods of collaborative learning, to increasingly master new communication skills with digital tools. But it certainly requires changes in the implementation of teacher management functions.

To create preconditions for more intensive application of social competences, changes are needed, both in the style of teacher leadership and in the dominance of his role in the teaching process. In this context, the challenges of teachers in the conditions of distance learning are to encourage self-motivation for proactive communication with students, as well as to continuously encourage the student's personal and professional development. Also, there is a need for a motivating role or transformational role of the teacher, which is exclusively focused on the needs of the students, which has a more direct impact on the learning outcomes, but also on the formation of the student's attitude toward learning and education. The teacher is autonomous in the choice of methods he applies in the teaching process, he is its moderator and leader and accepts responsibility for achieving learning outcomes. Therefore, in a modern teaching approach, hybrid teaching would be a good choice because elements of classical teaching (classroom teaching) and distance teaching elements (use of digital tools) are combined. In this, the teacher needs a lot of support from the educational system, but also from the whole society, which will ultimately be reflected in the willingness of students to enter the labor market independently and responsibly after completing their education.

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Promoting Innovative Thinking and Achievements in a Massive Open Online Course

Abeer Watted

Abstract

This chapter deals with the role of Massive Open Online Courses (MOOCs) in promoting innovative thinking skills and achievements among undergraduate students. The study compared two groups who studied the same course in different learning environments: 1. students who studied the course via MOOC (N = 91) and 2. students who studied the same via F2F course in the classroom (N = 66). The study applied the quantitative approach, collecting data via pre- and post-questionnaires and students' grades in the different assignments in the course. Findings indicated that MOOC students promoted innovative thinking skills, emphasizing exploring and networking skills, as F2F students promoted innovative thinking skills, emphasizing asking questions that challenge the status quo. Findings also indicated a positive relationship between innovative thinking skills and achievements in the MOOC group.

Keywords: innovative thinking skills, Massive Open Online Courses, quantitative approach, undergraduate students, 21st century skills

1. Introduction

Advances in information and communication technologies (ICT) in the 21st century have changed learning and career opportunities and competencies needed in considerable ways. The changes are conveyed in the possibility of learning anywhere and anytime in online courses, especially in Massive Open Online Courses (MOOCs) [1, 2]. The emergence of MOOCs has revolutionized education by making it accessible to anyone with an internet connection, regardless of their location, socioeconomic status, or prior education. MOOCs offer a diverse range of courses, from programming to humanities, and provide learners with the opportunity to learn at their own pace and on their own schedule. They often include video lectures, interactive quizzes, and discussion forums where learners can connect with other students and instructors from around the world [3, 4].

The emergence of Massive Open Online Courses (MOOCs) in the 21st century has had a significant impact on the development of skills needed for success in today's knowledge-based economy [5, 6]. MOOCs offer a flexible and accessible way for learners to acquire new knowledge and skills, often in areas that were previously inaccessible due to geographical or financial constraints [7–10]. In addition, MOOCs

encourage learners to take an active role in their education and develop self-directed learning skills, which are crucial for success in a rapidly changing job market [11, 12].

MOOCs foster the development of 21st-century skills, such as critical thinking, computational thinking, systems thinking, problem-solving, collaboration, and personal skills [5, 13–19]. Learners in MOOCs are often required to participate in group discussions, peer reviews, and collaborative projects, which help to develop these essential skills [3, 4]. Moreover, many MOOCs incorporate interactive elements such as quizzes and simulations that require learners to think critically and solve complex problems [13, 18, 19].

Innovation is a vital 21st-century skill; it is a process of making changes to an existing product, process, or service by introducing something new [9, 20–22]. It can involve developing new ideas, products, or processes or improving the existing ones to create new values [23, 24]. Innovation is an important topic in the study of economics, business, and engineering. In economics, innovation is seen as a driver of economic growth, as it creates new markets, increases productivity, and leads to the development of new industries [25]. In business, innovation is crucial for success and sustainability, as it enables companies to create and maintain a competitive advantage [26, 27]. In engineering, innovation is vital for the development of new technologies and products, as it involves the use of scientific knowledge and engineering skills to create new solutions to complex problems [28, 29].

Innovative thinking is a higher mental function that results in innovative outcomes [24, 30, 31]. Innovative thinking process involves several key skills, such as the ability to identify and assess problems, to explore and develop solutions, and to successfully execute complex and challenging tasks [32, 33]. Innovative thinking is widely recognized as a critical skill for success in the 21st century, both in learning and in various professional fields [21, 25–27]. However, despite its importance, there is a significant research gap when it comes to understanding and promoting innovative thinking, particularly in the context of education [20–22]. While there have been numerous studies exploring the role of innovative thinking in industrial fields, such as business and engineering [25–27], there is limited research that focuses on innovative thinking in education [20–22, 30, 32]. This is a significant gap since education is a key area where innovative thinking can be developed and nurtured [20, 32].

Furthermore, with the increasing popularity of online learning environments, there is an urgent need to explore how innovative thinking can be fostered in these contexts [20–22, 30, 32]. Online learning has unique features and challenges that require new approaches to promoting innovative thinking [30, 32]. For example, online learners often lack face-to-face interaction with peers and instructors, which can limit opportunities for collaboration and creative problem-solving [1–3].

In conclusion, despite the increasing recognition of the importance of innovation and innovative thinking in the 21st century, there is a significant research gap in this area, particularly in the education field and online learning environments. More research is needed to understand how to foster innovative thinking in these contexts and to develop effective strategies for promoting innovative thinking skills in learners.

To bridge the research gap in innovative thinking in education, particularly in online environments, this chapter examined the role of Massive Open Online Courses (MOOCs) in promoting innovative thinking skills and achievements among undergraduate students. The study compared two groups who studied the same course in different learning environments: students who studied the course via MOOC and students who studied the same F2F course in the classroom.

2. Theoretical background

2.1 Innovation and innovative thinking

Innovation is an emerging concept in the 21st century. It is conceptualized as the process of making changes to something established by introducing something new [9]. Innovation can also be conceptualized as implementing a new or significantly improved idea, process, or method [30, 34]. In today's global and changing world, a key factor to success is the ability to think innovatively, look beyond the obvious, and come up with creative and workable ideas [15, 20, 35].

Innovative thinking is the cognitive process that relates to innovation and results in innovative outcomes [20, 30, 36]. It includes the ability to identify and evaluate problems, to seek solutions, and to complete a challenging and workable task [32, 33]. Innovative thinking depends upon a person's experience, knowledge, and ways of thinking. Dyer and colleagues [26, 31] identified four consistent behaviors that are the basis for generating innovative ideas: 1. questioning: asking challenging questions; 2. observing: intensely observing the world around while seeking new ideas; 3. experimenting: engaging in active experimentation to explore options and to generate novel designs; and 4. idea networking: creating networks of individuals with diverse backgrounds and perspectives that could lead to new ideas and insights. According to the researchers, individuals who follow the four behavioral patterns are most likely to develop innovative ideas.

Although innovation and innovative thinking are considered primary skills for the 21st century, there is confusion between innovation and two other concepts - creativity and entrepreneurship. Innovation refers to the generation of new ideas and their successful implementation into new products, processes, and procedures designed to be useful [36, 37]. Differently, creativity refers to generating new and useful ideas, a necessary precursor for innovation [37]. Creativity (idea generation) is the first stage in innovation and requires thinking "out of the box," exploration, risk-taking, and tolerance of mistakes. As a result, creative people have to demonstrate a high level of initiative to bring new ideas to the implementation stage [38]. Differently, entrepreneurship is regarded as founding/starting a new business/venture [39]. Prior research has examined differences between entrepreneurs versus innovative entrepreneurs [26, 31, 40]. An entrepreneur is anyone who founds a new venture [40], while an innovative entrepreneur is the initiator of new ventures that offer a unique and novel value [26, 31].

Research has produced a wealth of knowledge about the characteristics of individuals, teams, and organizations related to innovation outcomes [20, 36]. However, only some of these studies focused on the effect of group configuration on the level of innovation [26, 41], showing that a group with a variety of cognitive types produces a higher level of innovation [41]. Additionally, innovation has rarely been discussed in the educational context. There is little empirical evidence for the promotion of innovative thinking in relation to student education and curricular programs.

The primary focus of research on innovation in the educational context was based on engineering education. This research can be classified into two main areas. The first area focuses on how engineering students perceive their own innovative abilities [20, 32, 42, 43]. The second area analyzes the innovation outcomes of students through their learning products, such as engineering projects [22, 32, 44]. With regard to the first area, a recent study, based on the work of Dyer and colleagues [26, 31], has presented a modified and validated self-report tool for assessing individual differences in innovative thinking. The researchers indicated that engineering students who

possess a deeper understanding and knowledge of the subject area are more likely to score higher on the four behavioral constructs that are the basis for generating innovative ideas: questioning, observing, experimenting, and idea networking [20]. Usher and colleagues [32] examined higher education students' innovation as expressed in their self-reports while comparing two formats of the same engineering course: an on-campus synchronous face-to-face (F2F) course and a fully online asynchronous course. Findings indicated that both F2F and online students self-reported similar levels of innovative behavioral constructs. Out of the four innovative behavioral constructs (questioning, observing, experimenting, and idea networking), students from both groups scored significantly higher on observing and experimenting and significantly lower on the behavioral construct of idea networking [32]. Similar results were indicated by Fila and colleagues [42] who examined how engineering students developed and utilized four behaviors commonly linked to innovativeness in an engineering context. They stated that engineering students tend to score higher on the component of experimenting and significantly lower on idea networking [42].

With regard to measuring innovation outcomes and outputs, Barak and Usher [44] examined the innovation level of engineering students' team projects and the relationships between project innovation and team heterogeneity in two online environments. Results identified that innovation type, product necessity, STEM interdisciplinary, and market readiness were the central constructs used to assess the innovation level of students' projects. The level of innovation in the projects was positively correlated with team heterogeneity in terms of academic discipline and academic level. However, heterogeneity in native language was found to be a hindering factor [44]. Usher and colleagues [32] examined engineering students' innovation as expressed in their learning products while comparing between an on-campus synchronous face-to-face course and a fully online asynchronous course. Finding indicated that the F2F students received higher mean scores on innovation, compared with the online students, in both individual assignments and team projects [32].

To conclude, even though innovative thinking is considered one of the primary learning skills in the 21st century, studies show a vast research gap in the subject. Most of the studies were conducted in the context of industry. However, little is known about innovative thinking in the education field, especially in online environments.

2.2 Massive Open Online Courses

Massive Open Online Courses (MOOCs) are web-based learning environments where participants worldwide can acquire knowledge for free without any commitment or prior requirements. They provide high-quality learning materials from well-known lecturers from elite universities [1, 2]. Since they were first launched, MOOCs' popularity has grown rapidly among adult learners. For example, in March 2013, there were three million enrollees on the Coursera platform. Ten years later, MOOC participants surpassed 220 million learners worldwide, and more than 19,000 MOOCs are offered through 950 global universities [45].

Many universities worldwide incorporated MOOCs through online learning in many academic programs [4, 46]. This way, the university enables its students to communicate with lecturers and experts worldwide to acquire knowledge and share thoughts and expertise [3, 4]. Previous research examined 21st-century skills via MOOCs, such as critical thinking, computational thinking, systems thinking, problem-solving, collaboration, and personal skills [5, 13–19]. However, few studies focused on innovative thinking in MOOCs among teacher education students [21].

3. Methodology

3.1 Research goal and participants

The goal of this study was to examine innovative thinking among undergraduate students who participated in the course “Approaches to Teaching Thinking,” as a MOOC for some and as a F2F course for others. This goal raised the following research questions:

1. Whether and how learning the “Approaches to Teaching Thinking” course as a MOOC promotes innovative thinking among undergraduate students?
2. Whether and how learning the “Approaches to Teaching Thinking” course as a F2F course promotes innovative thinking among undergraduate students?
3. What are the relationships between innovative thinking and achievement among MOOC and F2F students?

The research population (N = 157) included two samples of teacher education students who studied the same course titled “Approaches to Teaching Thinking” in different learning environments: (1) students who studied the course as a MOOC (N = 91) and (2) students who studied the same course as a F2F course in the classroom (N = 66). In both samples, around 92% were females, and most participants (about 90%) were between the ages of 21 and 35. The participants signed an informed consent form, indicating that participation is voluntary and that they could withdraw at any given time. The data were collected anonymously and analyzed in the aggregate to maintain the participants’ privacy.

3.2 Research setting

The study was conducted in the settings of the course titled “Approaches to Teaching Thinking.” The course was designed to advance instructional thinking among students. The course objective was to present education for thinking from different approaches: the skills approach, the dispositions approach, and the understanding approach. The course discusses key questions: what generates good thinking and how should we teach it to develop an awareness of effective, critical, and creative thinking?

The course was taught by the same lecturer to two different groups. The first group studied the course as a MOOC via the Campus IL platform (www.campus.gov.il). The second group studied a F2F course in the classroom. All the learning materials were identical in the two courses. Both courses were eight weeks long, with an estimated workload of 4–6 hours per week. Both courses included individual assignments, such as weekly quizzes, open-ended questions, and a final exam.

3.3 Methodology, tools, and data analysis

This study employed a quantitative research design in the form of an exploratory case study [32]. The quantitative data were collected using a close-ended questionnaire that included two sections. The first section included demographic questions, such as gender and age, and one question about the course learning method (MOOC or F2F course). The second section was based on the innovative thinking

questionnaire. The innovative thinking questionnaire included 18 items on a 1 (strongly disagree) to 5 (strongly agree) Likert-type scale, adapted from Dyer and colleagues [26, 31]. The original questionnaire was developed to examine innovations in business and industry, and it included 19 items. In this study, seven items were adapted to fit the educational field, and one item, “I am constantly asking questions to understand why products and projects underperform,” was removed because of its irrelevancy. Similar to the original version, the adapted questionnaire was divided into four categories:

1. Questioning (5 items): the tendency to recurrently ask questions, especially ones that challenge the status quo (e.g., “I regularly ask questions to check on the status quo.”)
2. Observing (4 items): the tendency to be a passionate observer, carefully watching the world and gaining insights and ideas for new ways of doing things (e.g., “I often acquire new ideas when I look closely at what people around me are doing.”)
3. Experimenting/exploring (5 items): searching for new information through experiments and explorations (e.g., “I like doing experiments to understand how things work and to create new ways to make things.”)
4. Idea networking (4 items): the tendency to create networks of individuals with diverse backgrounds and perspectives that could lead to new ideas and insights (e.g., “I have a network of individuals whom I trust and who bring new refined perspectives and ideas.”)

The questionnaire’s validity was established by three experts in education, reaching 100% consent. The reliability of the questionnaire, established by Cronbach’s coefficient alpha, was 0.93. For questioning, it was 0.77; for observing, 0.83; for experimenting/exploring, 0.86; and for idea networking, 0.77. These results show high Cronbach’s alpha coefficient values, indicating the research tool’s reliability. The questionnaire was administered twice, at the beginning and the end of the course.

4. Results

This section includes three parts, each answering one of the research questions. The first part presents the analysis of innovative thinking among MOOC students. The second part presents the analysis of innovative thinking among F2F students. Finally, the third part describes the relationship between innovative thinking and achievement among MOOC and F2F students.

4.1 Examining the level of innovative thinking among MOOC students

To examine undergraduate students’ levels of innovative thinking before and after completing the MOOC, a t-test was conducted for all research variables as shown in **Table 1**.

Table 1 shows significant differences in the levels of innovative thinking among MOOC students before and after they completed the MOOC. The MOOC participants

displayed higher levels of innovative thinking after completing the course ($M = 3.89$, $SD = 0.68$) than before commencing it ($M = 3.63$, $SD = 0.70$). These differences are statistically significant ($t(90) = 2.06$, $p < 0.05$). Similarly, the participants who completed the MOOC displayed higher levels of “Experimenting” after completing the course ($M = 4.10$, $SD = 0.72$) than before commencing it ($M = 3.79$, $SD = 0.81$). These differences are statistically significant ($t(90) = 2.40$, $p < 0.05$). Likewise, the MOOC students displayed higher levels of idea networking after completing the course ($M = 3.84$, $SD = 0.78$) than before commencing it ($M = 3.47$, $SD = 0.74$). The statistical difference was calculated at ($t(90) = 2.87$, $p < 0.05$). As for the other skills (questioning and observing), results show that they did not differ before and after participating in the MOOC.

4.2 Examining the level of innovative thinking among F2F students

To answer the second research question, “Whether and how does learning ‘Approaches to Teaching Thinking’ course as a F2F course promotes innovative thinking among undergraduate students?” a t-test was conducted for all research variables as shown in **Table 2**.

Table 2 shows that the participants who completed the F2F course displayed higher levels of “Questioning” after completing the course ($M = 3.68$, $SD = 0.76$) than before commencing it ($M = 3.34$, $SD = 0.73$). These differences are statistically significant ($t(90) = 2.06$, $p < 0.05$). However, the level of innovative thinking in the posttest of the students who studied the F2F course did not differ from the level of innovative thinking in the pretest. Similar results were indicated for the other skills (observing, experimenting, idea networking), showing that they did not differ before and after participating in the MOOC.

4.3 The relationship between students’ innovative thinking and their achievement in MOOC and F2F course

To examine the relationship between the innovative thinking components and level of achievement of MOOC students and F2F students, the Pearson correlation coefficient was calculated for innovative thinking components and level of achievement for each research group, as shown in **Table 3**.

Innovative Thinking Categories	Pre-test		Post-test		t value
	Mean	Std. Deviation	Mean	Std. Deviation	
Questioning	3.46	0.77	3.58	0.73	−0.80
Observing	3.89	0.80	4.11	0.73	−1.61
Experimenting	3.79	0.81	4.10	0.72	−2.40 [*]
Idea networking	3.47	0.74	3.84	0.78	−2.87 ^{**}
Innovative thinking	3.63	0.70	3.89	0.68	−2.06 [*]
On a scale of 1-to-5					

Table 1.
Mean and standard deviation of students’ innovative thinking before and after participating in “Approaches to Teaching Thinking” as a MOOC ($N = 91$).

Innovative thinking categories	Pre-test		Post-test		t value
	Mean	Std. Deviation	Mean	Std. Deviation	
Questioning	3.34	0.73	3.68	0.76	−3.16**
Observing	4.07	0.75	4.09	0.60	−0.14
Experimenting	3.93	0.82	4.06	0.72	−1.17
Idea networking	3.68	0.85	3.76	0.79	−0.73
Innovative thinking	3.73	0.71	3.88	0.66	−1.56
On a scale of 1-to-5					

Table 2.

Mean and standard deviation of students' innovative thinking before and after participating in "Approaches to Teaching Thinking" as a F2F course (N = 66).

The results of **Table 3** show that there is a statistically significant positive relationship between achievement level (grades) and innovative thinking components such as observing ($r = 0.53$, $p < 0.05$) and idea networking ($r = 0.38$, $p < 0.05$) among MOOC students. However, the results demonstrate no relationship between achievement level and innovative thinking components among students who study the course F2F in the classroom.

5. Discussion

This study aimed to examine innovative thinking among undergraduate students who participated in the course "Approaches to Teaching Thinking" as a MOOC for some and as a F2F course for others. Studies on innovative thinking are not new [25–27]. However, these studies based their findings on the industrial or engineering realm or in a classroom environment. The current study purposefully examined innovative thinking, especially in the education realm and MOOC environments. Although MOOCs were examined through the lens of quality standards, they are yet questioned by pedagogical professionals regarding their outcomes related to innovative thinking skills from students' perspectives. The main findings of this study are summarized and discussed in the following paragraphs.

This study found that students who studied the course "Approaches to Teaching Thinking" as a MOOC expressed higher means of innovative thinking after completing the MOOC than before commencing it. In contrast, students who studied the same course as a F2F course in the classroom expressed similar means of innovative thinking before and after completing the course. This indicates that learning via MOOCs promotes innovative thinking among undergraduate students. These findings correspond with extant research [5, 13–19], which reported that learning via MOOCs enhances 21st-century skills such as critical thinking, computational thinking, systems thinking, problem-solving, collaboration, and personal skills. For example, Gamage and colleagues [16] state that critical thinking was prompted by MOOCs, which contained peer reviews and opened spaces to provide different solutions. This leads to believe that MOOC participation encourages critical thinking skills. Otto and colleagues [18] explored the impact of MOOCs on learning about climate change. Their study included participants from two climate change MOOCs provided by two distance learning universities in Germany and Portugal. The results indicated that

Research group	Innovative thinking categories	Achievement level (grades)
MOOC students (N = 91)	Questioning	0.09
	Observing	0.32*
	Experimenting	0.14
	Idea networking	0.31*
	Innovative thinking	0.22
F2F students (N = 66)	Questioning	0.05
	Observing	0.02
	Experimenting	0.03
	Idea networking	0.03
	Innovative thinking	0.02

Table 3.
Pearson correlation coefficient for innovative thinking categories and the level of achievement for each research group.

participating in either MOOCs increased participants' competencies to think critically and engage in the climate change debate. Zimmermann and Höfler [19] presented in their study a didactical model for Massive Open Online Courses (MOOCs) to support the acquisition of 21st-century skills in Business Education.

Furthermore, deeper insights indicated that students who studied the course "Approaches to Teaching Thinking" as a MOOC expressed higher means of "Experimenting" and "Idea networking" after completing the MOOC than before commencing it. In contrast, students who studied the same course as a F2F in the classroom expressed higher means of "Questioning" after completing the course than before commencing it. The MOOC includes students from different disciplines, such as science education, mathematics education, Arabic education, and early childhood care. This allows the students to present and share their ideas on the different forums, as they rely on the support of their colleagues in the course, with little or no role played by the lecturer in supporting the students. As Saadatmand and Kumpulainen [47] present in their study, MOOC "learners participate in the flow and generation of knowledge and create and share their own content and digital artifacts through social technologies," resulting in a more connected environment where sharing of ideas takes place.

Our results also demonstrate that the more diverse the academic disciplines or levels in the team, the more innovative was the project. This finding corresponds with similar results from Barak and Usher [22], whose research concluded that team diversity in both academic disciplines and levels were strong predictors of innovation. Conversely, with reference to language, the more diverse the team, the lower was innovation [22]. In the F2F course, the lecturer played a central role in facilitating the development of questioning skills among students through their explanations of the material, answers to students' questions, and encouragement of question-asking during class discussions. These findings suggest that fostering diversity and promoting a supportive learning environment can contribute to developing innovative thinking.

The results of our analysis indicate a statistically significant positive correlation between academic achievement, as measured by grades, and the innovative thinking components of observing ($r = 0.53$, $p < 0.05$) and idea networking ($r = 0.38$, $p < 0.05$) among massive open online course (MOOC) students. However, no such relationship

was found among students who took the course face-to-face in a traditional classroom setting. This finding suggests that the opportunity for peer interaction and idea exchange afforded by the online course format may have contributed to the enhanced innovative thinking and subsequent academic performance of MOOC students. Further research is needed to confirm and expand upon these findings.

6. Conclusion

Based on the findings of this study, it is clear that Massive Open Online Courses (MOOCs) can be an effective learning environment for promoting innovative thinking, particularly in the areas of experimenting and idea networking. However, further research should be conducted to explore the potential for fostering innovative thinking in blended learning environments, which combine both online and face-to-face instruction.

In light of these findings, we recommend that educators consider incorporating MOOCs or blend learning approaches into their teaching, particularly when seeking to promote innovative thinking among students. Additionally, further research is needed to identify and understand the specific factors contributing to these approaches' success in fostering innovative thinking. This could include examining the role of instructor support, peer interaction, and technology in facilitating the development of innovative thinking skills.

Conflict of interest


The author declares no conflict of interest.

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Perspective Chapter: Advantages and Disadvantages of Online Learning Courses

Sabila Naseer and Hafiza Zahida Perveen

Abstract

Digital education is an innovative incorporation of modern technology to assist the teaching learning process. During COVID-19, its urgent need was underscored. In recent years, education is not limited conventional classrooms and textbooks anymore. This chapter highlights that the learning process has become more interactive and appealing due to the emergence of the ever-evolving technology, including its limitations. It has become more accessible, leading to a greater convergence of digital and traditional teaching methods. Due to the advancement of technology, online learning and pieces training have benefits such as flexibility and student-centered learning, reduced costs and increased collaboration, navigation, and exchange of ideas, variety of courses and learning styles, career advancement opportunities, enhanced time management skills, and immediate feedback. On the other hand, it also has some disadvantages. Withdrawal and attrition, more time taking, easier procrastination, self-motivation, and self-engagement, online courses may create a sense of isolation and difficulty in preventing cheating, and prolonged screen exposure causes health problems. The experts' given solutions on a national and international level to overcome the flaws must be discussed and the state should formulate educational policies to overcome these potential pitfalls and improve the quality of the online learning process.

Keywords: online learning, courses, advantages, disadvantages, policies

1. Introduction

Online learning is the use of diverse software to teach and instruct students and deliver content and skills out of traditional and conventional classroom teaching [1]. It refers to all the instructions which are delivered by the instructors electronically by using diverse Internet and multiplied platforms and applications. This term can be interchanged with e-learning, Web-based learning, computer-assisted instruction, Digital Learning, and Internet-based learning. It helps the students in their learning process and allows students to have greater control over their learning process in terms of time and place [2].

The COVID-19 pandemic forced all academic institutions to close their campuses and move didactic instruction online. However, the abrupt transition to online

learning has raised several issues and its benefits that have't been tried to be resolved. Although, several studies have investigated students' attitude toward online learning during the pandemic, mixed results have been reported. Additionally, little research has been conducted to identify and understand the pros and cons, especially pedagogical factors that impacted students' acceptance of online learning during campus closure. Furthermore, how online learning during the pandemic impacted students' learning performance has not been empirically investigated. In March 2020, the universities, colleges, and school studied here moved didactic instruction online in response to government issued stay-at-home orders. This first-of-its-kind comparative study examined students' perceived effectiveness of online courses during the summer quarter 2020, explored pedagogical factors impacting their acceptance of online courses, and empirically evaluated the impact of online learning on students' course performance, during the pandemic [3].

The idea of online learning was started in 1990s to describe that learning can be managed by utilizing the developments in the field of technology. But the spread of the COVID-19 pandemic has become part of the twenty-first century. Online learning was the only option during those days as all the academic institutions were closed because of lockdowns almost all across the world. It can be observed from the studies published during COVID-19 that several international journals have published a large number of academic studies focusing on online learning in higher education during this phase [4].

The online learning method is no less than the traditional method of learning. In a study, it was established that the online learning method was a successful and efficient way of learning for the accomplishment of academic requirements of students even though they were at a distance from their instructors and fellows. This distance learning was proved as efficient and effective as the traditional method was [5].

Although online learning has many advantages, it also has some challenges for students. It has made the process of learning for students much comfortable as they can have the material at any time as per their convenience. It gives them the flexibility to get engaged with the given task at a time of their own choice. However, it brings some drawbacks as students cannot have group or peer group studies. They cannot have class activities in real [6]. There are some other things that are also associated with online learning, that is, students have access to online educational courses organized by other countries, which saves their time, money, and effort. On the other hand, lack of Internet facility, network problems, lack of high-quality learning devices, and having little or no knowledge of the use of technical software or gadgets are problems linked to online learning which cannot be ignored [7].

Although online learning has its own advantages and disadvantages, it can be as effective as the traditional method if one has the skill about the use of technical sources/platforms, with surety of Internet facility and basic knowledge of computers. With the provided conditions, there was not a significant difference of student performance between online and face-to-face learning [8].

The purpose of present study is to highlight the importance of online learning. It also emphasized on the advantages and disadvantages associated with online learning. These days, online learning has become common for the purpose of some courses, diplomas, and even for higher studies. While considering the importance of online learning in present era, present study is aimed to highlight the pros and cons of online learning so that the students can learn to manage these things before going to be a part of such method of learning.

2. Objectives of the study

Several studies have been done in the field of online learning, such as its impact and consequences, etc. In this chapter/study a special attention was to exploring the merits and demerits of online learning. After reviewing several scientific and standard research papers, particularly the latest three years, the main objective of this study/chapter was the following.

1. To seek the advantages of online learning.
2. To evaluate the disadvantages of online learning courses, especially during and after COVID-19.

3. Methods

Twenty-six most recent studies were selected for review to seek the advantages and disadvantages of online learning courses. A Systematic and Tripartite Approach (STA) (Daniel & Harland, 2017) guided the review process. The data were analyzed by content analysis.

4. Results

Since the 1990s, online learning courses or pieces of training have been well-established in educational tertiary, and corporate training. Especially in higher education, online learning has been rapidly growing in recent years because of flexibility in schedules and ease of access [9]. In Pakistan, different institutions offer online education, Allama Iqbal Open University (AIOU), Virtual University of Pakistan, Preston University, COMSATS University, University of Peshawar, and British Trade Test Institute (BTTI), etc. [10]. In Pakistan, e-learning has become much more popularized in 2020 due to the onset of the COVID-19 pandemic. All the public and private educational institutes were turned into an online mode of learning. Numerous efforts were made to enhance the quality of education by improving the excellence of faculty members, their lectures, and methods of virtual teaching. The higher Education Commission (HEC) also remained in touch with the telecommunication companies to ensure that Internet facilities are cheap for students [11]. To make the learning process smoother, particularly for online learning courses, different factors can affect, such as students' satisfaction, teachers' role, academic motivation, personality traits, and emotional intelligence [12–14]. After systematically reviewing the empirical studies following advantages and disadvantages were concluded.

4.1 Advantages and disadvantages of online learning courses

Though the COVID-19 pandemic has triggered new ways of online learning, the whole world had to shift its educational system into the digital mode to educate its students. But in current times, it has emerged as an indispensable need of the day to teach and train students all over the world. Online learning is a new way to learn academic as well as co-curricular activities for students. It is also fruitful to train the workers

in their free time if they are not available physically. In recent months, the demand for online learning has risen significantly, and it will continue to do so in the future. Learning within the online environment differs from the traditional classroom learning community. Unlike traditional classroom learning opportunities, online learning environments foster additional learning experiences where learners can interact, collaborate, and take ownership of their learning. However, it has its pros and cons.

4.2 Advantages of online learning courses

Studies indicated that online learning facilitates to ensure remote learning in different circumstances where physical or traditional classes are not possible. In different courses, online mode is easy, accessible, manageable, and convenient for learners to reach instructors and teaching material. However following advantages from the literature have been drawn.

4.3 Flexibility and student-centered learning

Flexibility and student-centered learning are one of the major advantages of online learning courses [15]. Lectures by the instructor can be scheduled according to the feasibility and availability of the students and teachers. It provides more autonomy in one's decision-making and control over the learning process. The training can be arranged at the convenience of the workers by the boss. The noise can be managed, and distracters can be restricted easily. Students can be more responsible and can access the lectures and material easily when they are willing to learn.

4.4 Reduced costs and increased collaboration

Another advantage of online learning is reduced financial costs. Education can be expensive if the students have to travel to other cities, stations, or countries. But online learning eliminates the cost points of student transportation, student meals, and most importantly, real estate. Additionally, all the course or study materials are available online, thus creating a paperless learning environment that is more affordable while also being beneficial to the environment. Furthermore, they can also ask freely any kind of question to the instructors. They can get the opportunities to collaborate with the students and teachers comfortably on a national and international level which is impossible in the traditional classroom [16]. They can “talk” to each other and responds at their convenience.

4.5 Navigation and exchange of ideas

Navigation is another advantage of e-learning. With the help of the Internet, students can move from one document to another or one meeting to other in merely one sitting. The world has turned into Global Village, and one can access any person in the world just with one click. They are now easier and more comfortable exchanging their idea with each other at a global level rather than being limited to the classroom [17].

4.6 Variety of courses and learning styles

Another reason to support online courses is it has increased the options for education. Individuals who are working and unable to get admission in some particular

education setup can enroll themselves in online programs and complete their degrees to improve their knowledge and profession. Furthermore, individual differences exist among the students. Every student has a different learning journey and a different learning style. Some students are visual learners, while some students prefer to learn through audio. Similarly, some students thrive in the classroom, and other students are solo learners who get distracted by large groups. The online learning system, with its range of options and resources, can be personalized in many ways. It is the best way to create a perfect learning environment suited to the needs of each student [18].

4.7 Career advancement opportunities

Over the past few years, online learning has gained immense popularity. With more universities, training centers, and online learning platforms offering flexible virtual courses, employees now have a chance to improve their careers and maintain their professional edge. It does not provide different online professional degrees; a person can find many career advancement opportunities after getting a degree. The individual can be the master of their schedule and continue their study without any gap in one's resume.

4.8 Enhanced time management skills

Online courses teach students how they should manage their time. Including flexibility, the students have to submit their assignments and assigned tasks on time without procrastination. So, students still need to manage their tasks within the given deadline by the professor or instructors. However, students can submit their assignment anytime before the deadline, as in the traditional classroom on the assigned day and time. As a result, the students sharpen their time management skills [19].

4.9 Immediate feedback

Integrating with online learning coursework, one can get immediate feedback rather than wait for days, weeks, or months. Students can submit their assigned tasks and upload their assignments. The professors will give the feedback so the students can get it quickly without any delay. By receiving sooner the feedback they can learn faster and be motivated toward their learning process. They can adjust their time for future assignment [20].

4.10 Disadvantages of online learning courses

We are now well aware of the advantages of online learning. But there are also some challenges associated with this method of learning. Following are some of the disadvantages of online classes:

4.11 Withdrawal and attrition

In online classes, students have no face-to-face interaction with their fellows; therefore, they will not have competitors to compete and complete the lectures or assignments while working on any of these. Hence, it can lead them to leave the course incomplete. It is more likely that they will withdraw from the online courses

as compared to traditional on-campus courses. Murphy and Stewart [21] found in their comparative research between students of online and offline courses that more students (23%) withdraw from online courses rather than offline courses (18.4%). Schaeffer and Konetes [22] elucidated that students, who enrolled in an online course, dropped out of their course at a higher rate than students who were in the on-campus program. It is evident from these researches that the attrition rate is higher among online students as compared to the students of offline courses.

4.12 More time taking

Online classes also take more time than the traditional method for students and instructors. Instructors have to spend more time managing and uploading all the material for virtual classes, and students have to download and read all the relevant material rather than listening to the instructors in offline classes. Therefore, online classes consume more time; Bender et al. [23] stated that instruction time for their online course was almost the same as that of offline classes, but assessment and communication to students through email took more time than the offline class. They also added that online classes take more time because we had to prepare the instructors for online classes, especially for the development of IT skills and for the proper environment of online classes.

4.13 Easier to procrastinate

Students tend to procrastinate even in offline classes but when it comes to online classes, it becomes easier. Students will delay joining the classes, will skip class discussions, or remained incomplete assignments because there is no one to remind them about these activities. They are required to do all the activities on their own without any reminders from the instructors, as in offline classes. Elvers et al. [24] reported that the likelihood of procrastination was higher in virtual classes as students are prone to procrastinate more when they are not supposed to behave in a particular way for their learning.

4.14 Self-motivation and self-management; The only key to success

Online course classes need self-motivation and self-discipline so students can engage in the activities independently. A lack of self-motivation and self-management skills in a student will lead to failure in completing the online course. Bao [25] found that the usefulness of online learning depends on the student's personality or personal attitude toward learning. Moreover, in online classes, students have more freedom and self-control over their online activities [25].

4.15 Online courses may create a sense of isolation

During online classes, a student has to study alone and the technological device has to be the companion of the student. This can be terrifying sometimes, especially for those who are social persons. Park [26] found that 22% of online learning students reported that they were feeling isolated and it became challenging for them to continue the course. Online class students feel a weaker sense of connectedness and belonging than on-campus students who attend each other in face-to-face classes [27].

4.16 Cheating prevention is complicated

Usually, students try to find ways to cheat even in the traditional method of learning where invigilators are present. It becomes easier for online courses as they have various ideas and ways to cheat during the online assessment. Digital cheating is a term used for the description of cheating that is done by using a computer or the Internet. In a traditional learning method, where a teacher is invigilating the class during the examination, a teacher has more control over students to stop them from cheating as compared to the online examination. Baker and Papp [28] investigated digital cheating and identified that there are different ways in which students use an online assessment. Dendir and Maxwell [29] explained that cheating takes place in an unsupervised assessment, and an online examination is an example of it. They added that there are many factors behind academic dishonesty.

4.17 Prolonged screen exposure can lead to health problems

For online classes, a student has to spend hours in front of the screen. This prolonged exposure can lead to many physical and psychological health problems. Recent research has clearly explained that there are some health risks associated to screen time. Wong [30] found that e-learning requires time but has some risk factors attached to an individual's health, that is, brain development and well-being.

4.18 Online classes are not for computer illiterate persons

A student who does not have access to a computer, or the Internet and does not know how to use these; cannot get any benefit from online classes. Access to technology and the skill to use technology for learning are essential things. Link and Marz [31] suggested that some students, who were lacking in the essential skills to use web-based learning platforms competently, remained unsuccessful in online classes. According to this understanding, online classes are only useful for those who can use a computer or other technological devices [31].

5. Conclusions

The literature revealed numerous benefits and limitations of online learning courses. Flexibility and student-centered learning reduced costs and increased collaboration, navigation, and exchange of ideas, variety of courses and learning styles, career advancement opportunities, enhanced time management skills, and immediate feedback are the fundamental advantages of digital learning while it also has some disadvantages as withdrawal and attrition, more time taking, easier to procrastination, self-motivation, and self-engagement, online courses may create a sense of isolation, difficult to prevent cheating and prolonged screen exposure cause health problems.

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Conflict of interest

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Acronyms and abbreviations

EL	Electronic-Learning
AIOU	Allama Iqbal Open University
BTTI	British Trade Test Institute
HEC	Higher Education Commission

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Perspective Chapter: Effective Techniques for Getting and Keeping Students Engaged in a COVID-19 Environment

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Abstract

This chapter offers various techniques that have been used to get and keep students engaged in their learning, given the current state of the world. Based on a wide range of continuing education courses, it will describe ways in which to instruct students, regardless of whether the format is in-person, online, or hybrid. Interactive activities, such as Kahoot!, Jeopardy, Family Feud, Quizlet, Quizziz, and Poll Everywhere will be discussed. While recognizing that each student and class is unique, the strategies suggested can set the foundation for promoting an educational environment, stricken by the pandemic, that fully embraces diversity, equity, and inclusion.

Keywords: online learning, COVID-19, teaching techniques, student engagement, zoom platform

1. Introduction

The most recent pandemic, COVID-19, “posed formidable challenges, and these challenges will probably have long-term effects on education at all levels” ([1], p. 120). Although some institutions had already been onboard with offering a variety of online programs, several others were thrust into unknown and little-known territories, due to the enormity of the coronavirus. The resulting situations varied, based on the institution’s resources, the instructors’ training and levels of competency, and whether or not students were able to connect with their instructors and classmates to be able to stay engaged, which often became a sink-or-swim type of thing. Many lessons were learned by instructors, students, and institutions of the dos and don’ts of working in online environments, also referred to as Zoom university, which, according to universal design for learning (UDL), includes moving “toward a people-with-mobile-devices mind-set” ([2], p. 79). Based on those lessons learned, this chapter seeks to offer strategies that have worked for this particular instructor, while acknowledging that each institution, each course, each semester, and each student is different and what may work during a particular semester with a particular set of students for a particular course at a particular institution may not work in even

a slightly different institution, course, semester, or with a different set of students. However, after reviewing these techniques, it is this instructor's hope that other instructors may be able to tweak what is in this chapter and successfully apply this knowledge in their own online environment, while learning about "which strategies work best with which types of students or classes" ([3], p. 164). Additionally, it is also this instructor's hope that other ideas will be sparked, in order to create and maintain the best type of online learning as possible, for both students and instructors.

2. Background

As an instructor in a higher education setting during a pandemic, I am constantly searching for ways to improve my craft. This research not only brings to the forefront strategies that I have personally used but also highlights techniques my colleagues around the world have, as well. As we are now in the process of being in a post-pandemic world, it is important not to completely do away with or forget about things that were implemented over the last few years.

3. Motivation

In my research, I have taken notes about how different instructors have adjusted to the COVID-19 pandemic inside and outside of the typical face-to-face instruction. Additionally, I understand the importance of professional development courses to improve my pedagogical approaches. As a current assistant professor on the tenure track, my teaching and how I relate to my students is constantly being evaluated by my students themselves, my administrators, and my peers. Being a perfectionist and being that teaching is my passion, I strive for the absolute best in the work that I do and appreciate the constructive feedback I receive from all of the above.

4. Methodology

This research was conducted using different research databases, including Google Scholar, Proquest, and EBSCOHost. Key terms that were researched, included: COVID-19, online teaching, higher education, and pedagogical practices. Below is the literature review that resulted from my searches.

5. Literature review

Throughout the literature, various authors discuss techniques for online learning during the pandemic. Different themes were explored for quantitative, qualitative, and mixed methods studies. While several terms were used to describe online learning during this time, e-learning and distance learning tended to be the most frequently used. The feedback can be very positive for moving forward and as one author suggested, most students want to continue online learning in the future ([4], p. 1). Engagement seemed to be the overarching area for students and teachers in a COVID-19 world. I briefly discuss the ways found in the literature for how instructors have implemented engagement tactics.

5.1 A sense of community

The pandemic can be very isolating. Students are longing for a sense of community during this time. In order for students to feel connected, while socially distant, instructors must establish a foundation in which students can not only communicate and connect with one another but also with their professors. One author suggested that “a good connection communication network of all students and lecturers is a major aspect that must be considered in lectures” ([5], p. 1). Active learning goes along with a sense of community because the more students tend to feel connected, the more active their learning will become. This can be through teachers offering additional office hours, creating a GroupMe chat for their classes, or having a discussion forum for students to post any questions they may have. Even the platforms, Zoom and Moodle, can help to establish positive communication between instructors and students ([6], p. 1). Building a sense of community should be created at the beginning of the semester and maintained throughout.

5.2 Social media

Another area of engagement is the use of social media, as it can “enhance online education by: widening the context for learning beyond the class to larger networked publics; introducing a hybridization of expertise (e.g., past learners, practicing professionals); mixing different types of information and resources; and re-shaping instructors’ roles as facilitators” ([7], p. 514). Social media was found to be an effective tool for information exchange, collaboration, and cooperation ([8], p. 9), especially those platforms that could be easily integrated into learning management systems ([9], p. 219).

5.3 Gamification

Gamification was another huge area. One author noted that “the number of students attending regular classes increased to about 20%, and students were always willing to participate in the proposed activities” ([10], p. 66). That same author reiterated the vitality of having a variety of “large group, small group, and individual work experiences ([10], p. 64). Using games, such as Quizizz and Kahoot! help to promote “better engagement” and a “positive learning experience” ([11], p. 18).

5.4 Mental health

Taking into account the mental health of students and the instructor was also seen as crucial. “The economic uncertainty, racial injustice crisis, and political turmoil that occurred alongside the pandemic in the United States affected different people and different communities in different ways” ([12], p. 152). Hence, the need for compassionate pedagogy, which allows “students to share experiences and provide support for one another” ([12], p. 153). This theme also goes back to building a sense of community, because, as White states, “compassionate teachers should not only get to know their students but also share some aspects of themselves”. Additionally, it is an instructor’s responsibility to “regularly ask students about their mental health and teach motivation and achievement in academics” ([13], p. 6). Furthermore, adopting a trauma-informed approach to instruction can provide “a sense of stability, agency, and connection to the university and one another” ([14], p. 177). This can be

accomplished through check-ins at least once during each class session. Once instructors build rapport and get to know their students a little more, they become better equipped to sense when a student may need someone to talk to or resources to access.

6. My own pedagogical strategies

6.1 Setting goals and carrying them out

Throughout the pandemic, I have participated in many different professional development courses, in which I was able to take some techniques from each, further developing each, into my own style, in order to assist my students with their learning. Some of those courses included: Introduction to Teaching Online (ITO), Getting Ready for Quality Matters (GRQM), African American Studies Initiative Summer Institute, Association of College and University Educators (ACUE), Teaching Online for Faculty, Advanced Online Student Engagement, Texas Distance Learning Association (TXDLA) Digital Accessibility Certification: Faculty Track, Community of Practice: Digital Inclusion, Broadening Global Learning Opportunities Building Academic Leaders (B-Global): A Quality Enhancement Plan, and the Career Course Program. Completing these courses helped me to not only learn about the type of students I could encounter but also assisted with me assigning them a wide range of assignments. Some of which have worked well and some either need tweaking or need to be greatly revamped.

One assignment I have used began as a first-day, in-class assignment, simply titled, “Goals.” During my in-person classes, pre-pandemic, I would have all my students draft a 2-page paper on their goals for the semester, for the class, and for their profession. Once my courses were switched to online, I decided to keep this assignment, but convert it into a discussion post video. That way, students would be able to view their posts and their classmates’ posts, include a written or audio response and build rapport with one another. This assignment is now titled, “Introduction and Goals Presentation.” It is typically due during the first or second week of the semester. Additionally, there is a “Closing and Achievements Presentation,” which is a follow-up to their “Introduction and Goals Presentation.” Students discuss what goals they achieved and their overall opinion of the course and the semester. While I tend to be a little more lenient in my grading of the “Introduction and Goals Presentation,” I tell my students that the “Closing and Achievements Presentation” will be critiqued in more depth, given that they have had the entire semester to evaluate their own learning and my instruction. Both assignments help to keep the student accountable while allowing them to learn about their classmates and various topics that have been covered or that they want to learn more about. These two assignments are now assigned to each of my courses at the beginning and end of the semester, regardless of whether or not I teach a multiple-part course. When students are taking more than one course with me, I inform them to do a different video for each course, although some have attempted to upload the presentation multiple times. Outside of reviewing my student opinion surveys (SOS), I also review the presentation videos as assessment tools for my teaching. This assists me helping to get and keep my students more engaged throughout the semester and during future semesters.

As stated previously, it is best to tweak assignments based on the needs of students. Although I have assigned the above assignments in only paper and video formats, students also could complete them as vision boards, collages, songs that they

create, or even short films. The possibilities are endless and should allow students to think deeply about goals, not only for the class they are currently in but also for overall life goals. It is also important to introduce the goals portion using the Specific, Measurable, Attainable, Realistic, and Timely (SMART) method or in another style to which students can relate. Lastly, it may also be an excellent idea to model the type of presentation that would receive a high score. So, in addition to using a grading rubric, I tend to create my own presentation to share with my students or show them good and bad examples of previous students' submissions, keeping their identifying information confidential.

6.2 Interactive activities and gamification

As a competitive person, my personality tends to come through in the way I teach. I expect the best from my students and often insert myself into competitions among my classes. One way I do so is through the incorporation of games. I have found that is one way to make learning fun. As making learning fun is a key component of my teaching philosophy, I believe that I should do everything I can to make, what may often be considered as "dry" topics, interesting. When I was a college student myself, I remember very few instructors playing games in our classes. I strive to do so, in order to reach those students who may come from different majors or who may see learning as unidimensional. Some activities that I have played with my classes are: Kahoot!, Jeopardy, Family Feud, Quizlet, Quizizz, and Poll Everywhere.

The interactive activities I play with my classes are used to supplement the lectures for students to connect more thoroughly with the material. When meeting online with my classes, I do not lecture full-time. If I lecture, then it may only be for a few minutes, going over a few PowerPoint slides. The majority of our meeting time will be discussion and interactive activities. Therefore, in order to use class time wisely, I make sure I plan out exactly what I want to do with my classes and the time frame in which to do it. However, I am aware that sometimes, no matter how excited I am about what I have scheduled, I must still be open to throwing it all out of the window to address whatever issues may arise with my students or our institution. This has never been more needed than throughout the pandemic, as it can be extremely difficult, if not close to impossible, to teach a group of students, ignoring the current situation of the world and how it is affecting individuals. Using an activity like Poll Everywhere can allow an opportunity for students to express themselves anonymously, given that the right questions are posed. With Poll Everywhere, students can answer multiple-choice questions, create a word cloud with their answers, give open-ended feedback, and engage in several other ways, without the fear of being judged for saying or writing the "wrong" thing. I often use Poll Everywhere to do beginning, middle, and end check-ins.

For review sessions, although I have played Family Feud, Quizizz, and Quizlet, in my courses, I have had the most success with Kahoot! and Jeopardy, which is a play on the Jeopardy game. I tend to offer an extra incentives for the top competitors, such as extra points added to exam scores, the opportunity to bypass a low-stakes assignment or points added to students' final grades. I have asked students to create their own questions for review sessions to send to me. Once they do that, I will compile them into a study guide and choose the best questions to include in Kahoot! Students tend to get excited when they encounter their own questions or similar ones while playing. In the end, the top three players receive whatever the extra incentive, which keeps them interested in participating.

When playing JeoParody on Zoom, students use the chat box to enter in their answers in the form of a question to the given prompt. Whoever types in the correct answer first is allocated the points and has control of the board at that point. Although some students may have difficulty coming up with the correct responses during the timeframe, I still offer extra credit for the final JeoParody. Each student can send me their response directly in the chat box. I usually inquire about something that does not necessarily have a right or wrong answer, but that is based on the students' own viewpoints, such as their favorite or least favorite topic during the course or from the chapter being reviewed.

6.3 Social media as a friend

Although many instructors may cringe at the notion of integrating social media into the classroom, the truth is if you can use it to catch students' attention, they may learn more about what you are teaching than through strictly lecturing. In today's college environment, most students tend to be married to their phones. I come from the standpoint of, since that is the case, why not use that to get them to explore other avenues of the digital world? The activities mentioned previously, Kahoot! and Poll Everywhere, allow students to use their phones to participate.

As a participant in the Career Course Program for the 2022–2023 school year, one of my courses will have a career designation, in which I will include activities in my syllabus to assist students with thinking about and learning more about the career paths they are interested in going down. Before I was a part of the program, I had included low-stakes assignments or assignments that are only worth a few points toward their final grades. These included developing cover letters for their resumes and letter of recommendation for them to give their references to tweak, put on letterhead, and sign for them. These assignments came in handy, as I would often have students come back to me, once they completed my course, and ask for a letter of recommendation or to edit their cover letter or resume. At that point, I would tell them to refer back to the assignment we had during our course, update it, then send it back to me for feedback. Sometimes my students do not realize that those assignments were for those particular instances when they would need them, when on the job market. I tend to delight in the fact that some of them were able to directly apply those skills right after the completion of my course.

One assignment that I plan to implement in the future is another low-stakes assignment in which they create or revise their LinkedIn pages. One of the main questions my students ask is, how to get a job in their field. One of my first questions for them is, do they have a LinkedIn profile and what do their social media pages convey to employers? With this assignment, I plan to introduce the assignment by discussing what LinkedIn is and sharing my own profile, as well as, the profiles of some of my colleagues, with their permission. I will then expect students to do their own research and access other profile pages of the individuals who hold the types of jobs and careers they would like to achieve. While this assignment is currently in the works, I believe that it will help students become more aware of their online presence, or lack thereof, resulting in them either wanting to clean it up a bit, before graduating and being on the job market, or establishing a greater presence to make themselves more marketable. As I have experienced being recruited to apply for jobs based on my LinkedIn profile alone, I want my students to be able to experience the same, at least as a starting point in their field of choice.

Furthermore, I encourage my students to research podcasts in their field, I show YouTube videos related to my courses, and I challenge them to share relevant news on Twitter, Instagram, and Facebook to share with the class. For those with current businesses, I also ask them to share, in order to connect with others and grow their clientele base. I find that students enjoy connecting with one another via social media, which sometimes makes it a bit easier to work on group projects together, outside of class, since this allows them to better understand one another's interests and passions. Also, this helps to add creativity to students' group projects because they may come up with ideas from videos they have seen on YouTube or TikTok to illustrate their viewpoints. Utilizing such videos can be useful for teaching and learning ([15], p. 1). I dedicate points in each of my grading rubrics for creativity and count the incorporation of social media as a miscellaneous area, which is greatly welcomed.

6.4 Guest speakers

Guest speakers are such a blessing to my students and me. Not only do they allow a bit of a break from having to prepare activities for my classes to do, but they also give students an opportunity to break from traditional tasks to focus on hearing the experiences of another professional. With the pandemic, it has been a bit easier to schedule speakers via the Zoom platform, as I am not limited to colleagues in the area, but I also have more colleagues willing to present to my classes in different cities and states. For example, a professor at another Historically Black College and University (HBCU) that I connected with at a social work conference was hosting a study abroad program in Ghana. I invited her as a guest speaker to my classes and found that many students' interests were piqued by her presentation, with some reaching out to inquire about how they could attend that program.

One such instance in which having a guest speaker helped tremendously, was when I tested positive for COVID-19 the second week of the fall 2022 semester. As I scrambled to figure out what to do about my classes that week, while self-isolating, I decided to reach out to one of my social work colleagues, to see if she could assist. Although I had all in-person courses at the time, she accepted my invitation to be a guest speaker, virtually, for all three of my courses. My colleague was a huge help, as she shared some of her experiences in the field with my students, allowing them to ask questions and learn from a social worker who holds licenses in multiple states. She contributed to my students being more engaged and being able to meet in a safe learning environment.

Asking previous students who have graduated to return as guest speakers helps current students feel a bit more comfortable asking questions that only alumni of their institution may be able to answer. Just to know that not only did that individual graduate from their university but also is thriving in their field, can be incredibly inspiring to those students who may feel they have a long way to go. I have had a few different graduates as guest speakers for my classes and I could tell the difference between those speakers who had that connection and those who did not. My students tended to be much more engaged and willing to inquire about the next steps to take, following graduation. They seemed more eager to connect outside of my classes, as well, via social media.

In my summer internship seminar classes, students are required to find guest speakers themselves, either within or outside of their agencies. This helps them to step outside of their comfort zones and establish rapport with those in their field and similar fields. They realize that finding guest speakers is not always easy, as it often

comes down to more than just who they want to present. They must also consider one's timeframe, fee, relevance, availability, and accessibility. I ask my students to have a backup plan, or another guest speaker lined up, just in case the one they chose is not able to make it. This is also like a mini group project, as those placed at the same agency must collaborate to pick a speaker, then present them with a thank-you gift afterward. Students further learn how to plan ahead, value other professionals' time and efforts, and maintain working relationships. They may also have to answer their potential guest speakers' questions about what exactly to discuss and for how long, how many students are in the course, and what format the class is in. If the person has never used an online platform, such as Zoom, then students may have to offer a short training on how to navigate it. Moreover, students have to briefly introduce their guest speakers by giving their audience some information about their academic and professional backgrounds. Students tend to learn a lot about themselves, as well as others, throughout the process of choosing and scheduling guest speakers with their classmates.

6.5 Group presentations

Most students that I have encountered do not exactly jump for joy at the thought of having to complete group presentations. However, I always express the significance of learning how to work together effectively, as it allows "students to connect with one another to build a strong sense of community" ([16], p. 52). Although many complain throughout the process, they learn lessons from being grouped with different people that they can use as examples when interviewing for jobs. In addition, "it is suggested that social presence, as well as group cohesion among students and between students and instructors, can serve as a protective factor to ensure continued productive motivation for teaching and learning while facing the challenges that are experienced during such times" ([17], p. 35). Ultimately, it is yet another way for students to stay engaged while discovering characteristics of their work ethic and their classmates.

Since transitioning to a COVID-19 environment, I have learned that group presentations may become a little trickier to maneuver. While having to social distance, the importance of connecting outside of the typical face-to-face setting is even more crucial. I have found that many students will divide up the work, based on the different parts of the assignment, complete their parts, and not be concerned about the assignment, as a whole. I try to get my students to shy away from only worrying about "their" part, as it is a collaborative effort, in which each individual member should know, not just "their" part, but "every" part. Honestly, I have not had much success in this area. However, in my grading rubric, I allocate credit for group cohesion and being able to work out any issues ahead of time themselves, as adults, without having to inform the instructor of every single issue.

I usually reserve time for group presentations during the middle to the end of the course. So, I lecture during the beginning to the middle of the semester, then use the rest of the course for students to illustrate what they have learned and how what they have learned can be applied to our field. During my lectures, I try to model how and what I would like presentations to be set up. This includes setting up early before class time, preparing handouts or links for the audience, sending any information that will be presented to the instructor a few days in advance to receive feedback, and including an interactive activity, such as Kahoot!, Poll Everywhere, or Jeopardy.

Grading presentations can be very tedious. I start by reviewing a hard copy beforehand, filling in pertinent information, such as group names, presentation date, and

titles. Then, during the actual presentation, I enter points. I require groups to upload their presentations, at least an hour before the start of class time, in which they present. This gives me time to print them out, review them, and write down potential questions and comments. Following the end of a group presenting, I ask questions and provide feedback, both verbally and via email, within a day or two.

Furthermore, I require at least one meeting, based on the group's availability, which all group members must attend. During that meeting, I review the instructions, go over the group's outline for their topic, answer any questions that may arise, and offer them guidance for getting started and progressing. I reiterate reaching out ahead of time if there is something they are finding challenging. While some groups may not take the meeting as seriously as they should, the ones who do usually earn higher scores and get more out of the assignment.

Group presentations, when completed with much effort and without procrastination, can build a sense of pride within the instructor and the students. They showcase active learning and give students opportunities to highlight what they believe are vital subjects. Throughout presentation time, I learn so much about what drives my students and what their passions are. It also helps me to modify the setup for group presentations from semester to semester, honing what is expected of students, based on new standards that have been set during each course.

6.6 Pedagogy challenge

During fall 2022, instructors were challenged, by the dean, to include an activity in their courses during the first week of classes, in order to have a positive impact on enrollment and retention. The focus of the challenge was “belonging,” as “our need to belong influences everything we hear and is fundamental to our well-being” ([18], p. 173). We were tasked with putting into effect the teaching tips and lessons that the guest speakers at our college's mini conference presented on. We were to ask our students about the best and worst classes they had attended, what made those classes stand out in their memories, and how they made them feel. We also had to ask them to write down the characteristics of those classes and how the instructors and students made them positive or negative experiences. Lastly, we were to have group discussions about what they wrote and develop a list of qualities, for both faculty and students, that we would like to see in our class that semester. Once completed, we were to submit a letter detailing the use of the Pedagogy Challenge Activity, providing three examples of how insights from the activity were used to adjust teaching strategies, and providing two letters of support from students enrolled in our courses, in order to be nominated for the Pedagogy Challenge Teaching Award, for which two awards were available.

At first, I was unsure if I would even participate in this activity. I already had my schedule planned for each session throughout the week. However, I think that was part of the challenge. Although I had already prepared what I wanted to do, this activity taught me that sometimes you may have to throw out what you have planned, rearrange some tasks, and prioritize the needs of the students more. When I decided to give it a shot, I was pleasantly surprised by how much my students had to share, particularly about their worst classes. Most of the time, it is difficult to get students to feel comfortable enough to share, especially during the beginning of the semester. But that activity helped many to feel like they were in a safe space with an instructor who actually cared about getting to know them and making their semester in their course the best experience possible. Even students who had not taken any of my

classes before wrote that they felt like it was going to be a great semester for them because of my approach, which reinforced why I should have completed that activity in the first place. When students discussed their worst classes, most stated how they felt the instructor did not care about their learning, was hard to contact for additional assistance, or how they were tested on, which was different from what was discussed during lectures. For the best classes, most mentioned the opposite. They wrote that they felt that their opinions mattered, there were multiple opportunities to earn good grades, the instructor was easy to get in contact with, and the classes were engaging. It helped to put into perspective things that I, as an instructor, sometimes do and do not do, and made me more aware of things students find helpful with which I should continue.

The Pedagogy Challenge was not just something to do in the first week and then forget about it. I found that throughout the semester, I had to review the characteristics my students wanted to see implemented in my courses. I tried my best to encompass all of the traits they mentioned they wanted to see in their instructor. Moreover, accountability went both ways, as I reminded my students what was discussed during the first week and what they had pledged to do. Ideally, this is an excellent activity that should be tried out by all instructors, as a starting point for their classes. It sets the tone and can show instructors how to make their courses more student-centered, by hearing students' voices and giving them choices. It opens the door for further discussions about what different students want to learn and how they learn best, making it easier for instructors to get to know their students better.

6.7 Miscellaneous

While I have highlighted six major areas for getting and keeping students engaged, there are several others I have also implemented from semester to semester. One assignment that serves as another foundation to develop rapport with students is a questionnaire that asks about, not only what they know about the course topic so far, what they want to learn, and their passions, but also about what challenges they may currently be experiencing or that they foresee that may hinder them from completing their assignments on time. Being aware of what students are facing outside of the classroom can prepare instructors to make adjustments as they see fit. I tell my students that whenever there is an adjustment made, I always try to make sure that it is in their favor. The questionnaire is also a low-stakes assignment, in which I have received positive feedback on.

Meeting with my students one-on-one, each semester, is what I strive to do, as well. For the larger classes, this is usually accomplished through my group presentation meetings. I appreciate being able to meet, either in-person or virtually, with students in my smaller classes because I am able to spend more time addressing their needs. I know meeting with a professor, one-on-one, can sometimes be intimidating, whether it is virtual or in-person. So, I try to be transparent and let them know, ahead of time, what exactly we will discuss for them to be able to prepare. I encourage them to come to the meeting with their own agenda for questions they want to inquire about. This helps to break the ice and make it more student-led.

Also, for smaller classes, I tend to have more individual assignments. Instead of group presentations, I may have individuals present on different sections or chapters of the textbook. I still encourage interactive activities between the presenter and the audience. When only one student is presenting, I require the presentations to be shorter in the timeframe. For one of my classes, students were to present on a chapter section for five minutes, include an interactive activity, create potential exam questions and

multiple-choice answers from which I could develop my own, and use only one slide. This was challenging for some, as they had been used to presenting for more than five minutes, using multiple slides, and having someone else presenting with them. However, when students adhered to the guidelines, it helped me to be able to evaluate whether or not they really understood the material enough to be able to teach it to others.

From semester to semester, I frequently ask my colleagues for assistance with executing different assignments, getting some of their ideas of what to do in certain classes, and seeing if and how we can combine our courses for guest speakers or programs. This shows my students that working collaboratively is crucial as a college student and college instructor, since we are all “involved in a collective effort to help each other learn” ([19], p. 364). Furthermore, at the beginning of each semester, there is a library instruction day, in which a librarian either attends my classes or I take my classes to the library. Although some look at library instruction day as a free day and some students state that they have already participated in it multiple times for previous classes, there is always something new they can learn how to do.

Given all of the above techniques described, I try to stay as open as possible to making changes, trying out new strategies, and putting pauses on others until I find a better way to execute them. As teaching is my passion, my overall goal is to use my passion to demonstrate to my students how learning can be fun, engaging, and relevant. In a COVID-19 environment, all three are incredibly important and should serve as a basis for instruction.

7. Discussion

As this chapter took a look at teaching strategies during the pandemic implemented by both this instructor and others around the world, the significance of blended learning can not be stressed enough. In today’s society, there must be multiple forms of teaching and engagement, in order to assist students with diverse needs in a post-COVID-19 environment. In particular, “online teaching and learning has been adopted and accepted as a new normal which enforces self-learning and adaptive learning” ([20], p. 88). Instructors must constantly look for new and improved ways to reach their audience, incorporating material from within and outside their textbooks and incorporating how students view the current state of the world.

8. Conclusions

This chapter took a glimpse at several tactics for teaching in a pandemic. For each strategy, I have highlighted how and why I have used it and what the result has been thus far. I have emphasized the need for these techniques to be adjusted, based on one’s own teaching style and students’ needs. It is my sincere hope that this chapter has helped to spark ideas for additional teaching methods and that readers improve upon the methods already discussed.

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Conflict of interest

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Inclusive MOOC Supported by Assistive Technology

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and Márcia Campos Gouveia*

Abstract

The deaf and blind communities often struggle to communicate. In scenarios such as academia, these communication challenges prevent these communities from progressing within the wider intellectual communities, as most digital content and tools used for disseminating information remain inaccessible to them. Our work aims to revamp the learning experience of deaf and blind students by granting them access to education in their first language and through proper effective channels. Massive and Open Online Courses (MOOCs) provide a new opportunity for education. MOOCs are easily accessible; however, their availability tends to be non-inclusive. The aim is for them to be viewed broadly, even though minority groups, with needs for specific channels and languages, such as deaf and blinds, are usually not considered. To maximize the potential of these courses, an inclusive MOOC was developed, a broad pedagogical model with technologies that enable deaf and blind people to access digital educational content.

Keywords: educational content, inclusive MOOC, pedagogical model, assistive technology, automatic translator

1. Introduction

According to the World Health Organization [1], at least 2.2. billion people have a vision impairment and over 1.5 billion people globally live with hearing impairments. One of the impacts of visual and hearing impairment is the failure to easily communicate and access information. Deaf students often face communication challenges in educational settings. This happens due to the fact that almost every information tools remain inaccessible to them, which often limit their opportunities for academic and professional success, as well as their full integration in the academic community. In fact, digital information and most educational materials are only available in spoken languages, either in its written or audio form, which makes them unavailable to deaf students who do not understand spoken languages.

As an expected consequence, by using different mother languages, that differ in all aspects, including phonology, morphology, vocabulary, and syntax, users of sign language and users of spoken language struggle to communicate among them. While spoken languages are linear, sign languages are visual and make use of spatial

dimensions. This means that a deaf student who is comfortable with communication in sign language may or may not be able to read a spoken language fluently, just as a person who is used to communicate in a spoken language may not be able to understand its sign language counterpart.

According to Ziadat and Al Rahmneh's research [2], deaf individuals face several educational challenges; the need for a sign language translator, difficulties in understanding scientific subjects, and a lack of competent teachers with sufficient knowledge to effectively teach these students are some of these challenges.

However, technological developments have enabled the emergence of tools to include deaf and blind communities within the learning process. Nonetheless, they often involve expensive hardware and related services, including training. These questions often prevent educational institutions from adopting inclusive measures, hindering the integration of blind and/or deaf individuals in their courses.

Despite the daily challenges, the number of students with hearing and visual impairments enrolling in higher education has been rising considerably, raising the need to devise strategies of inclusiveness that enable access to information and educational content, improving learning.

For this purpose, this article presents an innovative approach to developing digital content for deaf and blind people, based on an inclusive learning approach, using web tools that allow any person with minimal computer expertise, regardless of their abilities, to improve their knowledge in a given topic. An inclusive massive online open course (MOOC) and a pedagogical model were designed specifically to address hearing and visual impairments.

Finally, the quality assessment of the inclusive MOOC is explained. Evaluation results are presented and discussed. In this process, performance indicators from the quantitative evaluation framework (QEF) [3] were applied, and two questionnaires for gathering the users' perceptions were produced.

1.1 Background and related work

In the past, institutions offering courses on Portuguese sign language (LGP) were primarily located in Setubal, Portugal. However, this has shifted in recent years and, since 2005, higher education programs in translation and interpretation of LGP have become available both at the Polytechnic Institute of Coimbra and the Polytechnic Institute of Porto. Their offer is mostly of undergraduate degrees in education and pedagogical sciences, focusing on sign language teaching and training sign language translators, interpreters, and teachers [4]. A significant portion of the technical literature on the subject has been developed only in Portuguese, and deaf students are therefore dependent on the interpretation provided in class without having access to study materials in sign language [5].

The presence of sign language interpreters in the classroom is a result of the lack of appropriate didactic materials and bilingual teachers. This contributes to the effective exclusion of deaf students from the academic community. Most interpreters do not have the same academic qualifications as the teachers and therefore struggle to understand the concepts being discussed in class. This can directly affect the translation process from Portuguese to sign language, leading to a vague understanding of the information by deaf students [6]. Furthermore, schools and universities often lack the necessary physical infrastructure and teaching methods based on sign language and deaf culture [7]. These factors illustrate how poorly implemented public policies

of inclusion can result in ineffective education for deaf individuals, as they do not provide access to learning in sign language.

The accessibility of education has seen significant progress in recent years [8]. While many authors have addressed this topic, few have focused specifically on the development of MOOCs for individuals with hearing and visual impairments. Gupta and Fatima [9] are among the few who have proposed ideas for developing MOOCs for people with hearing impairments. McKeown and McKeown [10] have identified barriers such as the lack of Sign Language support in learning management systems and difficulties with communication and course materials as challenges faced by deaf learners in e-learning environments.

Other studies in e-learning systems with accessibility for deaf and hard of hearing individuals are scarce. Alcazar et al. [11] implemented a speech-to-visual approach in an e-learning system for teaching English in the Philippines, which proved to be beneficial for deaf students in terms of comprehension and individualized instruction. Batanero et al. [12] redesigned a Moodle platform to include accessible learning objects for deaf, deaf-blind, and blind engineering students, resulting in their improved academic performance. Esdras and Galasso [13] developed the first bilingual virtual learning platform with tools such as mental maps and bilingual forums. Batanero-Ochaita et al. [14] evaluated the accessibility and usability of a learning platform prototype for deaf, deaf-blind, and blind students, finding a positive response from all students. These studies demonstrate the potential of digital accessibility for deaf and blind students.

1.2 Purpose of the study

Deaf students, who are comfortable with communicating using sign language, often face challenges when accessing information in spoken languages, which can negatively impact their academic performance. Providing digital content in sign language can be of great benefit to these students, allowing them to study and learn using materials in their first language.

In this paper, it is proposed a pedagogical model for delivering inclusive educational materials to deaf and blind students through Massive Online Open Courses (MOOCs). As proof of concept, it is described a course on digital literacy for school-teachers that was developed using this proposal. Our model has the potential to improve the academic performance of deaf students by providing them with access to materials in their first language, as well of blind students.

2. Methodology

The development of an inclusive Massive Open Online Course (MOOC) requires the collaboration of multidisciplinary teams in order to create an accessible and innovative educational environment. The inclusive MOOC discussed in this article is designed for deaf individuals in Portuguese-speaking countries and Portuguese and Brazilian people around the world. Each MOOC follows a common model that is based on a specific pedagogical structure and incorporates adapted technology to ensure consistency across the post-graduation degrees offered through these courses. The content production for each course must consider five key factors: structure, length, pedagogical design, content production, and validation [15, 16]. Each course

is a short, online learning unit, that follows a set of specifications to ensure coherence among MOOCs.

These specifications include: (1) prerequisites and learning objectives; (2) supporting content for the lesson; (3) evaluation strategies; (4) the interaction model to be adopted, including pedagogical tools for deaf individuals; and (5) an introductory welcoming video [17].

The authors of this article have taken on the challenge of applying a pedagogical model to create inclusive and innovative MOOCs. Their goal is to promote the inclusion of deaf individuals in higher education through the development of technical equipment, software, and strategies that allow the MOOC model to be adapted to a multilingual environment that includes Portuguese, Brazilian Portuguese, LGP, and Libras. The planning and development of these courses involves all relevant professionals in order to meet the objectives and ensure a consistent development process that produces courses that are suitable for deaf individuals (**Figure 1**).

The use of sign language in these MOOCs is facilitated by the VirtualSign technology, an automatic bidirectional translator of sign and spoken languages. The computer team is responsible for developing the VirtualSign application [19, 20], which allows deaf individuals to access digital content, as well as creating a sound environment that makes the same digital content accessible to non-deaf individuals.

As mentioned, VirtualSign is a bidirectional translator that can convert LGP into written Portuguese and written text into LGP. The translation from spoken to sign language is performed by a 3D avatar that reproduces the corresponding animations for the text. This supports the intended interaction model for the MOOCs.

The design of the MOOCs is the responsibility of the graphic design team, who use storyboards to guide the recordings of the lessons in order to avoid errors in task

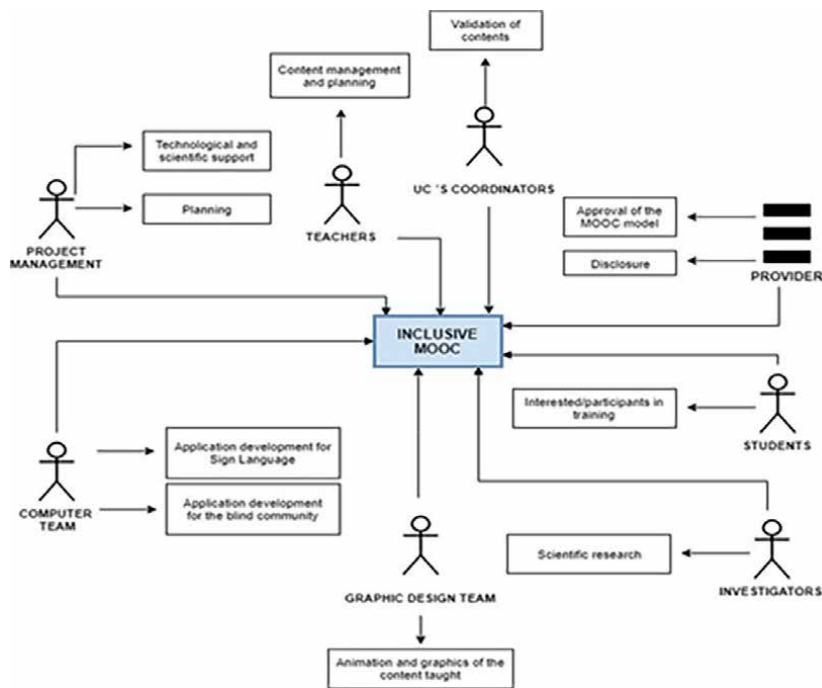


Figure 1.
Stages in the inclusive MOOC approach and respective roles [18].

performance. The design team is also responsible for video recording, image editing, animations, and graphics integration, following the input from the teacher.

The provider is responsible for disseminating the MOOCs through their network, and the “students” are the users of the final educational product. The teachers are responsible for planning and developing the content, including written texts, images, and videos. The UC Coordinators team validates the lessons, with the design team overseeing any necessary corrections or adjustments to the audio. The research team (“investigators”) is responsible for researching the specific needs of deaf individuals in order to enable intuitive interaction. Finally, the project management team oversees the planning and provides technological and scientific support for the successful development of the MOOCs.

2.1 Sign language technological framework

The MOOCs incorporate an automatic translation system that can convert text to sign language and sign language to text, based on the VirtualSign technology, in order to support bilingual content and interaction. **Figure 2** in the original article presents the pedagogical model, which integrates the content for deaf students and identifies each element: the digital content repository (DB), where the digital materials for a course are stored; the content experts (teachers), who can use various tools to provide the content (e.g., Word, PowerPoint, video, audio); the Kinect and sensor gloves, which allow the LGP specifications to be read by the computer; and the avatar, which translates written text into sign language. This system allows educational content to be automatically translated for both teachers and students without requiring them to have programming skills or be familiar with nonnatural communication channels.

In addition to the sign language translation capabilities, an audio add-on that converts text to speech was also included in the MOOCs to enable blind individuals to benefit from them as well. While this feature is not the focus of the current work, it is a proof of concept that the authors are interested in evaluating. The MOOCs must be clear and user-friendly for all deaf students. The participants are provided with an

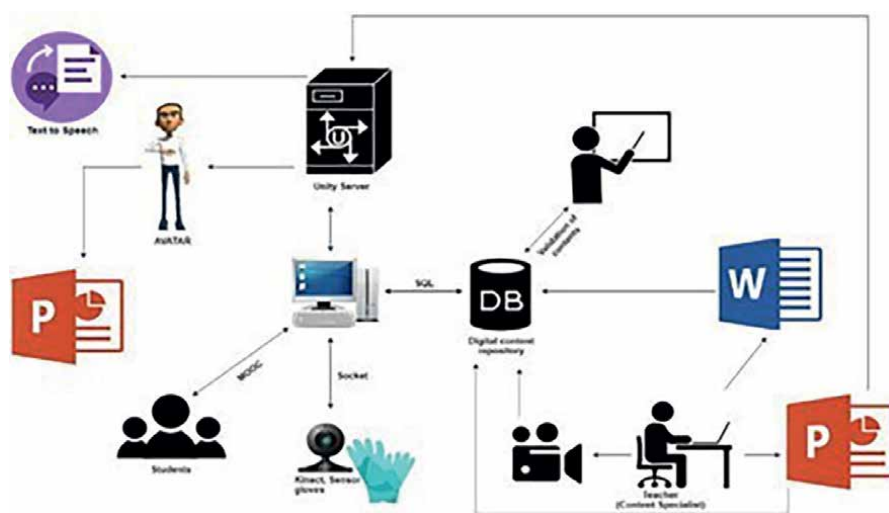


Figure 2.
 Design solution of the MOOC for the deaf [18].

environment that allows them to interact with the content and successfully complete the tasks. The architecture of the sign language components is described in the next section.

2.1.1 API translator architecture

It is well known that deaf individuals use visual and spatial representations to communicate, while non-deaf individuals are used to spoken languages. These differences require different methods of communication for each group. The Assistive Communication for Education (ACE) architecture [21], shown in **Figure 3**, addresses these distinct communication needs, particularly in educational settings, by using a model that considers the specificities of both deaf and non-deaf individuals.

Figure 3 shows the two main modules that perform the steps required for translation. The text recognition module converts written text into signs, which are animated by a 3D avatar. The second module translates sign language into text. This process uses two devices: the Kinect for motion recognition and data gloves for the recognition of static hand configurations.

2.2 Participants

The inclusive MOOC was evaluated using the Quantitative Evaluation Framework (QEF). The study sample consisted of 23 users, including 8 deaf participants and non-deaf students, with age ranging from 18 to 30 in both groups.

The participants were asked to provide their education level in order to be able to infer the results on the content quality (**Figure 4**).

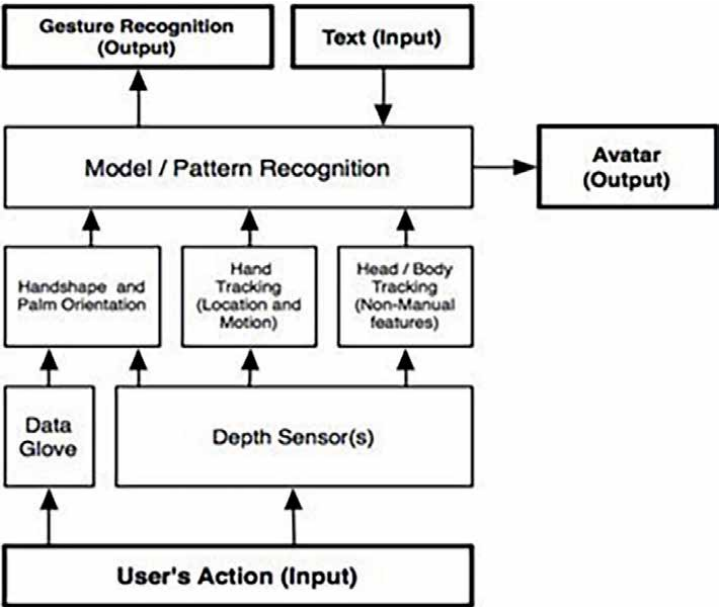


Figure 3.
Translator architecture.

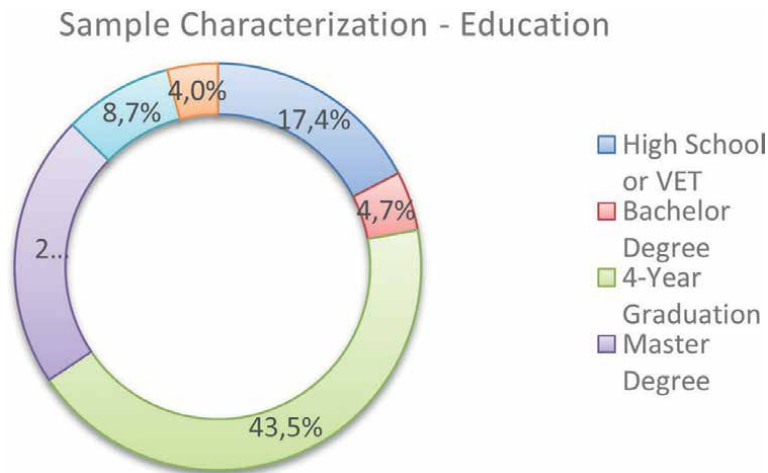


Figure 4.
Respondents' characterization concerning the education level.

2.3 Evaluation

The assessment procedure for the proposed architecture and the MOOC content was implemented in two stages in order to test their efficiency and effectiveness, as well as their usability and accessibility features. Questionnaires were used to collect end user feedback and generate the inputs required by QEF. The aim was to determine how the proposed model might improve access to educational digital content and to identify factors that could facilitate or hinder its effectiveness.

2.4 The QEF approach in general

QEF is being used to assess the quality of educational software products during their development cycle for the past 30 years. QEF has been shown to ensure consistency and coherence throughout the assessment procedure, which computes the product's quality and its evolution during the development cycle. It enables to assess the compliance of the proposed MOOC with the needs of deaf students. Blind students were also involved in this process in order to evaluate the suitability of the course for this group, although the features of the MOOC that are specifically designed for blind individuals are still in the early stages of development.

QEF uses performance indicators that are based on the ISO 9126 and SCORM standards and provide a quantitative representation of product quality in an orthogonal space [3, 22]. For educational software products, three dimensions are used: pedagogical, ergonomic, and management (**Table 1**).

The Quality of Experience Framework (QEF) is a method for evaluating the performance of a product. It is based on three dimensions: pedagogical, ergonomic, and management. Each dimension impacts the overall performance of the product. In order to use QEF to assess a product, a quality scenario must be designed specifically for that product. The pedagogical dimension of QEF focuses on the relationship between the subject, the participant, the object, and the technological instrument. This dimension is used to evaluate the effectiveness of different technological

Dimensions	Factors	Requirements
Pedagogical	Learning	Contents must be hierarchically and sequentially planned
		Contents must be divided into several knowledge stages, always starting in the least complex stage
		Contents, the course unit core, must reflect the best scientific or pedagogical evidence available concerning the subjects to be handled, and must be internally coherent, i.e., the considered subjects must be clearly linked and interconnected
		In each lesson/video class, the interaction with the participant/attendee must be considered by including content-related questions directly addressed to the participant/attendee
		A course unit must provide constructive feedback
	Evaluation	A course unit must be prepared for participants with different profiles/disabilities
		A course unit must provide problems to be solved in a short period of time
		The activities proposed in the course unit must consider the participants' collaborative work skills
		The course unit must propose critical reflections about its contents and developed assignments
		The course unit must allow the participants to choose their path while attending it
		The course unit must promote interactions and foster teamwork
		The Special Education course units (deaf and blind) comprising specific scientific and pedagogical contents must be validated by experts in these fields

Dimensions	Factors	Requirements
Ergonomic	Usability	The participant must be able to start and conclude each lesson when he/she wishes it
		The course unit provide help through complementary material
		The lesson's complementary material must be of easy and intuitive access
		The course units must consider a uniform help pattern
		The course unit must have various audios available, compliant with the participant's needs (including the blind participants)
		The course unit must allow the participant to configure the audio
		The deaf must have access to the digital content by means of an automatic bidirectional translator which translates the Portuguese written language into the Sign Language
		The system must have an avatar to foster the interaction with the deaf participants
		A help button must be available for the deaf/hearing impaired
		A help button must be made available for blind/visually impaired
		The lesson must use of visual resources such as images and icons, to help transmitting the content better
		The lesson must consider human perception, i.e., must be prepared for the diverse participants' physical abilities/capabilities (deaf/blind)
		The course must enable the participant to receive feedback in a forum
	Video/Audio	The course is supported in digital video classes
		Video class must have 8 to 10 minutes-length, corresponding to each lesson
		Each course unit must have a brief introduction to the lessons
		In the video edition, the use of images, graphics, and animations must be specifically prepared for the blind/visually impaired by a detailed audio description
		The video must include captions
		The audio is recorded in Portuguese
	Text	The whole text is presented in linear and concise form
		The text included is written in Portuguese
		The lesson title must be clear, objective, and appropriate to the content
		The content must be written following the Portuguese spelling agreement
		Whenever references are used, these must be included in the bibliography

Dimensions	Factors	Requirements
Management	Content Management	Contents are created by team of certified experts in the field of knowledge
		There is a previous and appropriate content planning to assure the course homogenous features
		Content must be validated by the course unit's responsible teacher
		Contents addressing the blind/visually impaired must be validated by experts in the field
		Contents addressing the deaf/hearing impaired must be validated by experts in the field
	Adaptability	The course is adapted to be attended by the deaf/hearing impaired by integrating the 3D avatar
		The course is adapted to be attended by the blind/visually impaired by audio analysis and processing

Table 1.
Quantitative Evaluation Framework (QEF) [3].

procedures for achieving educational objectives. The pedagogical dimension is made up of two factors: learning and evaluation.

The ergonomic dimension of QEF is concerned with the scientific knowledge and conditions that affect the technical, ergonomic, and social aspects of a learning scenario. This dimension includes three factors: usability, video/audio, and text. The management dimension of QEF reflects the quality of the product from a functional and implementation perspective. This dimension consists of two factors: adaptability and content management.

QEF uses the Euclidean distance between a real product and an ideal product to compute the quality of a product. The coordinates of the real product are determined using a weighted average of the values of the corresponding factors within each dimension of the framework. The value of each factor is determined using a weighted average of the percentage of fulfillment of the product features that contribute to the factor. The percentage of fulfillment of each feature is assessed using appropriate techniques such as questionnaires or direct input from sensors. The perceived quality of a product at each evaluation is inversely proportional to the distance between the coordinates of the real product and the ideal product.

2.5 QEF approach

This study included 29 participants, 6 of whom were blind, 8 of whom were deaf, and 15 of whom had no sight or hearing impairments. These participants provided input for the study and also completed evaluation questionnaires.

In the evaluation of the pedagogical domain using the Quality of Experience Framework (QEF), the learning factor scored 82%, while the evaluation factor scored 32%. In the ergonomic domain, the evaluation results for the three factors (usability, video/audio integration, and text integration) were all 100%. Similarly, in the management domain, both the content management and adaptability factors scored 100%.

2.5.1 Testing with the users: Usability questionnaires approach

In order to assess user satisfaction, a group of 23 users, including 8 deaf individuals, were given access to a lesson in an inclusive MOOC prototype. After interacting with the lesson, the users completed an online questionnaire using a five-point Likert scale to evaluate the usability, adaptability, and content quality of the MOOC. A total of 23 questionnaires were collected, including 8 from deaf users who specifically focused on the usability and adaptability of the model (as shown in **Table 2**). All participants, both deaf and non-deaf, were asked to provide their education level, and the survey procedure was the same for both groups.

3. Results

The results of the questionnaire on deaf users' satisfaction were grouped and analyzed according to the responses from eight deaf users. These responses focused on the usability and adaptability of the model. Of the 23 total respondents to the questionnaire, the majority were positive about the seven items, with an average of 70% of respondents choosing "strongly agree" as their response. None of the respondents had any negative responses (**Figure 5**).

The questionnaire was completed by 21 people, six of whom were blind. The majority of respondents expressed satisfaction with the items, with scores ranging

Questionnaire on usability and adaptability of the inclusive MOOC for the Deaf and Blind	
Deaf	Blind
1. The possibility to choose when to start or finish the lesson is very good	1. The possibility to choose when to start or finish the lesson is very good
2. The contents are interesting and well structured	2. The contents are interesting and well structured
3. For the deaf, the access to the contents using the automatic bidirectional translator, which translate text and sound into the Sign Language, is effective.	3. For the blind, the access to the contents using the available audio system is effective.
4. The interface with the avatar makes the interaction with the contents easier for the deaf trainees.	4. The interaction with the contents is clear and user-friendly for blind users.
5. The use of colors, graphs, and images are appropriate.	5. The audio resources available in the lesson are clear and helpful for blind users to access the content.
6. The visual resources such as images, icons, and diagrams help structuring and understanding the contents.	6. The lesson contents are formally prepared to be accessed by a blind individual.
7. The lesson contents are formally prepared to be accessed by a deaf individual.	
Regarding the interaction you have just had with the prototype of a lesson developed following the inclusive MOOC pedagogical model, classify the items according to your level of satisfaction, from 1 to 5, considering: 1-strongly disagree; 2-disagree; 3-neutral; 4-agree; 5-strongly agree.	

Table 2.
Questionnaire focusing on deaf and blind users' satisfaction.

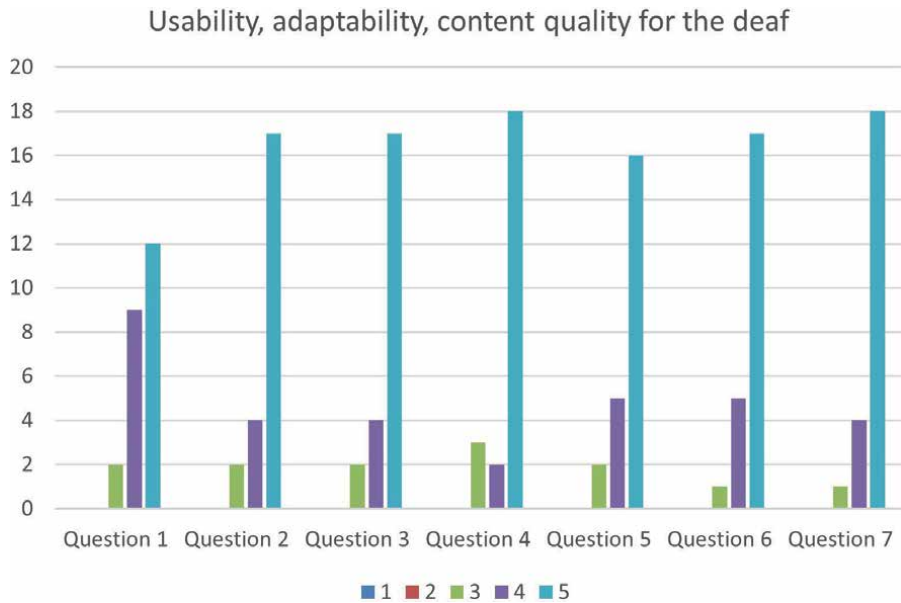


Figure 5.
The questionnaire results showed the satisfaction level of deaf users.

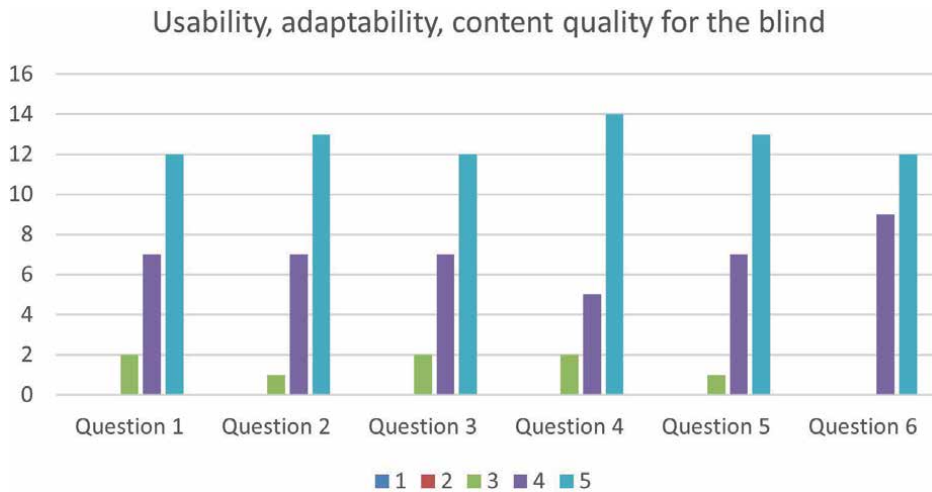


Figure 6.
The questionnaire results showed the satisfaction of blind users.

from 57.1 to 66.7% “strongly agree” responses (**Figure 6**). None of the respondents expressed any negative responses.

4. Discussion

The results of the QEF evaluation show that the overall product quality is 82%, which, in addition to being very encouraging, suggests that this approach has potential to create more inclusive and accessible educational content. However, there is

still room for improvement: the evaluation factor in the pedagogical domain and the usability factor in the ergonomic domain are areas to consider.

From the perspective of the users, both approaches were well received, with features that addressed the needs of both blind and deaf individuals when accessing digital content. Over 57% of respondents “strongly agreed” with the statements that the lesson content is prepared to be accessed by blind and deaf individuals. Previous research has emphasized the importance of developing virtual learning models for the deaf.

In terms of the main objective of the research, it was found that several studies have suggested the development of strategies and tools for web-based education for the deaf. Additionally, there is a need for an e-learning system with a user-friendly interface. Despite the various models that have been implemented in previous studies, including assessments, architecture, and design, only one LMS for communication between deaf and non-deaf people has been developed at the National Institute of Education for the Deaf in Brazil [13].

The process of creating multilingual courses in Portuguese/Brazilian Portuguese and sign language involves the use of visual-spatial aspects of sign language in a digital context. A team of educators, designers, screenwriters, interpreters, and specialized studio staff work together using project management methodologies to develop the learning objectives and activities. The visual language used is designed to engage deaf students conceptually and humorously. The role of the educational designers is to create an effective learning experience that aligns with the goals of the lecturers for each course [7].

These findings have encouraged researchers and practitioners to design and develop specific models with bilingual tools that will benefit both deaf teachers and deaf students.

5. Conclusion

In this article, we present an innovative MOOC designed to expand digital educational options for deaf individuals and provide a simple approach for blind students. Deaf individuals often face disadvantages in education due to their condition, which restricts their ability to communicate with others and limits their access to digital content and information, which are critical factors in education. The proposed pedagogical model and inclusive approach are designed to promote the development of inclusive and interactive learning environments. The aim is to reduce barriers to accessing educational content, allowing individuals with different needs to work together while using the same educational materials. This will enable bidirectional communication in any language, which can be used in classrooms to create inclusive learning environments, in the case of deaf students.

To assess the quality and potential of the MOOC to provide access to digital educational content, we used the QEF (Quality Evaluation Framework) framework, which follows the development of digital content and monitors its production throughout the entire cycle. The results of the evaluation showed the positive potential of this model, although there are still improvements that can be made, particularly in the areas of evaluation and usability. In conclusion, the proposed pedagogical model breaks the traditional, ineffective process of communication between different communities and promotes inclusion and access to information and educational content in every student's first language, supported by an automatic bidirectional sign language translator for the deaf and a sound environment for the blind.

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Perspective Chapter: Navigating the Cybersecurity, AI and Blockchain Landscapes of MOOCs – Challenges and Innovations

Margarita Bel

Abstract

The rapid evolution of technology has transformed education, giving rise to Massive Open Online Courses (MOOCs) as a pivotal platform for global learning. However, the increasing prevalence of cyber threats in the digital age poses substantial risks to the integrity, security, and privacy of MOOC platforms and their users. To counter these challenges, innovative solutions leveraging blockchain technology have emerged as a promising approach to enhance MOOC ecosystems. In this chapter we delve into the multifaceted intersection of cybersecurity, blockchain, and MOOCs, providing an in-depth exploration of the challenges and innovations within this dynamic landscape. We emphasize on various cybersecurity threats and vulnerabilities that MOOCs face, highlighting the importance of safeguarding sensitive user data, preventing academic misconduct, and ensuring the uninterrupted delivery of educational content. As education continues to adapt to the digital age, the interplay between cybersecurity and blockchain in MOOCs represents a crucial frontier. This chapter provides a comprehensive overview of the evolving landscape where cybersecurity, blockchain technology, and online education intersect. By shedding light on the challenges and presenting innovative solutions, this chapter contributes to the ongoing dialogue about the future of secure and transparent online education in the digital age.

Keywords: MOOCs, cybersecurity, blockchain, AI, innovation, data privacy, encryption, collaborative solutions, digitalization, cryptography, digital certificates

1. Introduction

Massive Open Online Courses (MOOCs) have revolutionized the education industry. These online platforms enable learners from different parts of the world to access quality education from top universities without geographical barriers. MOOCs provide a flexible learning environment, personalized learning experiences, and access to education. MOOCs have gained tremendous popularity in recent years, with millions of learners enrolling in various courses. However, the growth of MOOCs has been accompanied by several cybersecurity challenges that threaten the integrity, confidentiality, and

availability of learners' information. This paper examines the cybersecurity landscape of MOOCs, the challenges that learners and instructors face, and the innovations that are being implemented to mitigate these challenges.

1.1 Overview of the cybersecurity and blockchain landscapes of MOOCs

Due to the convenience and accessibility of MOOCs, they have gained popularity in recent years. However, the increased use of MOOCs has also raised concerns about cybersecurity.

The cybersecurity landscape of MOOCs is complex and multifaceted, with various security risks that need to be addressed. These risks can be classified into three categories: data privacy, system security, and content security.

The chapter is focused on identifying and addressing the cybersecurity challenges faced by Massive Open Online Courses (MOOCs). MOOCs are a popular form of online education, offering free access to educational resources to many learners worldwide. However, due to the open nature of MOOCs, they are susceptible to cyber threats and security breaches.

The chapter aims to explore the challenges faced by MOOCs in maintaining cybersecurity and the various innovative approaches that can be used to address these challenges.

The problem of cybersecurity in MOOCs has been studied extensively, with several research studies identifying various security challenges and proposing innovative solutions to address them. For instance, it was found that MOOCs are vulnerable to several types of attacks, including phishing, man-in-the-middle, and denial-of-service attacks. Another study proposed the use of blockchain technology to enhance the security of MOOCs. Additionally, several researchers have been focused on threat modeling and access control as effective approaches for managing cybersecurity risks in MOOCs.

Overall, the chapter builds on these previous studies by providing a comprehensive overview of the cybersecurity landscape of MOOCs and proposing innovative solutions to address the challenges faced.

MOOCs, or Massive Open Online Courses, have been growing in popularity since the early 2010s as a means for people to access high-quality education from top institutions around the world. However, with the rise of online learning comes the need to address cybersecurity concerns, such as protecting personal data and preventing cyberattacks.

In 2023 there're over 40 MOOCs providers are offering online courses of 500 universities to 35 million students worldwide, including 2 million in India.

More than 1,200 universities around the world have launched free online courses. In addition to the larger global MOOC platforms (Coursera, edX, FutureLearn), many national governments around the world have launched their own country-specific MOOC platforms, including India, Italy, Israel, Mexico and Thailand.

In 2021, over 220 million students had signed up for at least one course on one of the these platforms, and 40 million did so in 2021 alone (excluding China).

MOOCs and MOOC platforms are still in growing, even after the crazy "Year of the MOOC" prompted by the pandemic and travel restrictions. At Class Central, they try to catalog as many MOOCs as possible, and our listing currently includes more than 150,000 of them, from MOOC platforms and other online learning platforms [1].

The acronym MOOC was coined in 2008 by Dave Cormier of the University of Prince Edward Island, Canada for an online course offered by the University

of Manitoba. The Connectivism and Connective Knowledge course designed by Manitoba professors George Siemens and Stephen Downes was free and open to the public who could access video lectures, readings, and participate in discussion forums online [2].

However, it was not until 2011, when the Massachusetts Institute of Technology, Boston (MIT) launched the world's largest collection of free-of-charge open courseware, that MOOCs captured the attention of academics and educators worldwide. Subsequently in 2012, MIT and Harvard founded the edX platform for the promotion of MOOCs. In 2012, another MOOCs experiment caught academics' attention. Two Stanford University professors, Sebastian Thrun and Peter Norvig, uploaded a free online course 'Introduction to artificial intelligence' for which 160,000 students from 190 countries signed up — the first time, an open online course became truly 'massive' [3]. This successful experiment encouraged Prof. Thrun to find the first for-profit MOOCs provider Udacity. This was followed by the founding of Coursera by Stanford professors Dr. Daphne Koller and Dr. Andre Ng.

In 2015, MOOCs continue to grow in size and scale, they will become increasingly attractive targets for cybercriminals. As such, the need for robust cybersecurity measures will only increase.

One of the key challenges in securing MOOC platforms is the large number of users and the diversity of their devices and networks. As cybersecurity expert Dr. Edward Amoroso notes, "The sheer scale of MOOCs presents unique challenges for cybersecurity, as the number of users and devices involved in accessing the platform is much larger than in traditional classroom settings."

To address these challenges, MOOC providers have implemented various cybersecurity measures, such as encryption of user data, two-factor authentication, and regular security audits [4].

In conclusion, while MOOCs offer many benefits in terms of accessibility and convenience, they also pose unique cybersecurity challenges. It is essential for MOOC providers and institutions to prioritize cybersecurity and implement robust measures to protect their users' data and prevent cyberattacks.

When MOOCs first emerged in the early 2010s, cybersecurity was not a major concern. At that time, most MOOCs were hosted on a few large platforms, such as Coursera, edX, and Udacity, which had robust security measures in place to protect user data. However, as MOOCs grew in popularity and more institutions began to offer their own courses, cybersecurity became a more pressing issue [2].

One of the main cybersecurity risks associated with MOOCs is the potential for data breaches. MOOC platforms collect a significant amount of data from users, including personal information such as names, email addresses, and passwords. This data is valuable to cybercriminals, who can use it for identity theft, phishing scams, or other malicious purposes. In addition, MOOC platforms often collect data on users' browsing behavior and learning progress, which can be used to build profiles for targeted advertising or other purposes.

To address these risks, MOOC platforms have implemented a variety of security measures over the years. For example, most platforms now use encryption to protect user data in transit, and many have implemented two-factor authentication to prevent unauthorized access to user accounts. Platforms also typically have teams of security experts who monitor the platform for potential threats and respond quickly to any security incidents that do occur.

Another cybersecurity challenge associated with MOOCs is the potential for cheating. MOOCs often use automated assessment tools, such as multiple-choice

quizzes or coding exercises, to evaluate student learning. However, these tools can be vulnerable to cheating, as students can easily share answers or use online resources to complete assignments. To combat this, some MOOC platforms have implemented proctoring tools that use video and audio monitoring to verify the identity of students and prevent cheating [5].

Finally, MOOCs also present challenges related to intellectual property and copyright. MOOCs often use copyrighted materials, such as images, videos, or text, in their courses. However, using these materials without permission can result in legal challenges and potential liability for the MOOC platform. To address this, MOOC platforms typically have teams of lawyers who review course materials to ensure that they are compliant with copyright law.

Despite these challenges, MOOCs continue to grow in popularity, and they have become an important part of the educational landscape. To navigate the cybersecurity landscape of MOOCs, it is important for students, educators, and platform administrators to remain vigilant and aware of potential risks [5]. By implementing strong security measures, monitoring for potential threats, and ensuring compliance with copyright law, MOOC platforms can continue to provide high-quality educational resources to students around the world.

Data Privacy: MOOCs collect and store large amounts of personal data from students, including names, email addresses, and even financial information. This data can be valuable to cybercriminals who can use it for identity theft, phishing, or other malicious activities. MOOC providers need to implement strong data protection measures, such as encryption and access controls, to prevent unauthorized access to this data.

System Security: MOOC platforms are vulnerable to various cyber-attacks, including DDoS attacks, SQL injection attacks, and cross-site scripting attacks. These attacks can compromise the integrity and availability of the platform, potentially disrupting learning activities. MOOC providers need to implement robust security measures, such as firewalls and intrusion detection systems, to protect their systems from such attacks.

Content Security: MOOCs typically offer a wide range of educational content, including videos, quizzes, and assignments. This content can be valuable to cybercriminals who can steal and sell it on the black market. MOOC providers need to implement effective content security measures, such as digital rights management (DRM) and watermarks, to protect their content from unauthorized access and distribution.

There is a limited amount of research specifically focused on the cybersecurity landscape of Massive Open Online Courses (MOOCs), but some studies have been conducted in this area.

In conclusion, the cybersecurity landscape of MOOCs is complex and requires a comprehensive approach to address the various security risks. MOOC providers need to implement strong data privacy, system security, and content security measures to protect their platforms, content, and users from cyber threats.

1.2 Cybersecurity threats in MOOCs

MOOCs collect vast amounts of personal information from learners, such as their name, email address, phone number, and credit card details. This information is essential for registration, certification, and payment processes. However, this information is also highly valuable to cybercriminals who can use it for identity theft, financial fraud, or targeted attacks. Cybercriminals can gain access to MOOCs through various means, such as phishing, social engineering, or malware. They can

also exploit vulnerabilities in MOOCs' systems, such as weak passwords, unpatched software, or unsecured networks [6].

Phishing is a common attack that targets learners through fake emails or websites that impersonate MOOCs. Phishing emails lure learners to click on links that redirect them to fake login pages where they enter their credentials. The attackers can then use these credentials to access the learners' accounts or steal their personal information. Social engineering is another attack that exploits human behavior to gain access to MOOCs. Social engineering involves tricking learners into revealing sensitive information or downloading malware through emails, phone calls, or social media. Malware is a type of software that is designed to infiltrate systems, steal data, or cause damage. Malware can infect MOOCs' systems through phishing emails or unsecured networks. Once malware infects a MOOC's system, it can spread to other systems and compromise learners' information.

MOOCs also face threats from insiders who have authorized access to the system. Insiders can include instructors, administrators, or employees who abuse their privileges to steal or leak learners' information. Insiders can also intentionally or unintentionally cause system failures or breaches. For example, an instructor might accidentally upload a file containing learners' personal information to a public folder.

There are several cybersecurity threats that can affect MOOCs [7]. Here are common ones:

Phishing Attacks: MOOC platforms are vulnerable to phishing attacks, where attackers send fake emails, messages or links to the students and faculty to steal their credentials or gain unauthorized access to their accounts.

Malware Infections: Malware can infect MOOC platforms via downloaded course materials or infected links, causing damage to the system, stealing data, or even taking control of the devices.

Distributed Denial of Service (DDoS) Attacks: MOOC platforms can be targeted by DDoS attacks, where a large number of requests are sent to the servers, causing them to crash or become unavailable to the users.

Data Breaches: MOOC platforms often store sensitive information, such as students' personal and financial data. If the platform is not secure, hackers can exploit vulnerabilities to access and steal this information.

Insider Threats: Insiders such as administrators, instructors or students can pose a risk to MOOC platforms by misusing their privileges, accessing and sharing confidential information or engaging in cyberbullying.

Social Engineering Attacks: Attackers may use social engineering tactics to gain access to the MOOC platform, such as posing as a legitimate user or providing fake information to bypass security measures.

To mitigate these threats, MOOC platforms need to implement effective security measures, such as two-factor authentication, firewalls, antivirus software, and regular security audits. Additionally, users should be educated about cybersecurity best practices, such as not sharing passwords, avoiding suspicious links or emails, and using secure connections.

The state of cybersecurity in MOOCs (Massive Open Online Courses) is an important concern as online learning platforms have become increasingly popular in recent years. While MOOCs offer great opportunities for learners to access quality education from anywhere in the world, they also face various cybersecurity threats that can put users' sensitive data and privacy at risk.

To address these concerns, MOOCs have implemented various security measures to protect their users' information. For instance, they use encryption protocols to secure

users' login credentials and personal information. Additionally, MOOCs conduct regular security audits to identify vulnerabilities in their systems and fix them promptly.

However, despite these efforts, cybersecurity threats such as phishing attacks, malware infections, and unauthorized access to user data continue to be a major concern for MOOCs. Therefore, it is crucial for MOOC users to take their own precautions to protect their data and privacy. This includes using strong and unique passwords, enabling two-factor authentication, and avoiding clicking on suspicious links or downloading unknown files [8].

Overall, while MOOCs have made significant efforts to enhance cybersecurity, it remains an ongoing challenge as hackers and cybercriminals continue to find new ways to exploit vulnerabilities in online systems. As such, it is important for MOOC providers to stay vigilant and proactive in their approach to cybersecurity to protect their users' data and privacy.

To address these challenges, MOOC providers have been investing in cybersecurity measures such as two-factor authentication, data encryption, and regular security audits. Additionally, MOOC providers have been offering courses in cybersecurity to educate their users on best practices for securing their online accounts and personal data.

Overall, while MOOC providers have made significant strides in improving cybersecurity, there is still much work to be done to ensure that learners' data is secure and that learners are equipped with the knowledge and skills needed to protect themselves online.

1.3 Importance of cybersecurity in MOOCs

MOOCs have made education more accessible, flexible, and cost-effective. However, the increasing dependence on online learning platforms has also made them vulnerable to cyber-attacks. The lack of cybersecurity measures in MOOCs can have severe consequences, including data breaches, identity theft, and financial losses. Therefore, cybersecurity in MOOCs has become a critical concern for educational institutions, students, and online learning platforms. In this article, we will discuss the importance of cybersecurity in MOOCs and explore the various ways to ensure safe online learning.

MOOCs are a popular mode of education delivery, where learners can access courses online from anywhere, at any time [9]. While MOOCs have revolutionized the education landscape, they are also vulnerable to cyber-attacks. Cybersecurity is therefore critical in MOOCs to protect learners and institutions from the potential harm caused by cyber threats. In this article, we will discuss the importance of cybersecurity in MOOCs, both for learners and institutions offering MOOCs.

1.3.1 Protecting personal information

In MOOCs, learners need to provide personal information, such as name, email address, and sometimes even financial information. Cybersecurity is crucial in protecting this information from cybercriminals who may use it for identity theft, fraud, or other malicious activities. Institutions offering MOOCs should have robust cybersecurity measures in place to secure learners' personal information.

1.3.2 Preventing cyber attacks

MOOCs are vulnerable to a variety of cyber-attacks, including malware, phishing, and distributed denial of service (DDoS) attacks. These attacks can compromise the

integrity of MOOCs, disrupt learning, and cause financial losses. Institutions offering MOOCs must implement strong cybersecurity measures, such as firewalls, intrusion detection systems, and anti-virus software, to prevent cyber attacks.

1.3.3 Maintaining course content integrity

MOOCs often contain valuable and sensitive course content that must be protected from cyber threats. Hackers may attempt to gain unauthorized access to course materials or change them for their benefit. Institutions offering MOOCs should implement measures such as encryption and digital signatures to maintain course content integrity.

1.3.4 Enhancing learner experience

A secure MOOC platform enhances the learner's experience by providing a safe and reliable environment to access course materials. When learners are confident that their personal information is secure and that the platform is protected from cyber threats, they are more likely to engage and complete their courses.

1.3.5 Protecting institutional reputation

A cyber-attack on a MOOC platform can result in significant reputational damage for the institution offering the course. This can affect enrollment, funding, and partnerships. By implementing strong cybersecurity measures, institutions can protect their reputation and maintain the trust of learners, stakeholders, and partners.

In conclusion, cybersecurity is essential in MOOCs to protect learners' personal information, prevent cyber-attacks, maintain course content integrity, enhance the learner experience, and protect institutional reputation. Institutions offering MOOCs must invest in cybersecurity measures to ensure a safe and secure learning environment. Learners must also take responsibility for their cybersecurity by being vigilant about protecting their personal information and reporting any suspicious activity.

1.3.6 Importance of cybersecurity in MOOCs

MOOCs have become an attractive target for cybercriminals due to the large amounts of sensitive data they handle. MOOCs deal with personal information such as name, address, phone number, email, date of birth, and financial information such as credit card details, among others. Moreover, MOOCs contain intellectual property such as course content, research papers, and patents. Therefore, any unauthorized access to MOOCs can lead to identity theft, financial losses, and data breaches.

Data breaches in MOOCs can have severe consequences for students. Cybercriminals can steal personal information and use it for identity theft, fraud, and phishing attacks. For example, cybercriminals can use stolen identities to apply for loans, credit cards, and other financial services. Furthermore, data breaches can lead to reputational damage for educational institutions, which can impact their student enrollment, funding, and partnerships [10].

MOOCs also deal with sensitive academic data such as student grades, transcripts, and academic records. Any unauthorized access to academic data can compromise the integrity of the educational system and lead to academic fraud. For instance, cybercriminals can alter student records and grades, leading to unfair academic advantages.

Furthermore, MOOCs use various communication channels, including email, video conferencing, and instant messaging, among others. These communication channels are vulnerable to phishing attacks, malware, and other cyber threats. Cybercriminals can use phishing emails to steal login credentials, which they can use to access MOOCs. They can also use malware to infect students' devices and steal sensitive data.

Therefore, cybersecurity in MOOCs is crucial to protect personal information, academic data, and intellectual property. Cybersecurity measures in MOOCs can prevent data breaches, identity theft, and financial losses.

In conclusion, the cybersecurity landscape of MOOCs presents unique challenges that require innovative solutions. With the growing popularity of these platforms, it is essential to implement robust security measures and keep up with the latest trends in cybersecurity to ensure the safety and privacy of learners and instructors. Innovations such as machine learning, user-friendly interfaces, and user education can help to enhance the security of MOOCs and provide a safe and valuable learning experience for all users.

2. Challenges in navigating the cybersecurity landscape of MOOCs

Cybersecurity landscape of MOOCs presents several challenges that need to be addressed to ensure the safety and security of learners and instructors. Some of the challenges in navigating the cybersecurity landscape of MOOCs are:

Privacy concerns: MOOCs collect a significant amount of personal information from learners, including their names, email addresses, and sometimes financial information. This data can be a target for cybercriminals and can be used for identity theft, phishing attacks, and other cyber crimes.

Credential theft: MOOCs often require learners to create user accounts and passwords, which can be vulnerable to hacking and password cracking attacks. Cybercriminals can steal these credentials and use them to access the learners' personal information or launch attacks on the MOOC platform.

Malware and phishing attacks: MOOCs can be targeted by malware and phishing attacks that can compromise learners' devices and steal their personal information. Cybercriminals can use these attacks to gain access to the MOOC platform, distribute malware to learners, or launch phishing attacks to steal their login credentials.

Intellectual property theft: MOOCs often contain copyrighted material, such as videos, lectures, and other course materials. Cybercriminals can steal this intellectual property and use it for their own purposes, including selling it on the black market or using it to create their own courses.

Distributed denial-of-service (DDoS) attacks: MOOCs can be targeted by DDoS attacks that can overload their servers and cause them to crash. Cybercriminals can use these attacks to disrupt the MOOC platform's availability, causing learners to lose access to the course materials.

To address these challenges, MOOC providers need to implement strong cybersecurity measures, such as encryption, multi-factor authentication, and intrusion detection systems [8]. Learners also need to be educated about the risks of cyberattacks and how to protect themselves online. Additionally, governments and regulatory bodies can play a role in regulating the cybersecurity practices of MOOC providers to ensure the safety and security of learners and instructors.

2.1 Identity verification

Verifying the identities of learners in Massive Open Online Courses (MOOCs) is a challenge that has plagued the MOOC industry for years. MOOCs have been widely adopted as a means of delivering high-quality education to a large audience, but the lack of identity verification has raised concerns about the credibility of certifications and the potential for fraud.

One of the primary challenges of verifying learner identities in MOOCs is the sheer scale of the courses. MOOCs can have tens of thousands of students, making it difficult for instructors to accurately verify each student's identity. In addition, MOOCs are typically self-paced, which means that students can complete the course material at their own speed, further complicating the process of identity verification.

Several potential solutions have been proposed to address this challenge. One such solution is the use of remote proctoring, which involves using software to monitor a student's behavior during the course. Remote proctoring can include measures such as facial recognition, keystroke analysis, and audio recording, to ensure that the person taking the course is the same person who registered for it. However, remote proctoring has been criticized for being intrusive and for potentially violating students' privacy [11].

Another potential solution is the use of biometric authentication, such as fingerprint or iris scanning, to verify the identities of learners. While biometric authentication has been successfully implemented in other contexts, such as mobile phone security, there are concerns about the cost and feasibility of implementing biometric authentication in MOOCs.

A third potential solution is the use of blockchain technology to create tamper-proof digital identities for MOOC learners. This approach involves creating a unique digital identity for each student that is linked to a blockchain-based ledger, which records all of the student's course progress and achievements. While blockchain-based identity verification has the potential to be highly secure, it is still in the early stages of development and has not yet been widely adopted in the MOOC industry.

In conclusion, verifying the identities of learners in MOOCs is a complex challenge that requires innovative solutions. While remote proctoring, biometric authentication, and blockchain-based identity verification are all potential solutions, each approach has its own advantages and limitations. As the MOOC industry continues to evolve, it is likely that new solutions to this challenge will emerge.

2.2 Data privacy

Massive Open Online Courses (MOOCs) have gained popularity over the years, providing learners with access to high-quality educational materials and opportunities for collaborative learning. However, one major challenge associated with MOOCs is the protection of learners' personal data, which is often collected during the course of the program. This data may include personally identifiable information (PII), such as name, email address, phone number, and location, as well as information related to the learners' academic progress, including test scores, course activities, and discussion forum posts [12].

The challenge of protecting learners' personal data in MOOCs arises from the fact that such data can be easily accessed, shared, and potentially exploited by third parties without the learners' knowledge or consent. Some potential risks associated with

the unauthorized access and misuse of personal data in MOOCs include identity theft, phishing, and fraud, among others. Moreover, the disclosure of personal data may also have a negative impact on learners' privacy and security, leading to psychological and emotional harm [11].

To address this challenge, various solutions have been proposed to safeguard learners' personal data in MOOCs. One possible solution is to implement strict data protection policies and practices that conform to international standards, such as the General Data Protection Regulation (GDPR) in the European Union. Such policies may include obtaining explicit consent from learners before collecting their personal data, providing clear and concise privacy notices, and ensuring that data is securely stored and processed.

Another solution is to use technologies such as encryption, anonymization, and access control mechanisms to protect learners' personal data from unauthorized access and misuse. For instance, the use of encryption techniques can help to secure data transmission and storage, while anonymization techniques can help to protect learners' identities by masking their personal information. Access control mechanisms, on the other hand, can limit access to personal data only to authorized personnel [13].

Furthermore, education providers can also adopt ethical principles and guidelines for handling learners' personal data in MOOCs. Such principles may include transparency, fairness, accountability, and respect for learners' privacy rights. Additionally, education providers can also provide learners with education and awareness campaigns on data privacy and security to empower them to make informed decisions about their personal data.

In conclusion, protecting learners' personal data in MOOCs is a crucial challenge that requires effective solutions. Implementing strict data protection policies and practices, using technologies such as encryption and anonymization, adopting ethical principles, and providing learners with education and awareness campaigns can help to safeguard their personal data and ensure their privacy and security in MOOCs.

3. Innovations in navigating the cybersecurity landscape of MOOCs

Massive Open Online Courses (MOOCs) have revolutionized the way we access and acquire knowledge. These courses have been incredibly popular in recent years, with millions of learners from all over the world taking advantage of the convenience and accessibility they offer. However, MOOCs also present unique cybersecurity challenges due to their large scale and the nature of their content delivery. In this article, we will discuss some of the innovations in navigating the cybersecurity landscape of MOOCs.

One of the key innovations in MOOC cybersecurity is the use of secure platforms and software. MOOC platforms such as edX, Coursera, and Udacity have invested heavily in developing secure infrastructure and software to protect their systems and learners' data. For example, edX uses Amazon Web Services (AWS) for its cloud infrastructure, which provides industry-standard security and compliance measures. Similarly, Coursera uses multiple layers of security, including encryption and firewalls, to protect learner data and platform integrity [14].

Another innovation in MOOC cybersecurity is the use of machine learning and artificial intelligence (AI) algorithms to detect and prevent cyber threats. MOOC platforms use AI to analyze user behavior and detect suspicious activities such as

unauthorized access, data theft, and malware attacks. This technology can also be used to automate the process of identifying and blocking potential threats, reducing the workload for cybersecurity teams and ensuring quick responses to emerging threats [15].

Additionally, MOOCs are adopting new technologies such as blockchain to enhance the security of their platforms. Blockchain is a distributed ledger technology that allows for secure and transparent record-keeping. MOOC platforms can use blockchain to secure learner data, prevent unauthorized access, and create tamper-proof records of learner progress and achievements.

Finally, MOOC providers are also investing in cybersecurity training for their staff and learners. Cybersecurity education and awareness are critical in preventing and mitigating cyber threats. MOOC platforms offer cybersecurity courses that cover topics such as threat detection, incident response, and data protection. They also provide resources such as best practices, guidelines, and tips for learners to secure their devices and data [edX. <https://www.edx.org/security-compliance>].

In conclusion, MOOCs have become an integral part of the global education landscape, but they also present unique cybersecurity challenges. The innovations in MOOC cybersecurity, including secure platforms and software, AI and machine learning, blockchain, and cybersecurity training, have helped to address these challenges and provide learners with a safe and secure learning environment [15].

3.1 Use of blockchain technology

Blockchain technology can be used to enhance the security of MOOCs by providing a tamper-proof and transparent way to verify and store student credentials and course completion records. In a traditional MOOC, student records are stored on a centralized server controlled by the institution offering the course. This centralized approach has several security vulnerabilities, including the potential for data breaches or unauthorized access to student records [16].

By contrast, blockchain technology can provide a decentralized, transparent, and secure way to store and verify student records. Blockchain is a distributed ledger technology that stores data across a network of nodes, making it difficult for any single entity to manipulate or alter the data. This makes blockchain ideal for storing sensitive information like student records and course completion certificates.

One of the most significant advantages of using blockchain technology in MOOCs is that it allows for the creation of digital credentials that are cryptographically secured. These credentials can be easily verified by potential employers, institutions, or other stakeholders, which can help to increase the value of the MOOC and its credentials [17].

In summary, blockchain technology can be used to enhance the security of MOOCs by providing a decentralized and transparent way to verify and store student records. This can help to increase the value of the MOOC and its credentials, making it more attractive to potential employers and other stakeholders.

3.1.1 Blockchain technology can be used to enhance the security of MOOCs in several ways

Digital identity verification: Blockchain can be used to verify the identity of learners, instructors, and other stakeholders in the MOOC ecosystem. This can help prevent fraud and ensure that only authorized users are accessing the course content.

Secure transactions: Blockchain can be used to facilitate secure and transparent transactions between learners and instructors. For example, learners can use

blockchain-based cryptocurrencies to pay for access to premium content or for certification exams.

Immutable record-keeping: Blockchain can be used to create an immutable record of all transactions and interactions within the MOOC ecosystem. This can help prevent fraud and ensure that all parties are held accountable for their actions.

Some institutions have already begun to use blockchain technology in their MOOCs. For example, the University of Nicosia in Cyprus offers a Master's program in Digital Currency that uses blockchain technology extensively. The program is delivered entirely online and covers a range of topics related to blockchain and digital currency.

Another example is the MOOC platform edX, which has partnered with the blockchain-based credentialing platform Blockcerts to offer digital certificates that are verified on the blockchain. This helps prevent fraud and ensures that learners can prove their credentials to potential employers [16].

In summary, blockchain technology can be used to enhance the security of MOOCs by providing digital identity verification, secure transactions, and immutable record-keeping. Several institutions have already begun to use blockchain in their MOOCs to improve the learner experience and increase trust in the certification process.

Blockchain technology can be used to enhance the security of MOOCs by providing a decentralized and immutable ledger of all transactions and interactions that take place within the platform. This can help prevent fraud, cheating, and other forms of misconduct, while also providing learners with greater control over their personal data and credentials.

These are just a few examples of how blockchain technology is being used to enhance the security and credibility of MOOCs. As the technology continues to evolve, it is likely that we will see even more innovative applications in the years to come [17].

3.2 B. Machine learning and Artificial Intelligence

Machine learning (ML) and artificial intelligence (AI) can be used to detect and prevent cybersecurity threats in Massive Open Online Courses (MOOCs). These technologies can help MOOC providers to protect their platforms against various types of cyber-attacks, including distributed denial-of-service (DDoS) attacks, SQL injection attacks, phishing attacks, and others. Here are some examples of how ML and AI are being used in MOOCs to enhance cybersecurity:

3.2.1 Coursera

Coursera is one of the largest MOOC platforms, with over 77 million registered learners. To protect its platform against cyber-attacks, Coursera uses AI-powered fraud detection systems that analyze user behavior and detect any suspicious activity. For example, the system can detect when a user is using multiple accounts to access the same course or when a user is attempting to use a bot to generate fake course completion certificates.

3.2.2 Udacity

Udacity is another popular MOOC platform that offers courses in a wide range of subjects, including computer science, data science, and artificial intelligence. To prevent DDoS attacks, Udacity uses machine learning algorithms that can identify and block traffic from malicious IP addresses. The platform also uses AI-powered chatbots

to provide learners with instant support and assistance, reducing the risk of phishing attacks and other security threats.

3.2.3 edX

edX is a nonprofit MOOC platform that offers courses from top universities such as MIT, Harvard, and Berkeley. To ensure the security of its platform, edX uses ML algorithms to analyze user behavior and detect any suspicious activity. The platform also uses AI-powered chatbots to provide learners with personalized support and assistance, reducing the risk of phishing attacks and other security threats.

3.2.4 FutureLearn

FutureLearn is a UK-based MOOC platform that offers courses in a wide range of subjects, including business, health, and social care. To protect its platform against cyber attacks, FutureLearn uses AI-powered fraud detection systems that analyze user behavior and detect any suspicious activity [3]. The platform also uses ML algorithms to identify and block traffic from malicious IP addresses, reducing the risk of DDoS attacks.

In conclusion, MOOC providers are using machine learning and artificial intelligence to enhance cybersecurity and protect their platforms against various types of cyber attacks. These technologies help to detect and prevent fraud, phishing, and other security threats, ensuring that learners can access MOOCs safely and securely.

Machine learning and artificial intelligence (AI) are being increasingly utilized in the development and delivery of Massive Open Online Courses (MOOCs). MOOCs are online courses that are designed to be accessible to anyone with an internet connection. They offer a flexible and cost-effective way for people to learn new skills or advance their education.

Personalization of Learning Experience: Machine learning algorithms can be used to analyze the performance of learners and provide personalized learning experiences. For example, the system can analyze a learner's performance on quizzes and assignments to determine their strengths and weaknesses. Based on this analysis, the system can recommend additional learning materials and activities to help the learner improve their skills.

Adaptive Learning: AI can be used to create adaptive learning systems that can adjust the pace and content of the course to meet the needs of individual learners. These systems can use data analytics to determine how well learners are understanding the material and adjust the course content accordingly. This can help learners stay engaged and motivated throughout the course.

Automated Grading: Machine learning algorithms can be used to automate the grading process, which can save instructors a lot of time and effort. For example, a system can be trained to grade multiple-choice questions or short-answer questions. This can also reduce the possibility of human errors in grading.

Chatbots and Virtual Assistants: AI-powered chatbots and virtual assistants can be used to provide learners with quick and easy access to information about the course. Learners can ask questions about the course content, due dates, and other relevant information. Chatbots can also be used to provide automated feedback to learners on their performance.

Natural Language Processing (NLP): NLP is a branch of AI that deals with the interaction between humans and computers using natural language. NLP can be used

in MOOCs to create chatbots, virtual assistants, and other tools that can communicate with learners in a natural way. This can make the learning experience more engaging and interactive.

Recommender Systems: Recommender systems can be used to suggest additional learning materials to learners based on their interests, learning goals, and past performance. For example, a system can recommend videos, articles, or other resources that are related to the topic being studied.

Predictive Analytics: Predictive analytics can be used to identify learners who are at risk of dropping out of the course. The system can analyze data such as the learner's engagement level, performance on quizzes and assignments, and other factors to predict whether they are likely to complete the course. This can help instructors identify learners who need additional support or encouragement to stay engaged in the course.

In conclusion, machine learning and AI have a lot of potential to improve the learning experience in MOOCs. These technologies can be used to create personalized and adaptive learning experiences, automate grading, provide learners with quick access to information, and much more [5]. As the field of AI continues to evolve, we can expect to see even more innovative uses of these technologies in MOOCs and other educational settings.

3.3 Cloud-based security solutions

Cloud-based security solutions can play a crucial role in protecting learners' data and preventing cybersecurity threats in institutions offering Massive Open Online Courses (MOOCs). MOOCs offer a convenient and cost-effective way for learners to access educational content from anywhere in the world. However, MOOCs can also pose significant cybersecurity risks, such as data breaches, malware attacks, and identity theft. In this context, cloud-based security solutions can provide an effective way to secure MOOCs and protect learners' data.

One way cloud-based security solutions can help secure MOOCs is by providing robust data encryption. Data encryption ensures that sensitive data is scrambled into an unreadable format, making it difficult for hackers to intercept and access it. Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform (GCP) are some of the leading cloud providers that offer encryption services. AWS, for example, provides the Amazon CloudFront Content Delivery Network (CDN), which encrypts data in transit and at rest. Similarly, Microsoft Azure offers the Azure Security Center, which provides encryption and other security features to protect virtual machines, storage accounts, and databases.

Cloud-based security solutions can also help MOOCs prevent and mitigate Distributed Denial of Service (DDoS) attacks. DDoS attacks overwhelm servers with a large volume of traffic, causing them to crash and making MOOCs unavailable to learners. Cloud providers like AWS, Azure, and GCP offer DDoS protection services that use machine learning and artificial intelligence algorithms to identify and block malicious traffic. For example, AWS provides the Amazon GuardDuty service, which uses AI and machine learning to detect and respond to DDoS attacks.

Another way cloud-based security solutions can help secure MOOCs is by providing multi-factor authentication (MFA) to prevent unauthorized access to learner accounts. MFA requires users to provide two or more forms of authentication before they can access their accounts, making it difficult for hackers to steal login credentials. Cloud providers like AWS and Azure offer MFA services, such as Amazon

Cognito and Azure Active Directory, which enable MOOCs to implement MFA easily and efficiently.

In conclusion, cloud-based security solutions can help institutions offering MOOCs to better protect learners' data and prevent cybersecurity threats. By providing encryption, DDoS protection, and MFA, cloud providers like AWS, Azure, and GCP offer MOOCs the tools they need to secure their platforms and safeguard their learners' data. However, it is essential for MOOCs to work closely with their cloud providers to ensure that they are using the latest security tools and best practices to protect their platforms from emerging threats.

Cloud-based security solutions can offer a variety of benefits to institutions offering MOOCs.

Improved data security: Institutions offering MOOCs typically handle sensitive information such as student registration details, course materials, and assessment results. Cloud-based security solutions can help secure this data by providing encryption, access controls, and other security features. This can help prevent unauthorized access and data breaches.

Scalability and flexibility: Cloud-based security solutions can offer scalable and flexible security options that can be adjusted as per the needs of the institution. This can help institutions accommodate varying numbers of students and handle different levels of traffic.

Cost-effective: Cloud-based security solutions can be cost-effective compared to on-premises security solutions, as institutions do not need to invest in expensive hardware or software. Additionally, cloud-based security solutions typically offer subscription-based pricing, which can help institutions manage costs more effectively.

Compliance and regulation: Institutions offering MOOCs need to comply with various regulations and standards such as FERPA (Family Educational Rights and Privacy Act) and GDPR (General Data Protection Regulation). Cloud-based security solutions can help institutions meet these compliance requirements by providing features such as data encryption, access controls, and auditing.

In conclusion, cloud-based security solutions can provide a range of benefits to institutions offering MOOCs. These solutions can help improve data security, offer scalability and flexibility, be cost-effective, and ensure compliance with regulations and standards.

4. Conclusion

4.1 Recap of challenges and innovations

In conclusion, this study has explored the challenges and innovations in navigating the cybersecurity landscape of MOOCs. From the analysis, it is evident that the advent of MOOCs has significantly revolutionized education, providing students with an affordable and flexible means of acquiring knowledge. However, this mode of learning is not without its challenges, particularly in cybersecurity.

The study identified various challenges that MOOCs face regarding cybersecurity. The first challenge is the protection of intellectual property. Instructors invest considerable effort and resources into creating high-quality content, which is often at risk of theft, unauthorized distribution, or piracy. MOOC platforms must, therefore, invest in secure technology that protects intellectual property from infringement.

Secondly, MOOCs also face the challenge of maintaining user privacy and data security. Online learning platforms collect a vast amount of personal data from their users, ranging from personal identification information to academic records. This data is highly valuable and often targeted by cybercriminals who use it for various malicious purposes, including identity theft, fraud, and extortion.

The third challenge is the protection of MOOCs from cyber-attacks, such as Distributed Denial of Service (DDoS) attacks, phishing attacks, and malware attacks. MOOC platforms must ensure that they have robust security measures in place to prevent these types of attacks and mitigate their impact in case they occur.

Fourthly, MOOCs also face the challenge of addressing the digital divide. The digital divide refers to the gap between individuals who have access to technology and those who do not. MOOCs must ensure that their platforms are accessible to students from all backgrounds and provide adequate support for students who may not have access to high-speed internet or the latest computing devices.

In addition to these challenges, the study identified several innovations that have been implemented to address the cybersecurity challenges faced by MOOCs. One of the most notable innovations is the use of two-factor authentication (2FA) to enhance the security of user accounts. 2FA adds an extra layer of security by requiring users to provide two forms of authentication, such as a password and a security token, before accessing their accounts.

Another innovation is the use of Artificial Intelligence (AI) and machine learning algorithms to detect and prevent cyber-attacks. These technologies can analyze large amounts of data in real-time to identify suspicious activities and potential threats, allowing MOOC platforms to take proactive measures to prevent attacks.

Additionally, MOOC platforms have implemented secure video streaming protocols, such as encrypted video streaming and digital rights management (DRM), to protect against unauthorized access to video content.

Furthermore, MOOC platforms are increasingly collaborating with cybersecurity experts to identify potential vulnerabilities and develop new security protocols to address emerging threats.

In conclusion, MOOCs have revolutionized the education landscape, providing students with an affordable and flexible means of acquiring knowledge. However, these platforms face several cybersecurity challenges, including the protection of intellectual property, user privacy and data security, protection from cyber-attacks, and addressing the digital divide. Despite these challenges, MOOC platforms have implemented several innovative measures to address these cybersecurity concerns. The use of two-factor authentication, AI and machine learning algorithms, secure video streaming protocols, and collaboration with cybersecurity experts are among the most notable innovations. These innovations have significantly enhanced the cybersecurity posture of MOOCs, providing students with a safe and secure learning environment. Nonetheless, MOOC platforms must continue to invest in cybersecurity to stay ahead of emerging threats and ensure that their platforms remain secure and accessible to all.

MOOCs have been gaining in popularity, but with this popularity come challenges in navigating the cybersecurity landscape. Some of these challenges include:

Identity verification: MOOCs often have to verify the identity of students to ensure that only authorized individuals are accessing the course materials.

Data privacy: MOOCs collect a large amount of personal data from students, which must be protected from cyberattacks and data breaches.

Intellectual property theft: MOOCs often contain copyrighted materials, and preventing unauthorized access to these materials is a major concern.

Online harassment and bullying: MOOCs can be a breeding ground for online harassment and bullying, which can have negative effects on students' mental health and well-being.

To address these challenges, several innovative solutions have been developed, including:

Biometric authentication: This involves using biometric data, such as fingerprints or facial recognition, to verify a student's identity.

Data encryption: MOOCs can use data encryption to protect students' personal data from cyberattacks and data breaches.

AI-based monitoring: MOOCs can use AI algorithms to monitor online behavior and detect any instances of harassment or bullying.

Overall, navigating the cybersecurity landscape of MOOCs requires a combination of technological and policy-based solutions to ensure that students' personal data and intellectual property are protected, and that the online learning environment is safe and secure.

4.2 Implications for the future

The challenges and innovations that have emerged in the field of Massive Open Online Courses (MOOCs) and online learning have significant implications for the future of education. Some potential implications are:

Increased access to education: MOOCs and online learning platforms have the potential to democratize education by providing access to high-quality courses to learners across the world. This could lead to increased educational opportunities and greater social mobility.

Customized learning experiences: With the help of innovative technologies such as artificial intelligence and adaptive learning, MOOCs and online learning platforms can provide personalized learning experiences that cater to the unique needs of individual learners. This could improve learning outcomes and increase learner engagement.

Improved quality of education: As MOOCs and online learning platforms continue to evolve, they are likely to incorporate better pedagogical practices and instructional design, which could improve the quality of education provided through these platforms.

New models of assessment: MOOCs and online learning platforms have already introduced new forms of assessment, such as peer review and self-assessment, which could replace traditional forms of assessment such as exams. This could help reduce the emphasis on rote memorization and encourage deeper learning.

Increased collaboration: MOOCs and online learning platforms offer opportunities for learners to collaborate and connect with other learners and experts from around the world. This could help create new knowledge and increase innovation.

However, there are also potential challenges associated with MOOCs and online learning, such as:

Digital divide: Access to MOOCs and online learning platforms depends on access to digital infrastructure such as high-speed internet and computers, which may not be available to all learners. This could exacerbate existing social and economic inequalities.

Quality control: With the proliferation of MOOCs and online learning platforms, ensuring the quality of education provided through these platforms can be challenging. There is a risk that low-quality courses could undermine the credibility of online education.

Motivation and engagement: Online learning requires self-motivation and self-discipline, which can be challenging for some learners. There is a risk that learners may disengage from courses if they do not receive sufficient support and engagement.

Credentialing: MOOCs and online learning platforms offer a variety of credentials, but their value and recognition by employers and educational institutions are still being established. There is a risk that some credentials may not be perceived as credible or valuable.

Overall, the challenges and innovations in MOOCs and online learning have the potential to transform the way we learn and provide access to education for learners around the world. However, to fully realize these benefits, it is essential to address the challenges and ensure that online education is of high quality, accessible, and meets the needs of diverse learners.

Institutions offering (MOOCs) have a responsibility to prioritize cybersecurity and ensure that learners' personal and sensitive information is secure. As MOOCs become increasingly popular, the risk of cyber-attacks and data breaches grows, and it is crucial that institutions take proactive measures to mitigate these risks.

To that end, institutions offering MOOCs should invest in innovative solutions that ensure the security and privacy of their learners. They should implement robust security protocols, such as encryption, two-factor authentication, and regular vulnerability assessments, to protect against cyber threats. They should also educate their learners on best practices for cybersecurity, such as using strong passwords and avoiding public Wi-Fi networks.

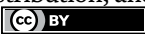
In addition to these measures, institutions offering MOOCs should continue to collaborate with cybersecurity experts and stay up to date with the latest developments in the field. By prioritizing cybersecurity and investing in innovative solutions, institutions can create a safe and secure environment for their learners to thrive in.

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Section 4

Country Case Studies

Opportunities and Challenges of Adopting MOOCs in Africa: A Systematic Literature Review

Vusumuzi Maphosa and Mfowabo Maphosa

Abstract

MOOCs are one of the most transformative tools of the 21st century offering scalable affordances such as increased access to quality education and providing new learning opportunities to communities previously disadvantaged by location and time. The outbreak of COVID-19 has magnified the need for remote-based teaching to minimise learning disruptions. Although developed countries have adopted MOOCs as a novel tool for technology-enhanced education, Africa still lags in adopting such platforms. Literature indexed by two databases, the Web of Science and Scopus, was used for a systematic literature review to evaluate research themes on African countries' opportunities and challenges when adopting MOOCs. The eight-step methodology selected 36 articles published between 2013 and 2021. Results indicate that a few African countries are researching MOOCs. Opportunities for MOOC adoption in Africa are repurposing MOOCs, democratising access to higher education, professional development of teachers, transitions in the workplace and using algorithms to enhance learning. The challenges faced include access to the Internet and educational equipment, lack of skills, pedagogical barriers and MOOCs as a preserve of the Global North. MOOCs provide the potential for universal access to education if African governments could enact policies that support development, adoption and growth.

Keywords: massive open online courses (MOOCs), higher education, educational technology, online learning, Africa

1. Introduction

The impact of Information and Communication Technology (ICT) on every aspect of human life has been revolutionary and disruptive. ICTs have transformed the creation, acquisition, storage and dissemination of knowledge, allowing knowledge to be shared with a more extensive and disparate audience simultaneously and at little or no cost. Over time, the transformation of ICTs and their pervasiveness in education has allowed governments, researchers and educational technologists to increasingly integrate and create a new paradigm supporting millions, where learning takes place regardless of time and geographic constraints [1]. Higher education institutions (HEIs) face challenges, such as changing roles, the relevance of education, dynamic

curricula, rising costs and sustainability [2]. Evolution in education has been slow; notably, changes began with the rise of correspondence courses supported by postal services, and then came the Internet, which supports 21st-century teaching [3].

ICT developments have resulted in developing a new understanding of the idea of open education. This overarching concept has gained popularity since 2002 with the UNESCO definition of the open educational resources (OER) [4]. Massive Open Online Courses (MOOCs) started as open online learning in the form of self-paced web-based courses due to the popularity of email and the web in the late 1990s and early 2000s [5]. Thus, MOOCs were preceded by open online learning and the OER movement. Open education was associated with open admissions and distance education throughout the previous century, marked by the growth of organisations like Open Universities. More recently, open education has been associated with developing OER and MOOCs [6].

The ubiquitous access to learning resources through digital media has transformed education from a distance learning to online and effective personalised learning, such as MOOCs, supporting 21st-century learning pedagogies which are student centred. Technological advances such as the widespread adoption of notebooks, tablets, cloud storage and lower broadband charges have led to the rapid adoption of MOOCs [7]. Top universities responded to the needs of learners by introducing online learning platforms such as MOOCs to the Net and Z generation of today's learners. These digital natives prefer autonomous and self-paced learning [8].

The introduction of MOOCs as a form of collaborative online learning has transformed how the instructor and learner conduct the business of teaching and learning, supporting the 21st-century learning model [9]. MOOCs are one of the greatest innovations transforming higher education in the 21st century. MOOCs are designed to free students from the rigidity of fixed learning timetables and classrooms by allowing learners to learn independently from wherever they are. Barnes [10] asserts that MOOCs are an online course delivery method with no formal entry requirements and are offered for free to hundreds of thousands of learners. Students follow a curriculum and are awarded a certificate after completing the MOOC, where enrolment is unlimited, there is no tuition and strict admission requirement, and the courses are entirely online [11]. MOOCs democratise access to education by not requiring exclusive prerequisites [12]. MOOCs provide diverse content to multitudes of learners, offering access to new knowledge and skills across all disciplines, which needs to be improved in developing countries [13].

The demands to democratise and broaden access to education are only two of Africa's numerous issues. According to statistics, every year, millions of learners who complete high school in Africa are not admitted to universities [14]. MOOCs are seen as an answer to some of the challenges. For instance, El Said [15] suggests that MOOCs are the solutions to problems such as "overcrowded classrooms, high costs of materials and books, commuting difficulty due to high traffic, and a need for continued education and specialised training for the workforce" (p. 7).

It has been established that Africa's efforts to adopt MOOCs are still emerging and fragmented [16]. A more recent study found that MOOCs' successful and efficient implementation in Africa has benefits but is laden with several challenges that need to be overcome [14]. This chapter aims to ascertain the opportunities and challenges of adopting MOOCs in Africa. A thorough, comprehensive literature review method was used to select the thirty-six articles for this investigation. Through a survey of the current literature, this chapter adds to the body of knowledge on the adoption of MOOCs in Africa.

To the authors' knowledge, there is little research that focuses on the benefits and challenges Africa faces when implementing MOOCs. This chapter seeks to explore the state of research on MOOCs in Africa. In particular, the study aims to identify the opportunities available when implementing MOOCs and the challenges of adopting MOOCs in the African context. The study seeks to answer the following research questions:

- What is the prevalence of MOOCs in Africa?
- What are the opportunities for adopting and the challenges faced when implementing MOOCs in Africa?

The rest of the chapter is organised as follows. Section 2 provides a brief literature review; Section 3 describes the methodology followed for this study. Section 4 presents the results, followed by the discussion and recommendations in Section 5. Section 6 presents the conclusion of this study.

2. Literature review

MOOCs were initially divided into connectivist MOOCs (cMOOCs) and extended MOOCs (xMOOCs) [17]. Less emphasis is placed on what is learned in cMOOCs than on how it is learned [18]. xMOOCs are typically organised around lecturer-centred teaching, recorded in a digital format. Information about predetermined learning objectives is didactically imparted and is primarily evaluated through automated grading or peer assessment [19]. Hybrid MOOCs are becoming increasingly prevalent; they use xMOOC platforms that offer structure, narrative, and resources but also downplay the importance of the teacher as the subject matter expert and promote connectivist ideologies like peer-to-peer learning [20].

MOOCs are easy to use and support self-directed learning, where learners worldwide access open-access educational resources [21]. In line with 21st-century learning needs, MOOCs support collaborative learning that nurtures connectedness, and a sense of belonging, which are good traits for the online learning [22]. For most developing countries where students fail to pay for online courses, MOOCs provide a better alternative as the cost is borne by the institutions [7]. The availability of MOOCs offers students free courses and improves the learning opportunities for most students in developing countries.

Africa's higher education has experienced exponential growth, with universities increasing from 294 in 1980 to 1682 by 2018, fuelled by immense demand for higher education [23]. Despite this growth, recent research revealed that 660 million people from the ten most populous countries had 740 universities, an acute shortage compared to 323 million people in the United States having 5300 universities [24]. The number of enrolled students in African HEIs grew from 2.7 million in 1991 to 9.3 million in 2006 [2]. The quality of African education has been questioned; as the number one ranked university in Africa, the University of Cape Town was ranked 272 in the world rankings [25].

Despite phenomenal growth, African HEIs are plagued by many challenges, such as limited government support, low tuition fees, and low research grants to supplement income streams. Globally, over 100 million potential students apply to study in HEIs, and due to inadequate infrastructure, facilities and instructors, only half are

enrolled by the institutions [26]. Educators, policymakers and governments across the globe responded by bringing innovative ideas that could bridge the gap. This saw the rise in the adoption of OER, online and available learning and MOOCs [2].

Educational costs have been rising, while the demand for HEIs has also been surging [27], forcing HEIs to innovate. MOOCs are one of the innovative ways that institutions have introduced to tackle these problems. Widening access to education and creating flexible learning environments have motivated HEIs to adopt MOOCs. MOOCs support tenets of the 21st century which include rich learning and collaborative and peer-to-peer interaction. Over 800 HEIs introduced and pioneered various MOOCs and enrolled millions of learners, altering the delivery of education and accommodating millions of learners who could not be absorbed by formal educational institutions [28]. MOOCs allow students to benefit from content created by top researchers across several universities, thereby allowing cross-pollination of ideas and concepts. Scholars have reported several factors that have led to the massive adoption of MOOCs. These include ease of use, perceived usefulness, zero costs, perceived enjoyment, easy to reach out, collaborative knowledge creation and learner-driven [17, 18].

Most MOOC providers are from the Global North, which limits the learning content's applicability to the local contexts of nations in the Global South, especially in Africa [29]. Currently, there are three basic methods used for the production of MOOCs used in Africa. Firstly, HEIs in Africa collaborate with an already-established MOOC platform. Secondly, a US or European institution with financing and resources teams up with an African HEI to "co-create" the MOOC. The third scenario is MOOCs made about Africa by a non-African institution without partnerships with any African institution [17]. In light of this, there is a need to understand the opportunities and challenges that the adoption of MOOCs in Africa has.

3. Methodology

A systematic literature review study addresses specific research questions and reduces bias by systematically and explicitly setting out how the review will be conducted [30]. There are several ways of conducting a systematic literature review, such as the Preferred Reporting Items for Systematic Reviews and Meta-Analyses [31] and the eight-step guide to conducting a systematic literature review [32]. The systematic literature review was performed from November to December 2022. The study followed the eight steps methodology by Okoli [32]. This is how the guidelines were implemented for this study:

Identify the review purpose: this study aims to identify the opportunities available when implementing MOOCs and the challenges of adopting MOOCs in the African context.

Create protocol and conduct training: this step involved creating a detailed protocol document for the reviewers and holding a training session to ensure consistency in executing the review.

Define screen criteria: the following screening criteria were used. The reviewers included articles whose geographical location was set to African countries by the bibliometric databases and published between 2012 and 2021. Furthermore, only empirical studies from peer-reviewed journals or conferences published in English were considered.

Literature search: the following search string was used to retrieve articles ((MOOC OR MOOCs OR "massive open online courses") AND ("opportunities" OR "issues"

Source	Initial search	Filtering		Evaluating quality
		Period (2012–2021)	Geography—African countries	
Scopus	3870	3464	154	32
WoS	1132	981	48	11
Total	5002	4445	202	43
Duplicates				7
Final				36

Table 1.
Article selection process.

OR “challenges” OR “threats” OR “problems” OR “risks” OR “obstacle”)). The initial results yielded 5002 articles from WoS and Scopus databases. Filtering was applied for the past ten years (2012–2021), leaving 4445 articles. After that, filtering was applied by geographical location, leaving 202 articles.

Extract information: the titles, abstracts, and keywords of the 202 articles were exported to excel for analysis by the authors. Articles which focused on general education and did not explicitly cover MOOCs and African countries were excluded. Articles that did not focus on the opportunities and challenges faced in adopting and implementing MOOCs in Africa were also excluded. Articles with a combined approach were excluded, such as African and other non-African developing and developed countries, leaving 43 articles.

Evaluate quality: The 43 articles were downloaded and evaluated to ensure they aligned with the research topic. This was achieved by minimising the bias by having two authors work independently to evaluate the articles’ quality, compare their selections, and reach a consensus. Seven duplicates appeared from both databases and were excluded leaving 36 articles that were analysed.

Synthesise data: this step combines the facts extracted from the studies using quantitative and qualitative techniques to analyse the data. This step is described in the next section.

Report the review results: a systematic literature review needs to be reported in sufficient detail such that other researchers can independently reproduce the review’s results. The steps are provided in the next section.

Table 1 summarises the values from steps 4 to 6 above. It shows the results obtained from the initial search to filtering and the final evaluation of the articles.

4. Results

This section presents the literature review findings on MOOCs research in Africa, focusing on the state of MOOCs research and the opportunities and challenges faced in adopting and implementing MOOCs. **Table 2** shows detailed information on the selected articles.

The citations were retrieved from Google Scholar on 15 November 2022. The 36 articles are based on studies done in eleven countries, with one study on Africa and another on Sub-Saharan Africa. One article focused on three countries—Botswana, South Africa and Zimbabwe. Regarding geographical representation, Morocco

ID	Ref	Source		Year	Country	Citations
		WoS	Scopus			
A1	[33]		X	2021	Mauritius	6
A2	[34]	X	X	2016	South Africa	75
A3	[35]		X	2020	Morocco	8
A4	[36]		X	2020	Morocco	4
A5	[37]		X	2020	Africa	7
A6	[38]		X	2020	Morocco	2
A7	[39]	X		2019	South Africa	1
A8	[40]	X	X	2020	South Africa	28
A9	[41]		X	2021	Morocco	4
A10	[42]		X	2015	South Africa	4
A11	[43]	X		2020	Sudan	8
A12	[44]		X	2018	Morocco	1
A13	[45]		X	2018	Nigeria	8
A14	[16]		X	2017	South Africa	79
A15	[46]		X	2015	Mauritius	7
A16	[47]		X	2019	Morocco	6
A17	[48]	X	X	2016	Egypt	707
A18	[49]		X	2016	Morocco	7
A19	[50]		X	2018	Sub-Saharan Africa	4
A20	[51]	X	X	2019	Rwanda	7
A21	[52]		X	2018	Kenya	30
A22	[53]	X	X	2021	Eswatini	4
A23	[54]		X	2019	Morocco	0
A24	[55]	X	X	2017	South Africa	81
A25	[56]		X	2021	Eswatini	2
A26	[57]		X	2020	Morocco	5
A27	[58]	X		2020	Kenya	15
A28	[59]		X	2021	Nigeria	0
A29	[29]		X	2021	Africa	1
A30	[60]		X	2019	South Africa	1
A31	[61]	X	X	2020	Morocco	26
A32	[62]		X	2019	Morocco	5
A33	[63]		X	2013	South Africa, Botswana, Zimbabwe	28
A34	[64]		X	2019	Morocco	0
A35	[65]	X		2018	Morocco	18
A36	[66]		X	2018	South Africa	3

Table 2.
Detailed information on the analysed articles.

dominates with thirteen articles, followed by South Africa with nine. In terms of citations, three articles had no citations, 22 were cited less than ten times each and two were cited between 10 and 20 times. Four articles were cited between 26 and 30 times. The top four articles were cited 707, 81, 79 and 75 times, respectively. The top-cited paper was published in 2016 and had an average of about 100 citations per year, indicating the importance of understanding the factors affecting MOOC retention.

No article on MOOCs in Africa was published in 2012 and 2014. One article (2.8%) was published in 2013, two in 2015 and 2017, each representing 5.6% and three in 2016 (8.3%). The highest number of publications was in 2020, with nine articles, followed by 2019, with seven articles and 2018 and 2021, each having six articles. Analysis of **Figure 1** shows that publications on MOOCs in Africa have been increasing steadily.

4.1 Research themes covered in the articles

Through an iterative process, we identified research themes on 36 selected articles identifying opportunities and challenges faced when implementing MOOCs in Africa. Eight themes were identified, five were related to opportunities offered by MOOCs, and three were related to challenges with adopting MOOCs. **Table 3** shows the themes and the different articles related to each theme. Below, we discuss each research theme's importance and link to the opportunities and challenges that exist when implementing MOOCs.

4.2 Opportunities offered by MOOCs

4.2.1 Repurposing MOOCs

For MOOCs to be effective in Africa, collaborations between institutions will be vital to curating and repurposing content to address local contexts and ensure it is

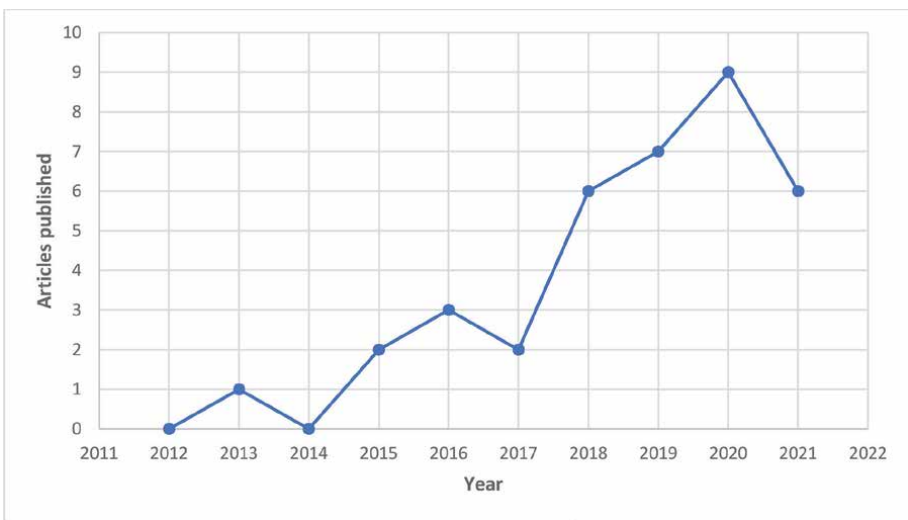


Figure 1.
Articles published between 2012 and 2021.

Research area	Research theme	Articles
Opportunities	Repurposing MOOCs	A3, A4, A8, A16, A20, A24, A27, A28, A29
	Democratising access to higher education	A9, A14, A15, A19, A31, A32, A33
	Professional development of teachers	A10, A13, A16, A21, A33
	Transitions in the workplace	A1, A7, A12, A22, A25, A28, A34, A36
	Use of algorithms to enhance learning	A5, A6, A15, A23, A26
Challenges	Internet and access to educational equipment	A13, A19, A20, A30, A31
	Enforcing credibility of assessments by identifying and tracking learners	A24, A26, A33
	Pedagogical barriers	A3, A14, A17, A18, A24, A33
	MOOCs as a preserve of the Global North.	A2, A4, A11, A14, A15, A35

Table 3.
Mapping of research themes to the 36 articles.

more accessible on mobile devices [29]. Ivancheva et al. [40] proposed that high-ranked institutions in developed countries, which are the significant contributors of MOOCs, could allow smaller and lower-ranked institutions to develop socially responsive MOOCs that solve the challenges in developing countries. This unbundling could result in cutting-edge, shorter and industry-oriented MOOCs. Scott et al. [51] acknowledged efforts by the Harvard team that developed lower-resolution video and audio files and provided flash drives containing all the course content to broaden MOOC content access in resource-constrained settings in Rwanda.

4.2.2 Democratising access to higher education

MOOCs display an attempt by top universities in the Global North to democratise access to education to previously marginalised communities in Africa [62]; for greater effectiveness, MOOCs must address the socioeconomic and developmental trajectory of the African continent [16]. Idrissi et al. [41] noted that MOOCs enhanced the quality of training in Moroccan universities by improving learning outcomes. This augurs well with efforts to introduce innovative ways to massify African higher education. A multilingual plugin was developed to aid learners in translating questions and transform the course into a game, where badges are awarded upon completing some milestones [38]. MOOCs have developed a vast network of tutors who have expertly designed courses offered for free, thus shrinking the geographical and time barriers by providing opportunities for learning to everyone regardless of place and time constraints [46]. Ahmed et al. [43] used MOOCs to overcome the location and timing challenges. Studies in Morocco show that MOOCs can effectively solve challenges affecting Africa's higher education, such as overcrowded classes [61]. Zaatri et al. [62] supported this by highlighting that MOOCs allowed lecturers managing large cohorts with minimum budgets to share learning resources and knowledge and collaborate in reusing and developing educational resources. Nyoni [63] notes that MOOCs can redress challenges with institutional budget constraints by availing affordable access to education suited for resource-constrained environments.

4.2.3 Professional development of teachers

HEIs in Africa are slowly taking advantage of the potential of MOOCs to support quality education and lifelong learning to meet growing educational demands [29]. MOOCs support lifelong learning for individuals coming from underserved communities [45]. Batchelor and Lautenbach [42] used MOOCs to foster lifelong learning habits for pre-service teachers, and this promoted personal and professional development. Teachers used MOOCs to identify opportunities for improvement, identify knowledge gaps and stay current in an environment where there are few options to address the needs of the teachers. Junior lecturers use MOOCs for knowledge and skills acquisition [45]. MOOCs are unlikely to displace the traditional classroom. Still, the disruptions caused by MOOCs provide an opportunity for teachers to rethink and remodel their teaching to serve the needs of students [63]. MOOCs foster and deliver quality education, supporting the needs of the instructors and learners [29]. In Kenya, the TESSA MOOC was used to promote teachers' lifelong and professional development, offering self-regulated learning with flexible commencement dates. Certificates of participation were awarded upon completion of the course, which motivated participants [52].

4.2.4 Transitions in the workplace

Small et al. [39] researched how working people used MOOCs to transition in the workplace. They proposed a framework to assist MOOC developers in capturing these transitions between careers and work roles. The study concluded that MOOCs were excellent for marginalised and remote communities. Walji et al. [66] studied transitions taken by individuals between learning and work. The authors noted that individuals applied what they learnt to their work, while others used MOOCs to transition into a different field. Walji et al. [66] pointed out that these individuals were beyond the reach of the traditional university. Quatig et al. [64] noted that it was essential to enact pedagogical policies that guide teachers before they are introduced to technology. A model was developed to mentor academics using MOOCs and Open Education Resources in Eswatini, and the model can be adapted to other countries with the same educational contexts [56].

4.2.5 Use of algorithms to enhance learning

Algorithms are being developed to predict learners' behaviour using MOOCs through classifying, clustering, visualising and data mining. Riyami et al. [57] proposed a cartographic synthesis tool for allocating ICT tools in collaborative tasks in MOOC courses at Moroccan HEIs, and this improved adoption and utilisation. Due to large amounts of data produced, teachers are using MOOCs to personalise learning, recommend learning paths and detect possible dropouts, thus improving course completion rates [54]. These guide teachers in providing personalised education and supporting interventions that stimulate and enhance the learning process [37]. The algorithms assist in determining learner participation and interaction during the learning process. These interventions can reduce dropouts and increase course throughput. Researchers developed an e-assessment plugin and gamification-based learning to attract the learner's attention and also allow learners to choose between different learning platforms [38]. Big data analytics and artificial intelligence are being applied in MOOCs to foster personalised learning and prepare learners for jobs in the future [46].

4.3 Challenges with MOOC uptake

4.3.1 Internet and access to educational equipment

Two-thirds of the African population is rural, where network connectivity is a challenge, high-cost bandwidth, and access to higher education is a challenge [60]. In most developing countries, the uptake of MOOCs is low due to slow Internet speed, lack of technology, lack of recognition of acquired certificates, lack of time and rigid learning resources that cannot be reused [34, 50]. Deacon et al. [60] noted that evaluating MOOC usage experience can assist designers in addressing issues that affect the learning experience and future adoption, such as balancing flexibility and keeping track of milestones such as assignment deadlines and time constraints. Scott et al. [51] conceded that limited Internet access and rigid course content were barriers to MOOC adoption. African universities face challenges in implementing MOOCs due to a weak ICT infrastructure and low Internet penetration [61]. A study at the University of Johannesburg revealed that students relied on institutional resources to access MOOCs; only 18% used their devices to access a MOOC, and only 16% used their data for the MOOC [42]. There is a need to address the digital divide in Africa by developing the teacher's and students' 21st-century skills to allow them to participate in innovative pedagogies supported by MOOCs [29].

4.3.2 Enforcing credibility of assessments by identifying and tracking learners

Some scholars designed applications to manage risks associated with deploying and managing online learning platforms such as Moodle and MOOCs [44]. Zaoudi and Belhadaoui [35] raised concerns about the credibility of MOOCs and developed a model that can detect unusual behaviour, actions and responses from the learners. The authors noted that if learners are not recognised during examinations and tests, then students are likely to cheat and bring the assessment results into disrepute. They developed Learner Behaviour Analytics (LBA), an AI-based model to identify and ensure that learners do not cheat during assessments [35]. Fotso et al. [37] developed a Recurrent Neural Network (RNN) model that could classify and predict learner behaviour and participation in a MOOC. This model can be extended to identify and track learners and is useful when conducting assessments.

4.3.3 Pedagogical barriers

Rambe and Moeti [16] contended that the low uptake of MOOCs in Africa is symptomatic of philosophical and operationalisation challenges as administrators are yet to grasp the transformative affordances of MOOCs. MOOC adoption is influenced by attitudes, perceptions and knowledge levels [29], which requires more outreach to promote MOOC uptake in Africa. Unlike learning management systems, the pedagogical tools offered by MOOCs, such as discussion forums, quizzes, and videos, are ineffective and do not foster collaborative work [49]. Scholars established that instructor interaction and learner retention significantly affect MOOC adoption, which challenges MOOC creators to pay attention to these human elements, including producing excellent content [48]. Rambe and Moeti [16] noted that large classes in MOOCs diminish student-to-teacher interactions, resulting in high dropout. Therefore, MOOCs must be adapted to the African context for pedagogical relevance. Others fear MOOCs will destabilise the current education system, thus resisting

adoption [63]. Riyami [49] also noted that in most instances, MOOCs are optional and used to reinforce course content.

4.3.4 MOOCs as a preserve of the Global North

There are concerns that, in their current state, MOOCs are perpetuating neo-colonialism and making higher education elitist [16]. Although top universities in the Global North have begun sharing MOOCs with previously marginalised African communities, they still fall short in addressing Africa's socioeconomic development needs [35, 53]. Rambe and Moeti [16] noted that top universities in the Global North were reluctant to offer credits and certificates to graduates in developing countries as they see this as lowering and weakening their academic standards and brands. This calls for African countries to create their own MOOCs. Students are affected by cultural, national and religious holidays as most MOOCs overlap and collide with classrooms and examination timetables. Unless African institutions play an active role and collaborate in the development of MOOC content, the success rate of MOOC completion will remain low, as Poncho [46] noted that completion rates of 5 per cent by African learners.

5. Discussion

Research on MOOCs in Africa is scarce but growing. The adoption of MOOCs by HEIs in Africa is expected to increase. This study sought to explore the state of research on MOOCs in Africa by identifying the opportunities and challenges available when implementing and adopting MOOCs in the African context.

The benefits of MOOCs may only be relevant to learners in Africa if connectivity challenges affecting the continent are addressed. The African continent has remained technologically backward, and the Internet and social network penetration have remained low at 18 per cent and 7 per cent, respectively [7]. Garba [67] noted that only 6% of African youth have access to education due to a lack of funding, poverty, and inadequate facilities. Recent studies show that Internet penetration in Africa has increased to 42%, lower than the global average of 57% [68]. Other scholars highlighted misaligned curricula, poor ICT infrastructure, incapacitated lecturers, undependable electricity and poor Internet bandwidth [26]. African countries struggle with funding research, attracting top academics, and commercialising higher education and governance [69]. Israel [70] challenged HEIs to enact frameworks and policies that foster constructive learning that significantly impacts student outcomes, invest in infrastructure, lower learning costs and train lecturers. Most MOOC providers are universities based in the Global North, with limited experience and knowledge of the socioeconomic challenges affecting the Global South [29]. African countries can invest and collaborate in creating MOOCs that inculcate African philosophies and values to develop content that responds to the socioeconomic needs of the continent.

Very few universities in Africa are using MOOCs to supplement their educational programmes. This makes Africa a fertile ground for partnering with developed countries in developing MOOCs that ensure contextual issues are integrated for effectiveness [7]. Research reveals that about 82% of research on MOOCs comes from North America and Europe; there is a need to expand the adoption of MOOCs across the world, especially in developing countries [71]. Since most MOOCs are created in the Global North, millions of learners in Africa are socio-culturally excluded as most

of the content is in English, and some of the content is not contextually relevant [17]. Scholars believe MOOCs can increase access to knowledge and skills for communities that were once disadvantaged, leading to improved socioeconomic development, skills, wealth and prosperity [72].

Evaluating its implementation, Razmerita et al. [22] noted that MOOCs are disruptive and innovative with a promise to transform the delivery and management of education, which had become stagnant and irrelevant over the years. MOOCs support self-directed learning, where students choose their learning path independent of the lecturer's lesson and course plans in their own time and space [73]. Pedagogical materials developed using multimedia content are broadcasted to a global audience irrespective of time and geographical constraints, thereby liberating access to education. MOOCs use digital content, quizzes, tests and other assessments. MOOCs are at the centre of knowledge sharing to eliminate barriers associated with access to the education [74]. MOOCs support independent, self-paced, and self-organised learning, where learners use universal interest, prior competencies and knowledge to develop their learning interests [73]. One major drawback of MOOCs is that they create a pressure-free environment where most learners fail to finish their courses.

Scholars noted how emerging economies were using technology to disrupt geographic barriers and foresaw a timeless future, and these concepts extended to the higher education [75]. The COVID-19 pandemic highlighted the future of education in digital and online technologies and emphasised MOOCs' critical role in achieving some of the Sustainable Development Goals [76]. The mobile phone has been transformative, enabling many people once alienated from the digital super highway to participate in the knowledge economy. Higher education funding in Africa is a challenge, resulting in high dropouts; the successful rollout of MOOCs promises to serve previously disadvantaged learners [77]. Technological, cultural and administrative hurdles must be addressed before developing countries enjoy the benefits of MOOCs, such as infrastructure expansion, increased bandwidth, training and accreditation of courses [7]. MOOCs provide an opportunity for educators in developed countries to capacitate educators in developing countries in producing content for MOOCs.

African governments should enact policies and legislation that support MOOC development and deployment in higher education. MOOC providers in the Global North should partner with their peers in the Global South to broaden their skills and accommodate their socioeconomic development needs. MOOC developers should accommodate the technological limitations and low bandwidth that characterise most African countries. Universities should put strategies to improve access to fast Internet, provide access to technological devices, and come up with clear programs to enhance the digital skills of the lecturers and learners.

6. Conclusions

This systematic literature review identified 36 studies on current research themes on the adoption and challenges faced when implementing MOOCs in Africa in the past ten years. The findings of the study indicate that few African countries are researching MOOCs. Eleven countries are featured in the 36 articles reviewed. The number of citations of the selected articles shows a limited impact on the research community. Only one article was cited more than 100 times, with most articles cited less than ten times.

Eight research trends within the two themes were also identified, and the relevant studies were mapped to them. The research themes identified regarding opportunities for MOOCs are repurposing MOOCs, democratising access to higher education, professional development of teachers, transitions in the workplace and using algorithms to enhance learning. The research themes identified regarding the challenges when implementing MOOCs are access to the Internet and educational equipment, pedagogical barriers and MOOCs as a preserve of the Global North. MOOCs provide a potential for universal access to education if African governments could enact policies that support the development and tailor MOOCs for the African context. This will improve adoption and growth. The research challenges identified in this study also provide potential directions for future research in overcoming the challenge of implementing MOOCs and taking advantage of the identified opportunities.

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Perspective Chapter: Current Practice of Massive Open Online Courses in South Korea

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Abstract

This chapter reviews the current operation of Korea Open Course Ware (KOCW) and Korean Massive Open Online Course (K-MOOC), which have emerged as Open Courseware in Korea and show the empirical research on the students' opinion of usefulness and future participation willingness to K-MOOC non-credit program and the students' satisfaction with an online program in N university. Korean OCW starting in 2007 has received content from universities and institutions, and shared educational materials in the form of videos, documents, or e-learning. Korea also started MOOC in 2015, like KOCW. The college students at N University highly recognize the usefulness of K-MOOC and have the willingness to participate in KMOOC program in the future. Both learners and instructors can use open courseware according to various purposes and interests, suggesting the continuous development of open courseware for lifelong learning in South Korea.

Keywords: open course ware, Korean open course ware, Korean massive open online courseware, distance education, online learning

1. Introduction

The development of information and communication technology has brought about changes in all industries, and education has moved away from school-centered education and ushered in the era of internet-based distance education. The basic concept of courseware is a compound word integrating course and software in terms of etymology. In other words, courseware can be said to be a program that helps users learn [1]. An ideal courseware can be defined as one that is carefully devised and produced to lead learners to their intended learning goals and supports learners to achieve the best individual learning [2].

Courseware is the most representative example of the Open Educational Resource (OER) movement. Open Course Ware (OCW) was launched to spread knowledge-sharing culture by publishing courseware online. Through OCW, learners around the world can take the classes they want. In Korea, Korea Open Course Ware (KOCW) was introduced in 2007 and system construction started, and after trial operation in December 2008, the service started in March 2009 [1]. In addition to KOCW, the Ministry of Education wanted to build a world-class MOOC in Korea and started

Korean Massive Open Online Course (K-MOOC) in 2015. Therefore, it can be seen that there are currently two large open coursewares in Korea, KOCW and K-MOOC.

Open courseware can be used for various purposes at the level of individual learners and can be used as various teaching materials at the level of instructors in higher education institutions. It can be used as a teaching material for blended learning or flipped learning, as a pre-learning or supplementary in-depth learning material. Blended learning has various definitions, such as mixing media and teaching methods and using various teaching methods, but generally refers to the appropriate mixture of online and offline classes. Flipped learning means that students watch the teacher's class at home through videos, etc., and at school, they do assignment activities or enrichment activities under the guidance of the teacher [3].

In this chapter, a brief review of the current situation of KOCW and KMOOC, two major open coursewares in Korea, will be followed by empirical research of K-MOOC and online course in a university. The commonalities and differences in the educational use of two open courseware focusing on blended learning and flipped learning will be discussed. These research results emphasize that open courseware can be used as an important method of teaching-learning by learners and instructors and will contribute to broadening the scope of its use.

2. Theoretical background

2.1 The concept of distance education

Distance education is a real and academic field of education that has developed in the last 20–30 years. The beginning of distance education, which we refer to today, is correspondence education. The term distance education was formalized in 1982 when the International Council for Correspondence Education (ICCE) changed its name to ICDE (International Council for Distance Education) [4].

The person who gave a comprehensive definition of distance education is Keegan [5], who sees that distance education has the following characteristics. Namely, the separation of learners and teachers, the use of technological media, two-way communication, individual learning, the importance of institutions and organizations providing distance education, participation in industrialized forms of education, and the privatization of learning. A more general definition of distance education is proposed by Holmberg [4]. Distance education is various forms of noncontiguous lessons and learning in schools or all types of education. It refers to non-continuous education that is far away and does not receive immediate supervision from the teacher.

The development of distance education can be largely divided into three eras. The first-generation distance education was the era of correspondence education using the postal system, emphasizing the expansion of educational opportunities for adults, and the second-generation distance education. In the era of industrialized distance education using mass media, educational opportunities were further expanded and diversification of education methods was pursued. In the era of education, the quality improvement of teaching-learning activities in the remote education environment was more emphasized [6].

Distance education is used similar to correspondence education, home study, independent study, external studies, distance teaching, and open learning [3]. Distance education can be said to have started with the postal system. Correspondence education, which can be traced back to the 1720s, has been developed

through the 1830s in which teachers and students receive education through self-instructional texts and correspondence [4]. In the late nineteenth century, what were known as correspondence schools provided education for out-of-school children, such as in Australia, where there were similar correspondence schools away from villages [7, 8]. Distance education has also provided an effective second opportunity for those without a diploma or qualification, and for clients who wish to improve some professional knowledge or skill. Particularly in the 1960s, distance education brought about a dramatic change in traditional education methods [8]. In developed countries in Europe, distance education has begun to be implemented for adults who do not have a diploma or certificate. This was mainly caused by the rapid rise of the idea of equality in education, and the UK's Open University is a representative example. However, efforts to secure highly educated human resources were also an important cause, and recently, it has become common because of efforts to meet lifelong educational needs such as vocational education and continuing education [8].

Distance education started in Canada and New Zealand, mainly in remote areas with low populations, but gradually spread to densely populated areas. However, distance education in the 1960s was a very rudimentary form and was completely different from today. Recently, the speed of development is rapid, such as the use of this distance education even in places with severe traffic congestion. This is due, among other things, to the development of information and communication technologies and educational technology. But it is also argued that next-generation education should be a form that considers students' learning objectives, learning environments, learning experiences, and readiness, rather than by fixed teachers or class programs. It is also because of this increase [9].

In distance education, learners do not attend in-person classes subject to a specific location or time constraints. Therefore, distance education is characterized by non-contiguous communication because it does not rely on direct face-to-face relationships between teachers and learners, but rather on media [4, 8]. Interaction between teacher and learner is necessary, but it occurs after a period of time. Therefore, it is an interaction by means of electronic or radio waves rather than a direct encounter with each other. Of course, there are cases of direct teacher-learner contact, but this is usually when the institution providing learning is large. This is called the non-face-to-face feature of distance education. Distance education is also characterized by openness. This means that the facilities that provide learning are not fixed. It also means that programs, classes, and assessments are not static. The range of choices and the process of learning vary depending on the learner's learning speed, time, and the characteristics of the program. Of course, there are places that request formal admission procedures, but the openness of distance education can be meaningful only when the content of learning and the teaching method are considered at the same time [8].

2.2 History of distance education in Korea

Globally, internet-based distance education is rapidly expanding based on the advantage that anyone can learn anytime, anywhere to overcome time and space constraints. Distance education in Korea can be said to have started with the opening of the Korea National Open University in 1972. In the 1980s, companies such as Samsung and Hyundai conducted distance education, and from the late 1990s, virtual universities were established, contributing to the vitalization of distance education [10].

Korea National Open University is the first national distance university in Korea, and it is also the second distance university in the world after the British Open

University. KNOU opened in 1972 as a 2-year education affiliated institution of Seoul National University and became an independent university in 1982 with a 4-year undergraduate course. In terms of size and university awareness, it is the most widely known among remote universities in Korea. Because it is national, the tuition is very reasonable compared to private schools, so the cost-effectiveness is good. It is an educational institution that mainly office workers and international students visit as part of an extension of education. Even after graduating from KNOU, it is common for students to re-enter another major and continue their studies. KNOU is composed of each department under the composition of four colleges, and regional universities are located in 13 special cities and metropolitan cities. As of 2021, it is a large university with 103,009 undergraduate students and 2291 graduate students [6].

Even in Korea, distance education is developing by leaps and bounds thanks to the government's policy consideration and the active participation of the private sector. In August 1996, the Ministry of Education of Korea selected "operation of cyber universities" as an educational reform task and conducted policy research on the introduction of cyber universities and conducted research on institutional and legal requirements. The pilot operation took place over 2 years with the participation of 65 universities and 5 companies and showed the possibility of establishing a remote university. As a result, the legal foundation necessary for the establishment of a private remote university based on advanced information and communication technology according to the Lifelong Education Act was prepared. In 2003, a total of 16 distance colleges, including one distance college, conducted professional bachelor's or bachelor's courses. As of 2023, there are 19 cyber universities, and there are two lifelong education facilities in the form of distance universities, so a total of 21 cyber universities exist [11].

A cyber university refers to a university that provides an educational method in which students can take lectures and obtain degrees using the Internet. Also called an online university. In English-speaking countries, it is called a virtual university. It is a higher education system that grants a bachelor's degree or professional bachelor's degree when learners learn educational services provided by instructors through the Internet without limitations of time and space and complete certain credits. Academic affairs are operated by students taking classes, taking exams, and submitting assignments through the Internet. Educational information is stored and managed in the form of a weblog, and students can take courses at convenient times at places equipped with computers and the Internet. It has the advantage of being able to receive a degree by taking classes at home without having to go abroad to study [12].

Since its opening in 2001, Korea's cyber universities have experienced explosive growth, starting with 5000 new and transfer students. As of 2018, the total number of enrolled students is about 100,000 and the cumulative number of graduates is about 240,000. It is a compressed growth unprecedented in the history of Korean education. The background of these causes can also be analyzed in three major ways [13].

First, the reason for this is the inconvenience and low graduation rate of the education demand class due to education only through broadcasting excluding the Internet, real-time education, attendance classes, and absolute evaluation tests of "National Korea Open and Correspondence University," which was in charge of major adult education at the time. A large part of the current student demand for Cyber University is in charge of the demand for Korea Open and Correspondence University. It is also objective evidence that the number of students enrolled at the National Open University of Communications has plummeted due to the demand for voluntarily moving to Cyber University, which is about five times more expensive than the National Open University's tuition. The second was a complacent response method

that recognized the demand for lifelong education at existing offline universities as just education at the level of ‘social education centers and lifelong education centers’. The demand for education, which was thirsty for an adult higher education institution that could receive specialized and timely education to cope with an increasingly sophisticated and rapidly changing society, was flocking to low-cost, high-efficiency cyber universities that transcended time and space and allowed entry without the CSAT. As a result, major cyber universities in Seoul have more than 10,000 students per school and mammoth departments with more than 1000 students per department [11].

Third, it is thanks to the education authorities’ “breakthrough change in perception” of cyber universities. Of course, not all ministries, including the department in charge of offline higher education in the Ministry of Education, showed a favorable view of the growth of cyber universities, but it was thanks to the appropriate judgment and support of the education administrator in charge of cyber education at the time. In particular, the cyber university, which was unable to properly conduct higher education due to the legal system at the time of its opening in 2001, was changed from a “remote university-type lifelong education facility” to a “higher education institution” according to the Higher Education Act (Law No. 8638) amended in 2007, it can be said that the biggest impact was that it was able to grow into an “online university that is an adult higher lifelong education institution” in name and reality. As a result, the legal basis for online higher education, which can provide complete education from undergraduate to graduate school, was established. This was in accordance with the Distance College System Improvement Promotion Plan announced on July 4, 2006, and the main revision at that time was the addition of the Higher Education Act so that distance college-type lifelong education facilities would have the same legal status as the National Open University [14].

3. Current situation review of KOCW and K-MOOC

3.1 KOCW

KOCW (Korea Open Course Ware) is a joint utilization service for higher education teaching and learning materials that shares information on lecture materials in connection with OCW (OpenCourseWare) of domestic universities and overseas open education resources (OER: Open Education Resources). It is provided by KERIS (The Korea Education and Research Information Service). OER refers to free teaching-learning materials that are publicly provided so that instructors, students, and learners for the OCW program can use them for education and learning. Representative OER institutions include MIT, UNESCO, and GLOBE, and OER uses CCL (Creative Commons License) according to free open conditions for loaded information.

KOCW started with the opening of a pilot service in 2007, and as of October 2019, 18,388 lectures and 270,443 lecture materials from a total of 215 institutions, including 188 universities and 27 related institutions, are being provided in Korea. In the case of overseas, a total of 12 companies are participating, including 9 universities and related organizations and 3 OAI (Open Archives Initiative), and 33,914 lectures and 417,505 lecture materials are provided (see **Table 1**).

Lecture materials provided at KOCW are largely composed of videos, documents, and e-learning, with videos taking up the most at 64.1%, documents at 28.8%, and e-learning at 5.3%. About 58.8% of KERIS holds the original text, and 40.7% of cases receive and provide lecture URLs from corresponding universities and institutions (**Table 2**).

Classification		No. of Institutions	No. of Lectures	No. of Lecture materials
Domestics	Universities	188	16,013	265,623
	Related Institutions	27	2375	4820
	Total	215	18,388	270,443
Overseas	Universities & Related institutions	9	15,526	16,593
	OAI	3	—	130,469
	Total	12	15,526	147,062
합계		227	33,914	417,505

Source: <http://www.kocw.net/>.

Table 1.
Status of registration of KOCW lecture materials.

Classification	Numbers(%)	
Lecture materials by file type	Videos	175,611 (64.9%)
	Document	77,849(28.8%)
	e-learning	14,433(5.3%)
	Others	2550(0.9%)
	Total	270,443
Lecture materials by service type	Original text	158,926(58.8%)
	URL connection	110,039(40.7%)
	Others	1478(0.5%)
	Total	270,443

Source: <http://www.kocw.net/>.

Table 2.
Classification of KOCW lecture materials.

3.2 K-MOOC

K-MOOC (Korean Massive Open Online Course) means a web-based (Online) course that can be taken by anyone (Massive) without any restrictions on the number of people (Open). In October 2015, K-MOOC selected 10 universities and opened 27 courses to start a pilot service.

In 2015, when the K-MOOC service started, there were 27 courses opened and 55,559 course registrations. Due to the increase in the number of college students and adult learners due to COVID-19, the number of course registrations in March and April 2020 (178,687) increased by 78% compared to the number in March and April 2019 (100,534).

Although the K-MOOC business has grown quantitatively since the start of the service, such as the number of courses opened and course registrations, there are opinions that improvement is needed in the educational effect of learners and the

operation and support of K-MOOC. Since the fields and topics of the open courses are not diverse, learners' choices are limited, and the course completion rate is low. Due to the K-MOOC platform developed overseas, it is difficult to apply teaching and learning methods to enhance the educational effect of learners. There is also an opinion that there is difficulty in activating K-MOOC policies and systems due to a lack of a promotion system [15].

The number of courses offered is increasing every year from 27 in 2015 to 143 in 2016, 324 in 2017, 510 in 2018, and 745 in 2019. The number of participating institutions is 10 in 2015, 28 in 2016, 31 in 2017, 18 in 2018, and 29 in 2019 [15] (see **Figure 1**). As shown in **Table 3**, by field, humanities accounted for the most at 28.0%, followed by social studies at 23.7% and engineering at 21.2% [5].

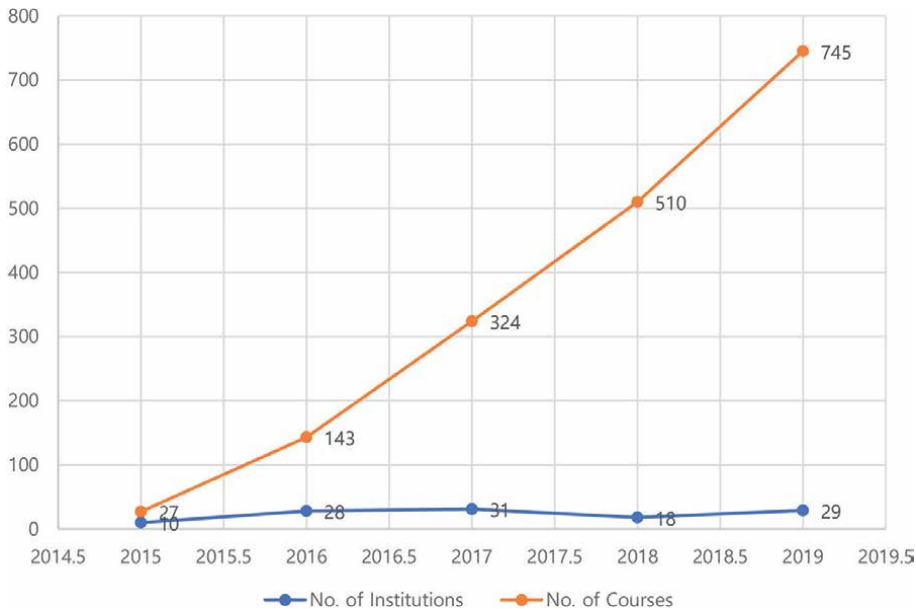


Figure 1.
No of courses and No. of institutions by year [3].

Classification	No. of Lectures	Per cent (%)
Humanities	143	28.0
Social science	121	23.7
Education	19	3.7
Engineering	108	21.2
Nature	58	11.4
Medicine	29	5.7
Arts and sports	32	6.3
Total	510	100

Source: Ministry of Education [16].

Table 3.
Number of K-MOOC courses by academic field.

4. Research on K-MOOC and online courses at N university

4.1 K-MOOC as non-credit course program

Namseoul University, located in Cheonan, provides MOOC as non-credit programs to students to strengthen the key competencies of the university (Communication, Collaboration, Glocal, Convergence, Creativity) and provides points upon completion. When students accumulate points, they can convert them into cash and receive tuition reductions. In 2022, a total 52 programs were provided as K-MOOC non-credit programs. On December 2022, 940 students who participated in the program were asked about the usefulness of the K-MOOC completion program and their willingness to participate in the future.

The evaluation of usefulness was 3.48 points (SD = .833) on average out of 5 points, and the willingness to participate was 3.35 points (SD = .907). Usefulness and willingness to participate were analyzed by gender with t-test. The perception of the usefulness of K-MOOC was significantly different by gender ($t = -6.639$, $p < .001$). Female ($M = 3.62$, $SD = .81$) thought the K-MOOC program's usefulness higher than male students ($M = 3.26$, $SD = .81$). Also, the opinion of willingness to participate the non-credit K-MOOC program in the future was significantly different by gender ($t = -7.283$, $p < .001$). Female ($M = 3.53$, $SD = .91$) expressed their willingness to participate in the program in the future higher than male students ($M = 3.10$, $SD = .83$) (see **Table 4**).

4.2 Exploring factors affecting university satisfaction in online learning

N University is a traditional four-year university that focuses on offline classes. However, there is a system that recognizes the online credits including K-MOOC as graduation credits by 24 credits. Due to COVID-19 in the first semester of 2020, professors took classes in various types using Real Time Online Conference Programs (e.g., Zoom, WebEX), using MP4 videos from PPT with voice and images, or using open source such as YouTube, KOCW, K-MOOC, were conducted. Classes using KOCW and K-MOOC can be called "external learning content type." The students' opinions on the online classes, including this Open Courseware, were examined. After the first semester of 2020, the online survey link was sent to students, and a total of 733 respondents were analyzed. The questionnaire questions used the four-point Likert scale.

Classification	Gender	M	SD	t
Usefulness	Male	3.26	.81	-6.639*
	Female	3.62	.81	
	Total	3.48	.83	
Willingness to participate	Male	3.10	.83	-7.283*
	Female	3.53	.91	
	Total	3.35	.90	

* $P < .001$.

Table 4.
Usefulness and willing to participate of K-MOOC in N-university.

At N University, even open-source programs such as K-MOOC and KOCW were connected to the LMS (Learning Management System) in the school, so the professor managed the class and interacts with the students. Therefore, the satisfaction of the support system and the satisfaction of the professor's activities were examined. Each variable consists of five items and Cronbach α is .827 and .863, respectively (**Table 5**). Satisfaction with the online support system means university guidance, ease of downloading learning materials, interaction and feedback with professors, feedback from friends, and technical support. Satisfaction with online instructor activity means using cases, pictures, videos, etc., reflecting the latest trends, providing additional explanations and information, and providing feedback and objective evaluation. Satisfaction with the online support system's mean was 2.11 out of 4 points (SD = .65) and satisfaction with online instructor activity's mean was 2.56 (SD = .66).

Satisfaction with the online support system and online instructor activity were analyzed by gender with t-test (**Table 6**). Satisfaction with the online support system was significantly different by gender ($t = -3.175$, $p < .01$). Female ($M = 2.16$, $SD = .63$) satisfied with the online support system higher than male students ($M = 1.99$, $SD = .67$). Also, satisfaction with online instructor activity was significantly different by gender ($t = -2.232$, $p < .05$). Female ($M = 2.60$, $SD = .63$) satisfied with the online instructor activity higher than male students ($M = 2.47$, $SD = .72$).

Variable	Contents	No. of items	Cronbach α
Satisfaction with online support system	University guidance, ease of downloading learning materials, interaction and feedback with professors, feedback from friends, technical support	5	.827
Satisfaction with online instructor activity	Using cases, picture, videos, etc., reflecting the latest trends, providing additional explanations and information, providing feedback and objective evaluation	5	.863

Table 5.
The variables' contents, number of items, and reliability.

Classification	Gender	M	SD	t
Satisfaction with online support system	Male	1.99	.67	-3.175*
	Female	2.16	.63	
	Total	2.11	.65	
Satisfaction with online instructor activity	Male	2.47	.72	-2.232**
	Female	2.60	.63	
	Total	2.56	.66	

* $p < .01$.

** $p < .05$.

Table 6.
The gender differences in two variables.

5. Discussion and conclusions

The educational use of KOCW and K-MOOC at the individual level of learners is as follows. In the case of college freshmen, basic knowledge and humanities lectures are shared, students on leave of absence and military service students can use them for class preparation and hobby activities, and workers can use them for vocational and job training. It can be used for major department and career exploration. Undergraduate (graduate) students can attend assignments and prepare for mid-term and final exams, graduates and job seekers can take classes on English, licenses, and entrepreneurship, and retirees and lifelong educators can take special lectures, liberal arts seminars, and self-development, can be utilized. Analyzing the best use cases of KOCW, high school students took in-depth learning while listening to KOCW lectures in a small group study, college students studied formal wear for their major study, prepared for certification, and office workers acquired the latest knowledge in related fields and linked it with work. A case in which performance was achieved by doing so is reported [17].

At the university level, instructors can have students watch KOCW/K-MOOC lecture videos related to the class. Video viewing can be provided as material before class (preparatory study), can be viewed together during class, or can be provided as in-depth learning material after class. Open educational materials provide students with files such as lesson plans, lecture notes, quizzes or tests, answers, and lecture videos or audio.

The flipped learning material is a method that can be used more extensively than a simple lecture video. Both KOCW and K-MOOC can be used for flipped learning, and the actual K-MOOC homepage emphasizes the use of flipped learning in K-MOOC. In other words, open-source videos can be provided as preliminary materials in flipped learning, which is being actively discussed recently. Originally, flipped learning refers to a method in which the main class in the classroom and home learning are crossed, the main class is conducted at home, and in-depth learning (team project, discussion class, etc.) is conducted in the classroom. Prior learning can be provided with materials from various media, such as newspaper articles, theses, textbooks, and videos. In recent years, the most common form of prior learning in universities is to provide video lectures that have the same depth and content as the main learning in the classroom, and instructors who try flipped learning record lectures in advance and provide videos to students [18].

As a pre-learning video material for flipped learning, KOCW and K-MOOC have a common feature that can be used. However, there are some differences in how the two OCWs are utilized. First of all, as mentioned earlier, KOCW allows both instructors and learners to watch a specific video even without logging in, so Professor A selects a specific week from his 16-week lecture by flipped learning and plays the video corresponding to that week. KOCW's video lectures can be specified. In other words, you can select only one video out of one KOCW course. However, K-MOOC allows both instructors and learners to register for a specific course and use only the registered videos for flipped learning. Rather than selecting only a part of a specific video, a specific course is designated as a lecture for pre-learning, and all classes for each week are flipped. The difficulty of progressing with learning follows. If the course registration period does not coincide with the start of university lectures, it is also difficult to designate flipped learning as pre-learning material. In other words, all students participating in offline classes at the university register for a specific K-MOOC course, take the K-MOOC course at home, and use the reverse process of discussions and

projects in the classroom. Learners have to do quizzes and assignments in K-MOOC, and professors at offline universities can use K-MOOC flexibly, which is a complete course that allows quizzes, assignments, and Q&A through tutors.

This chapter briefly overviews the construction status of KOCW and K-MOOC, two open courseware built in Korea, and discusses educational utilization plans that can be utilized at the level of learners and instructors. Open courseware such as KOCW and K-MOOC is a tool that enables learners to learn according to their individual learning needs and strengthen individual capabilities at the individual level. It has the advantage of being a reflective tool for planning and improvement. In addition, at the university level, the competitiveness of universities can be strengthened by sharing and disseminating excellent lectures, and socially, it can be seen that students' right to learn and opportunities for lifelong learning are expanded [17].

Among the dissertations written between 2001 and 2019, 9 papers related to OCW and 48 papers related to MOOC were analyzed. OCW was searched in RISS of the Korea Research Institute of Science and Technology with the keywords KOCW and Open courseware, and there were a total of four master's theses and one doctoral thesis [17]. On the other hand, it can be seen that a lot of recent research on MOOCs has been conducted not only in Korea but also in overseas MOOCs. This is because the MOOC system is spreading abroad and domestically and is being used educationally in various ways. However, as discussed above, currently, MOOCs in Korea are registered for each course and managed by tutors, so it is difficult to take classes without registering for classes, content download is restricted, and there are limitations in using only certain parts in class. Therefore, to be used as a teaching-learning medium in a more flexible way, it is hoped that it can be used as an open material in a flexible way like KOCW.

K-MOOC, which is led by the Korean government, has been able to maintain a steady increase over the past years, excluding profit, because the central government has continuously supported course development and operating costs based on Open edX, a free platform since its launch. However, the government cannot support the budget just in line with the increasing number of courses. Care should be taken in such an environment because an unexpected tragedy of the commons, such as mass production of low-quality content and consequent alienation of learners, may occur. Over the past years, the Ministry of Education, the overseeing institution of K-MOOC, and the National Institute for Continuing Education, the leading institution, have faced these problems and attempted to make desired changes in operation, and in the process, it has been confirmed that they are constantly reflecting the trend of overseas MOOCs [16].

Eom et al. [19] analyzed the learning experiences of MOOC learners at K University and reported that the students valued the MOOC contents as they are made by university professors and requested that the method of delivering the learning content be designed in various ways so as not to be boring and to be composed in a sense of reality.

Recently, by diversifying development subjects, it actively reflects various social needs, continuously induces learning of related courses, creates an environment where learners can always learn, and further introduces overseas platforms and MOOC courses to provide opportunities for comparative development. However, if the Ministry of Education had focused only on the quantitative expansion of K-MOOC, now is the time to seek a new change in qualitative expansion as a turning point for sustainable growth [20].

Author note


This chapter is basically based on Jun's paper in 2019 titled "Exploration on educational use of open course ware: focusing on KOCW and K-MOOC" [17] and in 2021 titled "Exploring factors affecting university satisfaction in COVID-19 online learning" [18].

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Perspective Chapter: MOOCs in India – Evolution, Innovation, Impact, and Roadmap

Partha Pratim Das

Abstract

With the largest population of the world and one of the highest enrolments in higher education, India needs efficient and effective means to educate its learners. India started focusing on open and digital education in 1980's and its efforts were escalated in 2009 through the NMEICT program of the Government of India. A study by the Government and FICCI in 2014 noted that India cannot meet its educational needs just by capacity building in brick and mortar institutions. It was decided that ongoing MOOCs projects under the umbrella of NMEICT will be further strengthened over its second (2017–21) and third (2021–26) phases. NMEICT now steers NPTEL / SWAYAM (India's MOOCs) and several digital learning projects including Virtual Labs, e-Yantra, Spoken Tutorial, FOSSEE, and National Digital Library on India—the largest digital education library in the world. Further, India embraced its new National Education Policy in 2020 to strongly foster online education. In this chapter, we take a deep look into the evolution of MOOCs in India, its innovations, its current status and impact, and the roadmap for the next decade to address its challenges and grow. AI-powered MOOCs is an emerging opportunity for India to lead MOOCs worldwide.

Keywords: AI, ChatGPT, ML, MOOCs, NDLI, NEP, NMEICT, NPTEL, SWAYAM

1. Introduction

MOOCs in India have evolved significantly over the past decade, providing access to quality education, bridging the skills gap, and democratizing learning, with a future focused on localized content, emerging technologies, and partnerships with employers.

– ChatGPT, 23:22, 14 May 2023.

India is a young nation in an aging world. The median age in India is about 28, compared to 37 in China and the US, 45 in Western Europe, and

49 in Japan. This simple stats, known as *demographic dividend*¹, is the main steam behind the resurgence and emergence of India as a global leader in various domains. Early this year (2023), India has surpassed China as the world's most populous country [1] and as one of the largest work-forces² globally. During the next 25 years, one in five working-age group persons will be living in India. As ET rightly quotes [2] a report of *Confederation of Indian Industry* (CII)

“If India’s demographic dividend is productively employed, growth prospects will brighten, helping it to leapfrog its GDP from the current \$3 trillion to \$9 trillion by 2030 and \$40 trillion by 2047.”

This certainly is an extraordinary opportunity with a temporal window spanning nearly five decades [3] from 2005 to 2006 to 2055–2056. India will need to focus on the right policies [4] to reap rich dividends from this demographic transition.

The mammoth size of the work force alone cannot take the nation forward; in fact it may become a huge liability, unless this working age population is skilled and is employable. According to *India Skill Reports 2022 and 2023* [5–7], employability in India has improved³ from 33% in 2014 to 46.2% in 2022, and to 50.2% in 2023. Yet, nearly half of the working population is still unemployable. This certainly is a big concern.

Raising education standards, in both rural and urban sectors, is naturally of foremost priority [3]. Every child needs to complete high school and go on to skilling, training, and vocational education. Only schools with modern curricula, open digital universities for higher education, and adoption of *Massive Open Online Courses* (MOOCs) at scale can contribute significantly to India’s qualified workforce.

Thoughts about scaling the quantity as well as quality of education has been around since the onset of the demographic transition window⁴. However, in 2013, *Ministry of Education*⁵ (MoE) undertook an in-depth study on the issue jointly with *Federation of Indian Chambers of Commerce & Industry* (FICCI). The findings firmly corroborated the adoption of MOOCs at a national level. We quote:

¹ Demographic Dividend is the economic growth potential that can result from shifts in a population’s age structure, mainly when the share of the working-age population (15–64) is larger than the non-working-age share of the population (< 14 and > 65). <https://www.unfpa.org/demographic-dividend>

² 25% population is in the age group of 0–14 years, 18% in 10–19 years, 26% in 10–24 years, and 68% in 15–64 years, and only 7% above 65 years [1].

³ This quoted figure is for employability of men. It is 52.80% for women in 2023. Interestingly, India has had higher employability for women for many years

⁴ Ministry of Education (MoE) launched several programs – NPTEL in 2001, e-Yantra in 2003, and NMEICT & Virtual Lab in 2009. We discuss in depth in Section 2

⁵ Erstwhile Ministry of Human Resource Development (MHRD) from 1985 to 2020

“The Indian higher education system has undergone massive expansion to become the largest in the world enrolling over 70 million students. Such expansion would have been unimaginable without the extensive use of Information and Communication Technology (ICT) tools. To illustrate, if India were to create this additional capacity through increase in brick and mortar institutions alone, it would have had to build six universities and 270 colleges each and every month in the last 20 years have been impossible to achieve with India’s limited resources. Instead, India chose to go the MOOCs way.” **Source:** From 2013 to 2030: the nuts and bolts of transformation [8], p. 11. More in [9]

This reaffirmation of faith on MOOCs resulted in accelerated growth of the digital education system in India riding on the wings of *National program on Technology Enhanced Learning* (NPTEL) from 2001, *NPTEL Online Certification* (NPTEL-NOC) from 2014, *Study Webs of Active-Learning for Young Aspiring Minds* (SWAYAM, India’s own MOOCs) from 2016, *University Grants Commission’s* (UGC) approval of credit earning from SWAYAM in 2016, and finally *National Education Policy* (NEP) in 2020.

The pandemic put a brake on the world and the world leaders of MOOCs like *Coursera*, *edX*, and *FutureLearn* lost 30 to 50% of enrolment [10] in 2021 over 2020. But SWAYAM managed to stay at the same level as India moved faster on MOOCs to protect and build its education. And since then it has been growing strongly—not only in numbers, but also in depth, diversity, and deployment. We tell that story in this chapter.

1.1 Background

Starting with *Vedic Education* (~1500 BCE) and subsequent *Buddhist Education* (~500 BCE) India has had a rich tradition of education systems since the Ancient era. It followed the *Gurukul system of learning* where the student (*shishya*) lived near or with the teacher (*guru*) and got educated through oral instructions (*shruti*) in an *one-on-one interaction*. Over time the need of scale led to the emergence of education hubs⁶ [11] at multiple places such as Takshashila (~600 BCE), Nalanda (~400 CE), and Vikramashila (~800 CE). These institutes continued with the gurukul style and drew learners from far and middle east. However, *scriptures* (written forms of education) started to complement *shruti* and *group-instructions* started to supplement one-on-one instructions. Education systems continued flourish in the Medieval (~600 CE–~1600 CE) and Early Modern (Moghul) eras (1526 CE–1850 CE) through the proliferation [11] of *Makhtabs* and *Madrasas*⁷ at places such as Delhi, Agra, Jaunpur, and Bidar. Beginning of the Modern era witnessed the invasion of and capture by the British. They systematically dismantled⁸ [12] the traditional Indian education system⁹ to introduce classrooms-centric teaching with multitudes of rigid institutional

⁶ Much like the universities today

⁷ Owing to the dominance of the Muslim rulers

⁸ “I propose that we replace her (India’s) old and ancient education system, her culture, for if the Indians think that all that is foreign and English is good and greater than their own, they will lose their self-esteem, their native culture and they will become what we want them, a truly dominated nation” – Lord Macaulay’s Address to the British Parliament on February 2, 1835

⁹ “The beautiful tree of education was cut down by you British. Therefore today India is far more illiterate than it was 100 years ago.”—Mahatma Gandhi, Round-table conference in 1931

framework. For over 150 years India has been following that system to the letters. In this chapter, we refer to this as *Traditional* or *Brick-and-Mortar*¹⁰ or *Classroom System of Education*.

Since independence in 1947, India focused on building educational institutions¹¹ at national scale. While many of these institutions such as IITs, IIMs, AIIMS started to shine very soon, within a few decades the enormity of the scale of building brick-and-mortar institutions appeared daunting and India launched its *Open and Distance Learning*¹² (ODL) programs through *Indira Gandhi National Open University* [13, 14] (IGNOU).

Easy availability of *personal computers* brought in a paradigm shift in the way students can learn using technology and *Digital Learning*¹³ started becoming commonplace in the 1990s. Teachers and students started using technology in the forms of soft copies of books, presentations, audios, videos, contents from repositories. During the early years, digital learning used technology yet the teacher and the student continued to be co-located at (almost) all times.

Advent of the *internet* elevated digital learning to the next level where the teacher and the student could be separated in space in *Remote/Online Learning*¹⁴. The education is relayed through technology, such as discussion boards, video conferencing, and online assessments.

Finally, online learning took to a massive scale with the introduction of *MOOCs* worldwide. We discuss that in the next section in depth as understanding of the *MOOCs* is key to understanding this chapter. In **Table 1**, we summarize the discussions above with a brief overview for and ontology of education systems in India.

1.1.1 Massive open online education (MOOCs)

MOOCs is **Massive** (designed to work at wide scales—from 10 to 10 thousand students or more), **Open** (for registration to all, for access to any content, and for free or affordable education), **Online** (using access to local or remote cohorts and real-time interactions over internet), **Courses** (self-paced with scripted assignments and instructor feedback—preferably with credit mobility and learning community support). *MOOCs* originated from *connectivist cMOOCs* (with focus on community and connections), and *extended xMOOCs* (with focus on scalability) in the early years of the millennium with the term “*MOOC*”¹⁵ being coined in 2008. Many US universities started offering free online courses for the public and *Coursera* [16] (Stanford), *edX* [17]

¹⁰ Brick-and-Mortar education occurs at a physical school, as opposed to a virtual environment

¹¹ IITs (1950), RECs (1959), ITIs (1950), IIMs (1961), AIIMS (1956), Law & Medical Colleges, Kendriya Vidyalaya (1962), etc.

¹² ODL is a system wherein teachers and learners need not necessarily be present either at same place or same time and is flexible in regard to modalities and timing of teaching and learning as also the admission criteria without compromising necessary quality considerations.

¹³ Digital learning is defined as any type of learning accompanied by the use of technology, or instructional practice that makes use of technology

¹⁴ In Remote Learning the student and the educator, or information source, are not physically present in a traditional classroom environment

¹⁵ Mishra [15] points to the Clark taxonomy of variants of *MOOCs*.

Name of learning paradigms	Mode of study material	Space: teacher and student	Time: Sync/ async	Intervening medium	Mode of interaction
Gurukul	Physical	Co-located	Sync	Face-to-face	One-to-One
Classroom	Physical	Co-located	Sync	Face-to-face	One-to-Many
Open & Distance	Physical	Separated	Async	Postal Mail	Sparse
Digital	Electronic	Co-located	Sync	Face-to-face	One-to-Many
Online/Remote	Electronic	Separated	Sync	Internet	One-to-Many
MOOCs	Electronic	Separated	Async	Internet	Machine-to-Many

Note: The ontology of educational paradigms are not standardized. Digital is often used more generically to mean physical as well as online learning using digital technology. e-Learning is taken synonymously with digital or online learning. Remote learning at times stands to mean Distance learning that may not be online. Traditional or Brick-and-Mortar and commonly use to mean Classroom. Finally, Hybrid as a mix of Classroom and Online.

Table 1.
Evolution of education systems in India.

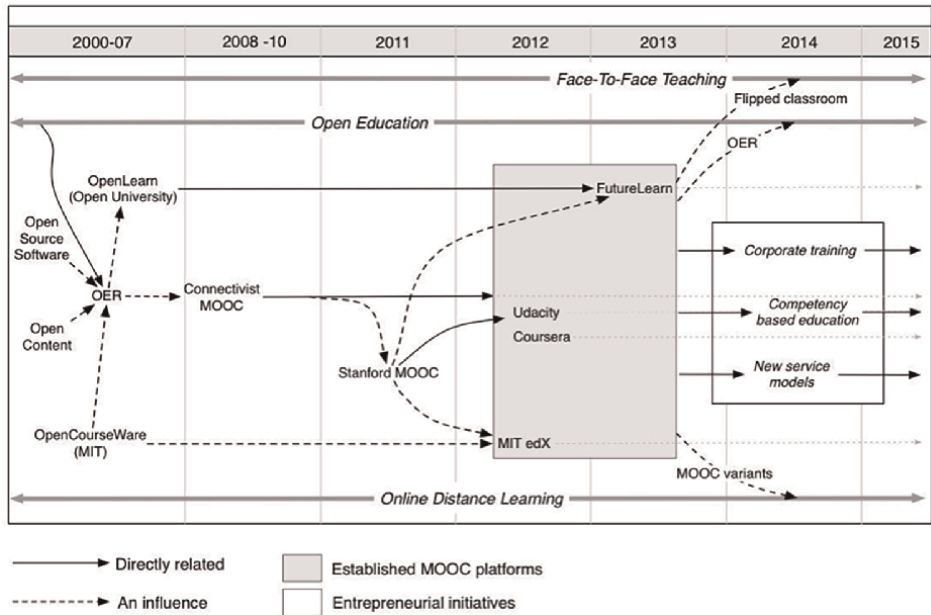


Figure 1.
Milestones in MOOCs and open education.

(Harvard and MIT), and *Udacity* [18] (Stanford) emerged in 2011–2012 in US. Also, *FutureLearn* [19] (consortium of 12 universities) started in UK by the end of 2012.

Figure 1 shows a simple schematic of this evolution process, MAUT [20] provides a brief history, and Aldahmani et al. [21] investigate the development process of MOOCs to assess their opportunities as well as challenges.

Over the past 10 years 1200+ universities across the world [22] have launched free online courses. Importantly, many countries including *India* (NPTEL [23], 2014 &

SWAYAM [24], 2016), China (*XuetangX*¹⁶ [25], 2013), Italy (*EduOpen* [26], 2016), Israel (*Campus-il* [27], 2018), Mexico (*MéxicoX* [28], 2015), and Thailand (*ThaiMOOC* [29], 2017) launched their own MOOCs.

After about a decade of launch, MOOCs world-wide reached an enrollment [22] of 200 million in 2021. As of now, SWAYAM, India's MOOCs, has an enrollment of 30 million and is steadily growing. Consequently, it is important and relevant to understand the various dimensions of MOOCs in India and explore the roadmaps. This chapter attempts to do that.

1.2 Motivation

In the last section, we have noted the transformation of education systems in India and the traction of MOOCs in India in the past decade. Recently, India's commitment to MOOCs has reached a new height with *Government of India* (GoI), in its Union Budget 2022–2023, announcing [30] the establishment of *National Digital University* (NDU) to offer exclusively online courses from various public and private universities. Under NDU, courses will start from July 2023 and the students will be able to opt for certificate, diploma, or degree courses with credit mobility through *Academic Bank of Credits* (ABC) [31]. In view of this fast track for use and growth of MOOCs at national scale, it becomes imperative to study the evolution, present status, and future roadmap of MOOCs in India. Hence, we formulate a few research questions the answers to which would be key to the understanding and planning of MOOCs in India.

1.2.1 Research questions

1. **RQ1:** How has MOOCs (and its ecosystem) have evolved in India over the decades? What has been its connections to digital and online learning in general? What are the milestones?
2. **RQ2:** What are the innovations in processes and technology that MOOCs in India have created/adopted? Which of these innovations have been key game-changers?
3. **RQ3:** What has been the impact of MOOCs in India in terms of direct and indirect outcome? How is it transforming education in India?
4. **RQ4:** What are the challenges of MOOCs in India? How are these being addressed or can be addressed? Is India missing out on some key opportunities for innovation—especially in technology of MOOCs?
5. **RQ5:** What should be the roadmap for MOOCs in India for the next decade?

It is important to seek answers to these questions and/or accept that more research is needed to answer them as the nation raises various pertinent questions about education in the new age. For example, right before the start of the budget session of 2023–2024, Agarwal [32] asks “*Why Swayam portal's a dampener for Modi govt's online*

¹⁶ Primarily fuelled by Tsinghua University and MOE Research Center for Online Education

learning dream. 3 cr signed up, 4% finished”—an oft-asked question on poor completion of MOOCs.

Next, we survey the literature to seek answers to these questions and identify the gaps which the current study intends to fill up in this chapter.

1.3 Literature survey

We survey two sets of literature to understand the state of the art for the research questions above.

- We study *literature on MOOCs in India* to identify prior work relating to all the five research questions including evolution, innovation, impact, challenges, and roadmap. We survey over a dozen significant articles published during the past 5 years.
- We also study *literature on research on MOOCs in different countries* to contextualize the research questions with respect to the developments across the world. We manage the enormity and complexity of such a study by focusing on about 10 significant review articles on MOOCs research published in the last 3 years.

1.3.1 Survey of literature on MOOCs in India

Over the past decade a lot has been written on MOOCs in India. Most of these articles provide *overview of MOOCs projects in India* with reference to infrastructure, investment, diversified needs, quality, web metrics, and challenges. They cover more or less the same ground and discuss similar points barring the temporally changing statistics. Some of the articles in this category, as published in the past 5 years, include Haumin et al. [33], Singh [34], Agarwal et al. [35], Sagar [36], Hooda et al. [37], Mishra [15], EdNet [38], Sharma et al. [39], and Amit et al. [40]. We relate to them in our discussions on questions of impact (Section 4) and challenges (Section 5.2).

In contrast to generic overview, Jaganathan et al. [41], Thakur et al. [42], and Pant et al. [43] *compare SWAYAM with leading MOOCs of the world*—private as well as country-led (including China) and identify a set of challenges for India. We address them in Section 5.2.

Finally, a few recent articles deal with unique questions and/or carry out novel analyses. For example, Varyani et al. [44] use *Power-Interest Grid* as a tool to analyze the problems and concerns of various stakeholders including students, teachers, parents, institutions, content /technology producers, and apex bodies. Singh et al. [45] show high acceptance of MOOCs as an alternative for internship for management students during pandemic and suggest that it may be extend for other domains also during the normal times. Kaicker et al. [46] highlight the *need for Public-Private Partnership for MOOCs* (Section 3.8) and online degrees.

1.3.2 Survey of literature on MOOCs research

The research on MOOCs is at least as old as the coinage of the term. Hence, we first take a look at the most cited research articles on MOOCs as compiled by Ledwon et al. [47] through an extensive analysis of citation data on Google Scholar. While these

20 papers have been well-cited and are impactful, they span 2008–2017 *only* as any paper would need 3 to 5 years to pile up an impactful citation. Hence, in the fast pace of technology, many of these papers have lost relevance for today's MOOCs. In **Table 2**, we summarize 14 review articles starting with the seminal paper by Liyanagunawardena et al. [48]. Of these, nine papers are from 2019 to 2022 and provide comprehensive current state of the art in MOOCs research through their findings.

Review reference, Year	#	Period	Findings and remarks
Liyanagunawardena et al. [48]		2008–2012	<ul style="list-style-type: none"> • Maiden systematic review and quantitatively analysis • Categorization into eight areas of interest
Bozkurt et al. [49]; Zawacki-Richter et al. [50]	362	2008–2015	<ul style="list-style-type: none"> • Finds four lines of research: (a) the <i>potential and challenges</i> of MOOCs, (b) <i>MOOC platforms</i>, (c) <i>learners & content</i> in MOOCs, and (d) the <i>quality</i> of MOOCs and • Bias toward theoretical or conceptual studies; neglect for analyses of actual practice.
Al-Rahmi et al. [51]	32	2012–2017	<ul style="list-style-type: none"> • Recommends strengthening of—intention to use, interaction, engagement, motivations, & satisfaction.
Pradhan [52]	155	2007–2018	<ul style="list-style-type: none"> • Only 155 of 4294 articles from India—it has <i>little contribution</i> (~3.6%); China (~21.7%); and USA (~18.0%) lead the race • Focus on <i>issues in computer science</i> (~73.5%) and concerns in education & learning sciences (~43.2%).
Zhu et al. [53]	541	2009–2019	<ul style="list-style-type: none"> • Observes—quantitative methods, survey & interview for data, and descriptive statistics for analysis. • Focus on <i>issues of students</i>, followed by <i>issues of design, context & impact</i>, and <i>instructor</i>. • Attention to <i>learner retention, learning experience, social learning</i>, and <i>engagement</i>. • India has ~10% MOOCs learners [54] of the world, yet <i>its MOOCs is not studied</i> here along with US, Canada, Australia, China, Israel, UK, Spain, Sweden, and The Netherlands
Jibril et al. [55]	81	2008–2020	<ul style="list-style-type: none"> • Stress on the impact of MOOCs on higher education and professional development • Skepticism about MOOCs for school education
Meet et al. [56]	102	2013–2020	<ul style="list-style-type: none"> • Most researchers based out of United States (22.55%), China (16.67%), and India (11.76%) • Adoption has focus; completion status, instructor-instruction quality, and democratization get less attention • Contradicts the observations by Pradhan [52] who finds marginal research contribution from India. This may be due to the restriction to WoS in [52].
Stracke et al. [57], 2021	103	2013–2019	<ul style="list-style-type: none"> • Use four dimensions—<i>organizational, technological, social, and pedagogical</i>—to ascertain the quality of MOOCs. • All but one article focus on only one or two dimensions, often pedagogical dimension. • Assign all 103 articles to the categories of the <i>Quality Reference Framework for MOOCs</i> [58], they observe that oft-neglected organizational, technical, and social dimensions are relevant and decisive for the design and quality of MOOCs.

Review reference, Year	#	Period	Findings and remarks
Shah et al. [59]	70	2015–2021	<ul style="list-style-type: none">• Dominance of Technology Acceptance Model in adoption• Growth in Asian; slow in developed economies
Dalipi et al. [60]	40	2015–2021	<ul style="list-style-type: none">• Students’ feedback in MOOCs—<i>Sentiment analysis</i>
Zhu et al. [61]	166	2011–2021	<ul style="list-style-type: none">• First study on trends and critical issues of <i>Learning Analytics</i> (LA) in MOOCs.• LA research is <i>published in top-tier communication</i> and <i>used frequently for research than for practice</i>.• ~60% articles <i>use data science</i>—learners’ log & achievement, ML, network analysis, & visualization• Positive traction of emerging technologies in research, yet lack of actual practice.
Cheng et al. [62]	70	2013–2018	<ul style="list-style-type: none">• Research in China by <i>methods, themes, and objects</i>.
Despujo et al. [63]	6320	2009–2021	<ul style="list-style-type: none">• Supervised ML to classify to 6 topics—institutional approach, pedagogical approach, evaluation, analytics, participation, and educational resources.• Content analysis by visual network analysis.• Least articles on pedagogical approach & educational resources; most on participation & evaluation.• Analytics and resources most cited; pedagogical and institutional less cited.

Table 2.
Summary of the reviews of MOOCs research.

1.3.3 Research gaps in literature

Based on the survey of literature, we identify the following gaps:

- Most articles on MOOCs in India are repetitive and provide only generic overview with similar analyses of impacts, challenges, and resolutions.
- No article talks about evolution of MOOCs and its necessary ecosystems in a comprehensive manner.
- There is no attempt to evaluate MOOCs in India with respect to various process innovations.
- Most studies comment on a select set of challenges without interrelating their possible resolutions.
- Research on MOOCs in India as well as from India are both quite inadequate: **Table 2** (Pradhan [52], Zhu et al. [53], and Meet et al. [56]).
- Research on MOOCs is focused more on input (adoption) and much less on output and outcome (completion status, democratization) [56].

- Some of the reviews are contradictory:
- Stracke et al. [57] observe pedagogy as the dominant dimension of research, while Despujo et al. [63] find that pedagogy getting least attention¹⁷.
- While Pradhan [52] finds marginal contribution in research from India and Zhu et al. [53] do not consider India while studying research in nine countries; Meet et al. [56] finds India having the third highest population of MOOCs researchers.
- No review article on applications of emerging technology in MOOCs research like Knowledge Graphs, AI-powered MOOCs, or bots for MOOCs could be found.

1.4 Methodology

Given the national (pan-India) scope of the research in this chapter, we decided to use multitude of data sources and research methodologies.

1.4.1 Data sources

The major data sources (**Figure 2**) used for the study are summarized below:

1. *Literature on MOOCs*: Over 300 published articles on MOOCs (and related areas in digital/online education) are studied (about 60% of these are listed in the references). The study focused on seminal papers from the early years, extensive topical discovery for the past 5 years, and review papers for the rest.
2. *NPTEL Data (2014–2022)*: Data of MOOCs offered in NPTEL from 2014 to 2022 along with various statistics such as enrolment, exam registration, exam attendance, pass percentage, local chapter engagement, student distinctions. Specific interest is focused on MOOCs impact data and data on various shortcomings and lacunae (gaps).
3. *MOOCs/GoI Sites*: MOOCs in India are significantly covered in GoI and institutional sites that provide a lot of program information along with rich time series data on MOOCs. These include but are not limited to NPTEL, SWAYAM, and IITM BS.
4. *Expert Interviews*: The author had the opportunity to be acquainted with a number of experts (and first-movers) of MOOCs in India. They have been interviewed (as a part of this study or earlier) to provide informative insights into various aspects of MOOCs in India.
5. *MOOCs Hands-on*: The author has been an active MOOCs instructor¹⁸. In the process, he has gathered a lot of hands-on information on MOOCs and had the opportunity to interact with participants on their feedback.

¹⁷ This may be due to skewed sizes of corpus between these two studies.

¹⁸ The author has created three courses in NPTEL [64] that are regularly offered every semester / year. Since 2011, he has been a part of the core team to create and offer IITM's BS in Data Science [65].

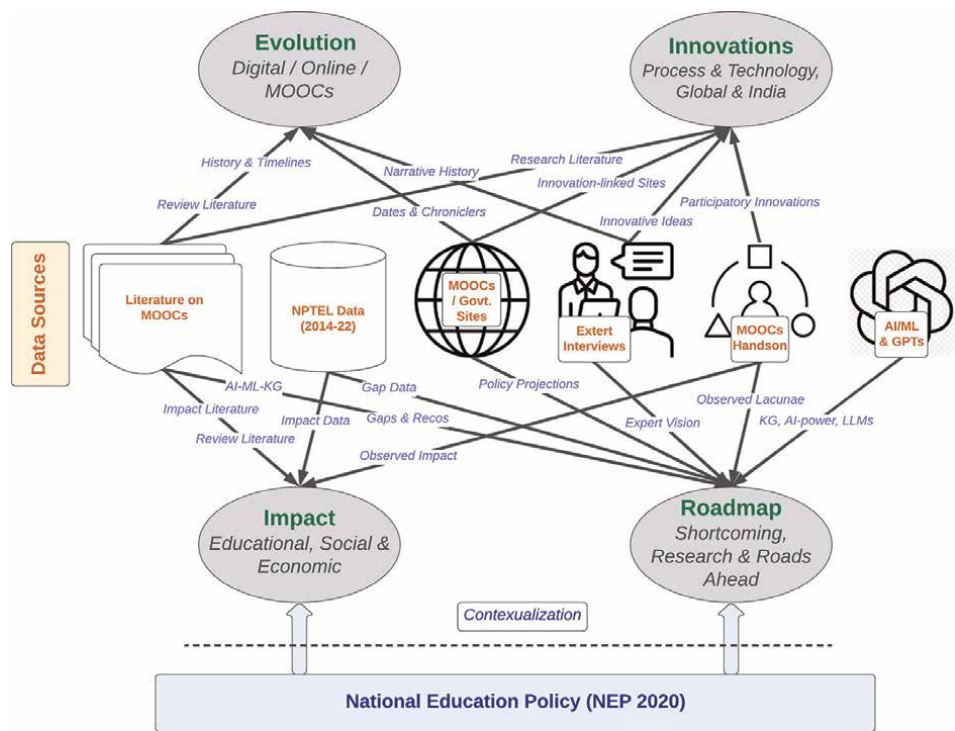


Figure 2.
Methodology framework of the study with major data sources.

6. AI^{19}/ML^{20} & $GPTs^{21}$: The author has conversed with ChatGPT (and other GPT 3.5 and GPT 4 engines) at length to explore specific AI developments for knowledge graph of MOOCs, AI-power MOOCs, and LLMs in MOOCs. This gives a good perspectives on what research is going on in this area.

1.4.2 Data analysis

For each research question, multiple of the sources are used—each with a set of appropriate transformations as shown on the arcs in **Figure 2**.

- **Evolution Digital/Online/MOOCs**: To chronicle the evolution of MOOCs in India over decades, we first review articles from MOOCs literature and dates & chroniclers from MOOCs & GoI sites to identify significant events and then arrange them in a timeline with causal relationships. We validate and fill the gaps from interviews with experts. We present a single-page summary²² in **Table 3** which is subsequently used in the chapter to understand the ecosystem and its

¹⁹ Artificial intelligence

²⁰ Machine learning

²¹ Generative Pre-Trained Transformers

²² A detailed four-page table is available from the author on request.

MOOCs programs	Year	Open education
	1974	• Working Group on Open University
	1985	• IGNOU [66]
	1987	• CET, IITD
	1995	• CET, IITKGP
	1997	• ELNet-3 L [67], CET, IITKGP
	1998	• Visits to CMU
	1999	• VCTEL • First Virtual Campus of IGNOU
• NPTEL [64], IITM (Conceptualized)	2001	
• NPTEL Phase 1 (Started)	2003	• e-Yantra [68], IITB
	2005	• eGyanKosh, IGNOU
• NPTEL Phase 2	2006	
• MOOCs coined, cMOOCs started [20]	2008	
• NPTEL Phase 3	2009	• NMEICT [69] • Virtual Lab [70], IITD
	2010	• NKN [71] • Baadal [72], IITD • FOSSEE [73] • Spoken Tutorial [74]
• Coursera, edX, FutureLearn, Udacity launched	2012	• VIDWAN [75]
• “Year of the MOOC”, says NYTimes [76]		
• XuetaangX (China) launched	2013	• NROER [77], CIET & NCERT
• NPTEL Online Course	2014	• NDLI [78], IITKGP
• mooKIT [79], IITK		
• IITBombayX [80], IITB		
• IIMBx [81], IIMB		
	2015	• e-Pathshala [82], CIET & NCERT
• SWAYAM [83]	2016	• SWAYAM Prabha [84]
	2017	• DIKSHA [85] • NMEICT Phase 2
	2018	• NDLI [78, 86] Live
	2020	• NEP 2020 [87] • NISHTHA [88] • NMEICT Phase 3
• Coursera listed in NYSE and edX acquired by 2 U [10]	2021	• NITI Aayog partners with Byju’s [89]
• NPTEL+	2022	• NEAT [90, 91]
• Multi-lingual NPTEL		
	2023	• NDU [92], PPP for edTech

Table 3.

Timeline of MOOCs and online education infrastructure in India. Blue items relate to global events.

causal transformations to assess the innovations, impacts, and challenges of MOOCs in India.

- **Innovations** *Process & Technology, Global & India*: Innovations in MOOCs in India have primarily been in the processes of delivery, mentoring, engagement, and empowerment. Hence, to understand the innovations we study the processes in various MOOCs including NPTEL and IITM BS program in depth and identify the introductions of process innovations (with causal necessity and resultant outcomes) at different stages of the timeline. We complete the process using various innovation-guided filters on the data sources as shown in **Figure 2**.
- **Impact** *Educational, Social & Economic*: Impact is primarily assessed from NPTEL Data using various metrics. This is supplemented with literature review (including data from social media like Quora) and the hands-on experience of the author.
- **Roadmap** *Challenges, Research & Roads Ahead*: Challenges are identified from published literature (indirect), MOOCs /GoI sites²³ (indirect), NPTEL data (direct), and hands-on (direct). Availability and projections of emerging technology are extracted from the literature (and technology sites) in consultations with ChatGPT (with factual validations). Finally, experts are consulted on the recommendations of the roadmap.

2. Evolution of MOOCs in India

MOOCs in most countries grew bottom-up. Typically, universities created contents and course providers distributed them [93]. For example, we had Coursera and Udacity from Stanford, edX from Harvard and MIT, or FutureLearn and 12 university partners in UK [76]. In contrast, MOOCs in India grew top-down through IGNOU, NMEICT, NPTEL, SWAYAM, and others, where the MoE coordinated the spectrum of initiative from open institutional education and educational content creation, distribution, and certification in associations with HEIs. MoE funded the projects at national level as well. Similar initiatives (Section 1.1.1) have also been taken by *China* [42] (*XuetangX* [25]), *Italy* (*EduOpen* [26]), *Israel* (*Campus-il* [27]), *Mexico* (*MéxicoX* [28]), and *Thailand* (*ThaiMOOC* [29]) where all but *XuetangX* are free. Notably, no other free MOOCs are as large as SWAYAM.

MOOCs need an ecosystem to exist, grow, and succeed. An ecosystem where *Open Educational Resources* (OER), OER Repositories, *Open and Distance Learning* (ODL), Open Credits and Certification, technology-leveraged processes (like Hybrid mentoring strategies, Industry Associates, Proctored Exams, Internships, and Credit Mobility), and most importantly a open mindset to accept and recognize education beyond the brick-and-mortar, exist and thrive in a harmonious manner. Further, this needs to be supplemented with technology (connectivity, authoring systems, interactions mechanisms, etc.), technical as well as domain expertise, and finances. In India, these happened over half-a-century mostly driven by MoE and partly in an organic manner and we chronicle the significant events of this period in **Table 3**.

²³ In terms of plans and policy projections

2.1 Open University: Open and distance learning (1974–1985)

While pinning the onset of the process is difficult, we can trace this evolution to 1974 when Mr. Dipanshu Sharma from the Ministry of Education and Social Welfare organized a seminar [94] on *Open University* in collaboration with the Ministry of Information and Broadcasting, the UGC, and the Indian National Commission for Cooperation with UNESCO. On the recommendations of the seminar, the GoI appointed an eight-member working group on the open university under the chairmanship of Prof. G. Parthasarathi, the-then Vice-Chancellor (V-C) of the *Jawaharlal Nehru University* (JNU). The working group recommended (Working Group Report [94], 1974) as follows:

“... establishing an open university by an act of parliament as early as possible ... the university should have jurisdiction over the entire country so that, any student even in the remotest corner of the country can have access to its instruction and degrees.”

On the basis of the recommendations of the working group and several years of deliberations and due diligence, the *Indira Gandhi National Open University Act, 1985* (IGNOU Act 1985) [13, 14] was passed by both the Houses of Parliament in August 1985 and the *Indira Gandhi National Open University* (IGNOU) came into existence on September 20, 1985. India's march on open education started.

Over 1000 students graduated with diplomas and were convocated in 1989, audio-video courses were the first broadcast by radio and television in 1990, UGC recognized degrees from IGNOU as being equivalent to other universities in 1992, the first virtual campus in India *via* Internet was launched in 1999. Meanwhile, things started moving in other fronts in India.

IGNOU has made a significant mark in the areas of higher education, community education, and continual professional development. It has been networking with reputed public institutions and private enterprises for enhancing the educational opportunities being offered by it. As a world leader in distance education, IGNOU has been conferred with awards of excellence by the *Commonwealth of Learning* (COL), Canada, several times. As of 2020's, IGNOU has [66].

- Nearly 4 million enrolled students
- 21 schools and 67 regional centres
- About 2667 study centres and 29 overseas centres (in 15 countries)
- Approximately 20% of all students enrolled in higher education in India are enrolled with IGNOU.
- Offers 274 academic programs comprising courses at certificate, diploma, and degree levels.
- 810 faculty members and 574 academic staff at the headquarters and regional centres and about 33,212 academic counselors from conventional institutions of higher learning, professional organizations, and industry among others.

2.2 Online and digital education (1985-2009)

Soon after IGNOU, India started realizing that open and distance learning cannot scale unless the telecommunications and (then emerging) information & video technology are engaged in it. Also, ODL meant using a pedagogy different from face-to-face classroom teaching²⁴. All these needed focused research in what emerged to be known as *Educational Technology* or *EdTech* today.

In 1987, Prof. Anup Roy [86, 95] moved to IIT Delhi from NITTTR, Chandigarh, and setup the country's first *Educational Technology Services Center* (ETSC)²⁵. Working with VHS video tapes and miles-long physical wires, ETSC created the first fully interactive remote learning scenarios. Further, Prof. Roy setup *Center for Educational Technology* (CET) at IIT Kharagpur in 1995 and launched *ELNet-3 L: Electronically Networked – Life Long Learning* [67] in 1997. During 1997–1998, CET also connected 15 studios with video labs at Kharagpur, Bhubaneswar, and Raipur²⁶.

Later in 1998, few directors of IITs and IIMs and some MHRD officials visited *Carnegie Mellon University* (CMU), USA, to learn online learning initiatives by Prof. Paul Goodman who had established an entire University in Mexico functioning completely on the Online Learning model. Impressed by the CMU model, hectic activities started for online education in India and NPTEL was conceptualized in 2001, initially for engineering education. By 2003, NPTEL (Phase 1) led by IIT Madras and collaborated by IITM, IITKGP, IITB, IITD, IITK, IITG, IITRm and IISc started creating video (recording of teaching) as well as web courses (animation with text). It soon created 100 of each type. Further, 700 courses were created by NPTEL (Phase 2) starting 2006. In Phase 3, by 2009, NPTEL moved to HD quality video courses and was scaling up in numbers.

Notably, most of the efforts in this period were focused on creation of quality content and its dissemination to the interested learners. As the time progressed, naturally the quality of recording and editing improved, pedagogy was getting better tuned for online, and the dissemination mechanisms evolved from VHS tapes to VCDs to DVDs/ pen drives to downloadable media on the internet (streaming video was not easy yet²⁷).

The initial growth phase for online and digital education was coming to an end and India was getting ready to launch herself at a national scale.

2.3 National Mission on education through information and communication technology (NMEICT): Initial period (2009–2014)

National Mission on Education through Information and Communication Technology (NMEICT) [69] – the title says it all. The country ventured on a mission mode to impart education by leveraging technology. By the turn of the millennium, India had already been a superpower in ICT serving all across the globe. It decided to use ICT to

²⁴ Pedagogy of ODL needs in-depth end-to-end planning, detailed explanations for everything, clear assignments and solutions, and so on

²⁵ <https://etsc.iitd.ac.in/>

²⁶ Internet started in India with *Education & Research Network* (ERNET) project in 1986 and on August 15, 1995, *Videsh Sanchar Nigam Limited* (VSNL) launched public Internet access [96]

²⁷ The first popular video streaming site, YouTube, was founded in 2005

serve its own educational needs. India committed to the three cardinal principles of **Education for All: Access, Equity, and Quality**, served by:

- providing *connectivity* to all higher institutions,
- providing low cost and affordable *access-cum-computing devices* to students and teachers, and
- providing *high quality e-content*s free of cost to all learners in the country

The Mission encompasses all these elements and has three major components:

1. No talent of the country should be allowed to go waste
2. All the services of content delivery through Sakshat²⁸ should be free
3. Freely available material on the web should be reused

Following its launch, NMEICT launched several projects and programs in the next 5 years (2009–2014) for the core purposes of

- *Content Creation*: Course contents such as presentations, videos, assignments, and solutions; Contents for learning programming and *Open Source Software* (OSS); Contents for learning Robotics; and Contents for virtually performing experiments
- *Content Delivery*: Online courses maturing to MOOCs; Tutorials for programming; Embedded Systems Kits for Robotics
- *Certification and Credit Mobility*: This happened a few years later in 2016—on full maturity to MOOCs
- *Content Repository and Digital Library*: Open and free repository of digital learning contents created in NMEICT or reused from other sources; Support for various digital library services
- *Support Infrastructure & Activities*: Academic Cloud for high-volume computing; e-Governance for academic campuses; Plagiarism detection for quality research; Unique researcher IDs and database for academic networking; Clubs and competitions for robotics; Local chapters for MOOCs; and so on.

²⁸ SAKSHAT: A One Stop Education Portal, launched on October 30, 2006, was a precursor to NMEICT to facilitate lifelong learning for students, teachers and those in employment or in pursuit of knowledge free of cost to them. <https://www.education.gov.in/technology-enabled-learning-1>

NMEICT [69] Platforms for Digital Learning			
Project	Platform	Level	Purpose
SWAYAM [83] & (NPTEL) [64]	MOOCs	School, UG, PG	Contents, Delivery & Certification
SWAYAM Prabha [84]	34 DTH Channels	School, UG, PG	Contents & Delivery
Spoken Tutorial [74]	Learn Programming	All learners ^a	Contents
Fossee [73]	Learn OSS	UG, PG	Contents
e-Yantra [68]	Learn Robotics	UG, PG	Contents Activity ^b
Virtual Labs [70]	Scientific Experiments	UG, PG	Contents
NISHTHA ^c [88]	Teachers' Training	School	Contents & Delivery
NDLI ^d [78]	Open & Free Contents	All learners	Library
e-ShodhSindhu [97]	e-Journals Subscriptions	UG, PG	Library
eGyanKosh [98]	ODL ^e Institutions	UG	Library
e-PG Pathshala [99]	UGC PG	PG	Delivery
Shodh Shuddhi [100]	Plagiarism Detection	UG, PG	Infrastructure
Samarth [101]	Campus Governance	UG, PG	Infrastructure
Baadal [72]	Free Academic Cloud	UG, PG	Infrastructure
VIDWAN ^f [75]	Experts Database	UG, PG	Infrastructure

^aSchool, UG, PG, Teachers, Life-long learners, Working professionals. ^bRobotics Clubs, and Regional and national competitions. ^cDelivering indigenous kits for robotics. ^dNational Initiative for School Heads' and Teachers' Holistic Advancement. ^eNational Digital Library of India. ^fOpen and Distance Learning. ^fVIDWAN means learned, knowledgeable.

Table 4.
Digital platforms in India (NMEICT, MoE).

These have been summarized in **Table 4** and put in the timeline in **Table 3**. In addition to the NMEICT fold of projects, *National Knowledge Network* (NKN) [71] was established in 2010 for high-speed backbone connectivity between 1500+ institutions to enable knowledge and information sharing toward ushering in a knowledge revolution in the country.

Thus, during 2009–2014, India got ready with a strong ecosystem to go the MOOCs way at the national scale [102]. As of 2023, the footfall to different major projects as reported from NMEICT [69] site are:

- SWAYAM: 9,20,027 (9.2 lakh \equiv 920 thousand)
- SWAYAM PRABHA: 1,25,07,512 (1.25 cr \equiv 12 M+)
- NDLI: 3,18,46,733 (3.2 cr \equiv 32 M)
- SPOKEN TUTORIALS: 1,79,42,101 (1.8 cr \equiv 18 M)
- ICT INITIATIVES: 3,08,436 (3.1 lakh \equiv 310 thousand)

2.4 Massive open online courses: NPTEL-SWAYAM (2014-2023)

Though NPTEL has been offering online courses since 2006 in multiple forms, these have not been as complete as normal courses to be used for curricular requirements. Students loved NPTEL courses for *Quality*—the quality of the teachers, the quality of teaching, and the quality of contents. Yet, they could use these courses only for better understanding and leaning, but were not being able to use them for their curricular requirements. And many, naturally, wanted to.

2.4.1 NPTEL

So NPTEL decided to go the full-fledged MOOCs way and started *NPTEL Online Certification* [64] (NPTEL-NOC) in 2014. About 600 video and web-based courses came to the fold with a well-developed four-quadrant pedagogy (**Table 5**). A course in NPTEL got structured as follows:

- A course has a duration of 4, 8, or 12 weeks.
- Every week the student gets to download 5 modules for the week.
- Each module is discussed in a 30-minute video with presentation and video transcription files.
- Every week has an assignment which the student has to complete and upload within a stipulated time. It is evaluated and the performance is shared with the student. The model solution is also shared.
- The students also connect to a discussion forum where doubts are discussed and clarified.
- An interactive live session is conducted with the instructor once every 4 weeks.
- At the end of the course, a proctored examination is conducted physically in multiple cities where the student can take the examination showing an official ID.

<i>Quadrant-I is e-Tutorial:</i> <ul style="list-style-type: none">• Video and Audio Content in an organized form• Animation, Simulations, Video demonstrations, Virtual Labs, etc.	<i>Quadrant-II is e-Content:</i> <ul style="list-style-type: none">• PDF, Text, e-Books• Illustrations, video demonstrations, documents• Interactive simulations wherever required.
<i>Quadrant-III is Web Resources:</i> <ul style="list-style-type: none">• Related Links, Wikipedia Development of Course• Open source Content, OER• Case Studies, books including e-books, research papers, & journals	<i>Quadrant-IV is Self-Assessment:</i> <ul style="list-style-type: none">• Problems/Solutions: MCQ, MSQ, SA, LA, Matching• Assignments and solutions• Live Sessions• Discussion forum and FAQs

Table 5.
Four quadrant pedagogy of NPTEL [64] and SWAYAM [83].

- Finally, the student gets the grade based on the performances in the assignments and the final examination. Passing students get a certificate from NPTEL. There are further distinctions to earn for good performances.
- The course is free to attend (including assignments), while the final examination has a nominal fee.

As of January 2023, NPTEL bears the following stats [103]:

- 1.6 Billion+ views
- 4.4 M+ YouTube subscribers
- 2500+ unique courses available for self study
- 2.07 Cr. + enrollments
- 23.8 Lakh+ exam registrations
- 5322+ LC colleges
- 4707 MOOCs completed
- 70+ Industry associates
- 60,900+ hours of videos English subtitles

Riding on the acceptability of NPTEL courses, NPTEL-NOC soon proved to be very popular. Thousands of students started learning from them. This led to two questions:

- Should MOOCs be limited to NPTEL, that is, primarily in engineering and science?
- How can a student transfer the earned credit from NPTEL to college/university transcript?

In response to the first question, SWAYAM [83] was born in 2016, and a while later a new regulation was passed in response to the second question.

2.4.2 SWAYAM

SWAYAM [83] is designed to cover all aspects and disciplines of education. To ensure that best quality content is produced and delivered, nine *National Coordinators* (NC) have been appointed with respective focus areas:

1. AICTE (All India Council for Technical Education) for Self-paced and International courses
2. NPTEL for Engineering

3. UGC for Non-technical post-graduation education
4. CEC (Consortium for Educational Communication) for Under-graduate education
5. NCERT (National Council of Educational Research and Training) for School education
6. NIOS (National Institute of Open Schooling) for School education
7. IGNOU or Out-of-school students
8. IIMB (Indian Institute of Management, Bangalore) for Management studies
9. NITTTR (National Institute of Technical Teachers Training and Research) for Teacher Training program

The NCs have the mandate to drive SWAYAM within its specified guidelines [104]. While SWAYAM follows the same four-quadrant pedagogy (**Table 5**) like NPTEL, depending on the diversity of levels of education, requirements, and discipline, it follows multiple different course delivery and evaluation structures. In 2019, Singh [34] studied the working of the SWAYAM platform in respect of navigation, content management, interactions & communications, and assignment management from the responses of the faculty who have been developing MOOCs. Many of its recommendations got adopted over time.

As of October 2022, the major stats of SWAYAM have been as follows:

- 9.5 M+ Total registered Users
- 9 National coordinators: Operated by AICTE, NPTEL, UGC, CEC, NCERT, NIOS, IGNOU, and NITTTR
- 8000+ Total number of Courses hosted so far
- 2 M+ Exam registrations over 7 years
- 2.6 M+ July 2022 Semester enrollments

2.4.3 Credit mobility of MOOCs

UGC soon followed up with the regulation *Credit Framework for Online Learning Courses through SWAYAM* [105, 106] in 2016 and allowed (limited) credit mobility [107]. Credit Mobility has given a real boost to MOOCs as a strong supplementary arm of education in India which can play a deep curricular role. We discuss the details in Section 3.1.

2.4.4 Institutional MOOCs

While MoE led the country with the umbrella of NMEICT for MOOCs and related online education initiatives, there have been other efforts by institutions on

Other platforms for digital learning			
Project	Platform	Level	Purpose
mooKIT [79]	MOOCs ^a	All learners ^b	Contents, Delivery & Certification
IIT Bx [80]	MOOCs ^c	All learners	–do–
IIM Bx [81]	MOOCs ^d	PG	–do–
NROER ^e [77]	Multi-format Books & Flipbooks	School	Contents
e-Pathshala ^f [82]	Learning Contents	School	Contents activity
NKN [71]	Pan-India Network		Infrastructure ^g
DIKSHA [85]	Knowledge Sharing	School	Infrastructure
NEAT [90]	EdTech Products		Infrastructure ^h
Electronics & ICT Academy [108]	Financial Assistance		Infrastructure ⁱ
Shagun [109]	Integrated Information	School	Infrastructure
NDU [92]	Virtual University	UG & PG	Infrastructure ^j

Many other MOOCs or other online platforms are studied in Refs. [33, 41].
^aConnect with IIT Kanpur for 150+ courses in India and abroad having 2,00,000+ learners from 160+ countries. ^bSchool, UG, PG, Teachers, Life-long learners, Working professionals. ^cOffers Hybrid MOOCs with flipped classrooms, online lectures, and live sessions in multiple flavors—EduMOOCs (as extension courses), SkillMOOCs (vocational training), TeachMOOCs (for teachers), LifeMOOCs (for working professionals). ^dOffers MOOCs on SWAYAM, edX and IIMBx (open edX). ^eDeveloped by Coimbatore Institute of Engineering and Technology (CIET) and NCERT. ^fDeveloped by CIET & NCERT. Besides contents, students participate in exhibitions, contests, workshops; teachers /educators participate in research, and parents can learn to nurture creative talent. ^gA high-speed backbone connectivity for knowledge and information sharing between 1500+ institutions. ^hA PPP model between the GoI (through AICTE) and the EdTech companies of India. Selected companies showcase products on a national portal for the learners to purchase. ⁱMeitY (through IITG) provides Financial Assistance to Set up Electronics and ICT Academies. ^jFirst digital university of India—will operate as a hub for flexible online education.

Table 6.
 Digital platforms in India (besides NMEICT).

specialized MOOCs. Year 2014 saw the emergence of three pioneering programs—IIMBx [81] from IIM Bangalore, IITBombayX [80] from IIT Bombay, and mooKIT [79] from IIT Kanpur. These are summarized in **Table 6**.

IIM Bangalore partnered with edX, a not-for-profit (at that time) online initiative of Harvard and MIT, to create IIMBx [81] platform for MOOCs in all areas of management—data and insights, economics, finance, marketing, people management, operations, and strategy. Apart from edX, the program offers courses on its own platform and SWAYAM for every kind of learner, ranging from first-generation entrepreneurs to college educators looking to teach better.

IIT Bombay, on the other hand, invested in IITBombayX Hybrid MOOCs Platform [80]. Its novelty hovered around its hybrid nature in the forms of flipped classrooms, online lectures, and live sessions. However, what stands out in this initiative is its the user-centric flavor where special MOOCs are designed and offered for Extension courses (*EduMOOCs*), Vocational training (*SkillMOOCs*), Training of teachers (*TeachMOOCs*), and Courses for life-long learner and working professionals (*LifeMOOCs*).

Last but not the least, IIT Kanpur offered mooKIT [79] with 150+ courses in India and abroad for 2,00,000+ learners from 160+ countries.

MOOCs started booming from the past 10 years.

2.4.5 Learning support systems

SWAYAM, NPTEL, and institutional MOOCs aside, there have been other efforts by ministries and departments of GoI to propel advances in this area (See **Table 6**). Notable among these are *National Repository of Open Educational Resources* (NROER) [77] in 2013 (with Video, Image, Audio, Document, and Interactive for schools with NCERT books in Flip book format) and e-Pathshala [82] in 2015 (with resources in English, Hindi and Urdu for teachers, students, parents, researchers, and educators on the web and the mobile). In 2017, *Digital Infrastructure for Knowledge SHaring* (DIKSHA) [85], a knowledge sharing platform for schools known as *One Nation, One Digital Platform* under PM's *eVidya* initiative of *Atma Nirbhar Bharat*, started providing DIKSHA in NCERT Textbooks 36 Indian languages for learners and teachers of India.

2.5 National Education Policy: NEP 2020

The story of MOOCs in India reached out for a climax beyond MOOCs as India announced its much-awaited *National Education Policy* [87] in 2020 (NEP 2020) replacing NEP 1986 [110]. NEP 2020 outlines the vision of new education system of India. It is a comprehensive framework for elementary to higher education as well as vocational training in both rural and urban India. It targets to transform India's education system by 2030 through *National Educational Technology Forum* [111] (NETF)—a platform for the free exchange of ideas on the use of technology to enhance learning, assessment, planning, administration. While the general response to NEP has been quite positive, there have been legitimate voices of concern [112] especially regarding its implementation.

NEP 2020 is structured in terms of multiple clauses in different sections covering different aspects of the education system. Highlights from clauses focusing on online digital education including MOOCs are given below:

- *Online Courses*: apps, online courses, TV channels, online books, and ICT-equipped libraries (Cl 21.9, p. 52), Life-long learning (Cl 21.10, p. 52)
- *Digital Learning Contents*: Digital libraries for contents and textbooks (Cl 24.4 (d), p. 59). Coursework, Games & Simulations, AR & VR. Textbooks (Cl 21.9, p. 52) (Cl. 4.32, p. 17)
- *Indian Languages*: Education in all languages in India (Cl 22.19, p. 56)
- *Pedagogy & Teaching–Learning Process (TLP)*: Digital Pedagogy & enriched TLP with online resources, Technological interventions in TLP (Cl 23.5, p. 57). Teacher Education. Educational Software and Contents (Cl. 23.6, p. 57)
- *Smart Infrastructure*: Digital classrooms with appropriate technology (Cl. 4.46, p. 20)

- *Flexible Processes*: Flexible Curriculum & entry-exit, Assessment & Certification, and Flexible entry-exit
- *Equitable and Inclusive Education*: Learning for All and in HE (Cl. 6, p. 24)

2.6 National Digital University

The establishment of *National Digital University* (NDU), as envisioned under NEP 2020 [87], has been announced [30] in the Union Budget 2022–2023. NDU [113] will be setup by *Department of Higher Education*, MoE, in consultation with UGC, AICTE, and other stakeholders. On this, Mr. Mayank Kumar, Chairman of the *India Edtech Consortium* (IEC)²⁹ observes [92, 114]:

“NDU could be India’s next UPI³⁰ moment, making quality education more accessible and flexible.”

The salient features of NDU [115] include:

- NDU will function in a *hub-and-spoke model* [116] where SWAYAM and Samarth [101] will be the hub and universities and higher educational institutions will collaborate as a network of spokes.
- *All government-funded institutions* such as IITs, NITs, IIITs, and central universities (and a few private universities) would be a part of the network.
- NDU will allow students to *register for multiple courses at different institutions*³¹, accumulate credits from them in *Academic Bank of Credits* (ABC) [31], and redeem these to get a certificate, diploma, or a degree.
- Students will be *awarded degrees* by the university where they earned 50% of the credits. If the credits are thinly spread, NDU will award the degree.
- There will be *no quota of seats*—any number of students can join, based only on the passage of the qualifying exam.

Union Budget 2023–2024 reiterated the plans for NDU [119] and announced [114] that courses will be offered from July 2023.

In summary, we have discussed the evolution of MOOCs, its ecosystems, and its synergy with digital and online learning over decades. We have also chronicled the milestones in a timeline while addressing RQ1 (Section 1.2.1).

²⁹ <https://www.indiaedtech.in/>

³⁰ India’s Universal Payments Interface (UPI) has transformed the digital payments system in the country and is extremely popular.

³¹ In April 2022, the UGC approved simultaneous dual degrees, in both physical and online modes [117]. Also, there are 500+ UGC-approved online degrees from India’s top universities [118]. With NDU as hub for everything online, it is not clear how this will be integrated.

3. Innovations in and extensions of MOOCs in India

MOOCs have made significant impact in India through SWAYAM in general and NPTEL in particular. The early success of NPTEL (focusing on Engineering and Science) in the first decade of the millennium paved the way for SWAYAM with MOOCs in all disciplines, at all levels, and in multiple forms of education. Based on the learning from NPTEL MOOCs, SWAYAM/NPTEL continued to innovate in various programs [103, 120] to enrich the ecosystem on MOOCs to enhance its traction and effectiveness. We highlight a few key innovations that happened on the way.

3.1 Credit mobility

To understand the credit mobility, let us see how credit is computed.

3.1.1 Credit computation

Every 4 weeks' course entails 14 hours of academic work for the student:

- *Videos*: 30 minutes/video \times 5 video/week \times 4 weeks = 10 hours of video-based self-study
- *Assignments*: 1 hour/assignment \times 1 assignment/week \times 4 weeks = 4 hours of assignment workout

According to UGC norms [120], 14 hours of academic work is worth for 1 credit. Similarly, 8 or 12 weeks' courses are worth for 2 or 3 credits, respectively. In addition, if a college wants to count the discussion forum, extra material, and more time for videos/assignments, 1 extra credit can be assigned to the courses.

3.1.2 Credit mobility and management

UGC allowed (limited) credit mobility [105, 106] in 2016 (Section 2.4.3). Under this an institution can allow up to 20% of the total courses in a semester through SWAYAM. Any regular/part-time student of any educational institution in India [121] can avail of the credit transfer. Credit mobility soon became popular and in 2021, the limit on credit mobility per semester [122] was increased to 40%.

Further, to facilitate easy management and mobility of credits, UGC has setup [123] the *Academic Bank of Credits* [31] in 2021. Institutions register to ABC and deposit credits earned by the students' to their respective accounts. This helps to maintain the integrity, authenticity, and confidentiality of student credits, easy credit transfer in digital mode, and fast credit recognition.

Credit Mobility has given a real boost to MOOCs as a strong supplementary arm of education in India, which can play a deep curricular role. Recently, Singh and Kakkar [124, 125] have analyzed the impact of credit mobility to reveal that there has been a considerable increase in student enrollment (due to the mobility) but with extremely low certifications (We discuss this aspect in Section 5.2).

3.2 Certification

MOOCs usually have certificates for courses successfully completed. However, India has been desirous of creating certificates that will be *credible and acceptable to all academic institutions* and also define the *scope of skills the student is certified for*.

3.2.1 Credible certification

To add credibility to the SWAYAM certificates, NPTEL-NOC had introduced a *physically proctored examination* conducted in multiple cities where the student can *take the examination showing an official ID*. While weekly assignments, their solutions, and evaluations comply with the continuous learning principle of SWAYAM (MOOCs), award of final grade adequately weighted with the performance of the proctored examination mean credibility of the certification. Three levels of certifications have been created over a decade:

- *Course-level certificate* (as in NPTEL-NOC) certifies skills in the course
- *Domain-level certificate* (discussed below) certifies skills in a domain of specialization comprising multiple courses.
- *Degree-level certificate* (discussed under Online Graduation) certifies comprehensive skills in a discipline—at par with what is obtainable from brick-and-mortar curricula.

3.2.2 NPTEL domain certification

NPTEL has been giving out course-level certificates since 2014 and there have been a lot of students doing multiple courses from NPTEL, which are not always connected. Hence, a need has been felt to link courses together for the foundations (*core*) and to define baskets of electives for further specialization. NPTEL Domain Certification has been created for this purpose. In this, NPTEL has grouped courses across 12 disciplines to help learners specialize in 51 domains. Completing a domain helps to gain expertise in a specific area [126]:

- To gain expertise/foundations in an area of interest
- To gain mastery to pursue Higher Education
- To become more employable for jobs in the opted area

Every domain comprises Core course and Elective courses (to choose from a list). The learner has to complete the courses with at least 55% score in each and at least 60% in aggregate to get a domain certification.

3.3 Online graduation

Building up on online certification, which is for specific courses and domain certification, which is for a basket of courses from a domain, IIT Madras launched the world's first 4-year Bachelor of Science (BS) Degree in Data Science and Applications [65].

This gives the students an opportunity to work toward an undergraduate degree/diploma from an IIT regardless of her/his age or location, and with a wide range of academic backgrounds.

This was launched in January 2021 as a BSc Degree in Programming and Data Science from IIT Madras. Keeping with the structure suggested by NEP 2020 [87] it is designed as a multi-entry and multi-exit Online Degree program where a student can earn certification at Foundational, Diploma, and Degree levels. Subsequently, IIT Madras launched 4-year BS in Data Science and Applications [65] and Diploma in Programming & Diploma in Data Science [127].

3.4 Partnering and networking

From the early days NPTEL, and later SWAYAM, have been built on a strongly participatory model between various institutions. These partnerships and networks have been designed for course creation, delivery, and certification. On way to NPTEL-NOC, NPTEL realized that the success of MOOCs as a large-scale model for affordable education needs the engagement of students and the colleges that the students attend. Hence, the concept of *Local Chapters* (LC), at the colleges partnering NPTEL, was born.

As the industry engages the skilled man-power, SWAYAM/NPTEL needs to have close collaboration with it. The *Industry Associate Program* thus created by NPTEL, helps employment and course monitoring for effective skilling.

3.4.1 NPTEL local chapters

Following the launch of NPTEL-NOC [64], NPTEL started setting up LCs in colleges to encourage more students to participate in it. Every LC is headed by a faculty member of the college, who acts as the *Single Point of Contact* (SPoC) between the college and NPTEL. The SPoC disseminates information about programs among the students, identifies suitable mentors for courses, ensures that the students are active in courses, clarify their doubts, and so on.

Local Chapter has been the most effective outreach for NPTEL. Over the past five years (2017-22), about 70 to 80% of total NPTEL registrations have taken place through the LCs [128]. States having more LCs have shown more engagements with NPTEL.

3.4.2 NPTEL industry associate (NIA) program

NPTEL partners with industry to bridge the gap between the academics and the industry and to create courses along with the industry to cross-skill and upskill the existing workforce. CSR initiatives are also welcomed as part of this association. A total of 79 NIAs [103, 120, 129] have signed up and facilitated in one or more areas:

- *Recruitment/Internship*: NIAs are regular recruiters of NPTEL learners and are offering internships
- *Co-offer Courses*: NIAs have collaborated in offering 170+ live sessions in NPTEL Special Lecture Series on Latest technologies, Skills or competencies for the industry, and Career opportunities

- *CSR Support*: Through CSR, NIAs are supporting waivers for examination fees (~1,20,000+ students benefited)
- *Soft/Digital Skilling*: NIAs support to conduct soft skills training and digital skilling courses to learners in local chapters.
- *Upskill/Reskill Employees*: Courses for working professionals to reposition in career.

3.5 Student connect and recognition

Students are the purpose of MOOCs. So keeping them encouraged, motivated, and engaged are critical for effective MOOCs at scale. NPTEL started this through various honor programs for students and also created opportunity for internship at academia as well as industry.

3.5.1 NPTEL star

To motivate learners to excel, NPTEL has introduced multiple honors³² under the *NPTEL Star* program. Starting the Jul-Dec, 2019 session, over 10,000 certificates have been awarded to stars in various categories in the past 3 years. This has proved to be quite motivational from the learners [130].

3.5.2 NPTEL internship

From 2018 summer, NPTEL has started offering internships to NOC examination toppers with the respective course instructors to provide an opportunity to toppers to gain rich research experiences. The internship is offered for 4, 6, or 8 weeks in summer and winter each year with a stipend of Rs. 5000/= for 4 weeks of internship. A total of over 200 students [103, 120, 131] took internship in summer and winter sessions of 2021 and 2022.

3.6 Extensional courses

NPTEL has also launched extensional courses for students (GATE), teachers (FDP), and industry professionals (NPTEL+) appropriately reusing the IP already created for NPTEL courses. It has high return on low investment.

3.6.1 NPTEL GATE project

To provide students with an integrated platform to prepare for the *Graduate Aptitude Test in Engineering* (GATE)³³, NPTEL GATE Project was initiated with CSR

³² NPTEL Domain Scholars, Superstars, Evangelists, Motivated Learners, Enthusiasts, Discipline Stars, and Believers

³³ GATE is an examination conducted in India that primarily tests the comprehensive understanding of various undergraduate subjects in engineering and science for admission into the Masters Program and Job in Public Sector Companies. GATE is a *Computer-Based Test* (CBT) organized by IISc Bangalore, IIT Bombay, IIT Delhi, IIT Guwahati, IIT Kanpur, IIT Kharagpur, IIT Madras, and IIT Roorkee, on behalf of the

support from Amadeus Labs, Bengaluru, India. This project supports preparations for GATE in multiple ways including in-video contents for [132]:

- *Video solutions to previous GATE questions:* The video solutions are designed to be self-contained—starting from a quick recap of the basic concepts for solving the problem, followed by a detailed solution using fundamental concepts, and ending with smart tricks, if any, to solve the problems.
- *Video explanation of Subject Concepts:* For easy access, all the topics of GATE syllabus are mapped and linked to the most relevant NPTEL lecture/s. These lectures, in turn, are mapped to various topics of the GATE Syllabus.

With solutions for 9 departments, 4191 videos, ~420 hours of content, and ~ 800 live mentoring sessions in 2 phases, 6500+ students have benefited [103].

3.6.2 NPTEL courses as FDP

In July 2018, NPTEL signed an MoU with AICTE for advanced NPTEL online certification courses [133, 134] approved for *Faculty Development Program* (FDP) by AICTE. About 4, 8, or 12 weeks courses are offered as $\frac{1}{2}$, full or $1\frac{1}{2}$ FDP of 1 week. 2400 + FDP courses [103] have been offered during January 2021 to April 2023 with 66,000 + faculty applying for FDP during January 2021 to July 2022.

3.6.3 NPTEL+: Anyone, anywhere, anytime

NPTEL deviated from *free* paradigm of MOOCs and designed paid e-learning courses for working professional as NPTEL+ portal to expand the variety of offerings and for learner upskill. Three types of training programs are available [135]:

1. *NPTEL courses in self-paced mode:* These are self-paced courses where learners may progress through the course and complete assignments at their own pace. Learners may also choose to write a remote proctored online exam from the comfort of their homes and earn a certificate.
2. *Short-term training programs from the IITs/IISc:* Short-term training programs which might involve fully live lectures coupled with hands-on training or a blended mode of learning (recorded videos+live lectures) are planned.
3. *Other programs:* These are targeted toward specialized courses in an emerging technology or complementing the existing NPTEL courses with dedicated hands-on content to equip the learners to be industry ready.

With 200+ courses and 550+ professionals already qualified [103], NPTEL+ is leveraging the IPs of NPTEL MOOCs to add new value for the online courses. Extensions of these are offered for in-person lab certification through workshops:

National Coordination Board – GATE, Department of Higher Education, MoE. GATE 2023 is coordinated by IIT Kanpur.

- *NPTEL lab workshops*: Typically offered during summer and winter, these in-person courses motivate students and faculty to get hands-on experience.
- *NPTEL+ workshops*: These live and interactive workshops are offered through the year in online or in-person mode for half-a-day to a week. They cater to a wider audience including students, faculties, and professionals.

A total of 24 NPTEL+ course have been offered during August 2022 to December 2022 where 4000+ learners have participated [103].

3.7 Multi-lingual MOOCs

In India there are 22 languages [136], referred to as *scheduled languages*, and given recognition, status, and official encouragement. About 96.71% of the population in the country has one of the 22 scheduled languages as their mother tongue. Several students undergo their schooling in their regional language and may face challenges transitioning to English for technical education.

The MOOCs courses, however, are primarily in English. In the early years of development (2000–2010), this was not considered a bottleneck as MOOCs meant courses in engineering, science, and management where the teaching in classrooms are also only in English medium. However, with the widening of education with online and digital options, decision of using MOOCs at all levels (including school education, adult education, and life-long learning), and broadening of outlook in education across the Nation, it became imperative that skills in English cannot be a prerequisite for education through MOOCs. Hence, multi-lingual MOOCs have become a necessity for India. Given the diversity of disciplines and levels, and variety of languages, multilinguality is a major challenge. Yet, NPTEL had an early start which SWAYAM too is adopting.

3.7.1 NPTEL translation

NPTEL has initiated translation of course contents into *11 different languages*—Assamese, Bengali, Gujarati, Hindi, Kannada, Malayalam, Marathi, Odia, Punjabi, Tamil, and Telugu. Translations are available as pdf transcripts, e-books, subtitled videos, scrolling text-on-videos, and audio files. So far, NPTEL has received 1500+ requests to provide the translation of course contents. With the help of LCs³⁴, it has translated ~300 courses in 11 languages having 40,000+ lectures for 10,000+ hours [103, 137]. These are freely accessible and downloadable.

Through this intuitive, SWAYAM/NPTEL has been supporting the need for *education in all languages in India* as envisioned in NEP 2020 [87] (CI 22.19, p. 56).

3.8 Public-private partnership (PPP)

With the fast increasing need for skilling India's workforce, huge resources are continually needed. A part of that is addressed by the structure and efficiency of MOOCs. Yet it is beyond government's resources to satisfy all the need of skilling; and participation of the private sector is a dire necessity. Kaicker et al. [46] have drawn

³⁴ Over 3500 translators and 200+ curators from nearly 1500 LCs have been contributing

parallels between SWAYAM and edTech start-ups in India that offer online degrees in collaboration with different universities to highlight the complementarity between private and public sectors in India in this space.

Keeping the above in view, under NEP 2020, EdTech companies and startups are provided with necessary guidelines and impetus to develop learning management systems, ERP softwares, assessment platforms, online labs, etc., for schools and universities. NETF, an autonomous body mandated by NEP 2020, is created to facilitate exchange of ideas on technology usage to improve learning [138]. Government is also experimenting with different mechanisms to make the PPP successful and effective. We highlight two recent initiatives.

3.8.1 PPP of NEAT

MoE has announced a *National Educational Alliance for Technology* [90] (NEAT) as a *Public-Private Partnership Model* between the GoI (represented by AICTE) and the EdTech companies of India. The aim of NEAT is to bring the best products in educational pedagogy on a single platform for the convenience of learners. Technology Products using AI for customized learning or e-content in niche areas having highly employable skills would be identified for showcasing on the portal. In September 2021, *NITI Aayog*³⁵ partnered with Byju's³⁶ to provide free access to its tech-driven learning programs to engineering aspirants from 112 districts [89].

3.8.2 Electronics and ICT academy

In November 2014, MeitY³⁷ launched *Scheme of Financial Assistance for setting up of Electronics and ICT Academies*³⁸ for faculty/mentor development/upgradation in fast evolving areas in electronics and information technology. Under the Scheme, seven Electronics and ICT academies have been set up at seven premier academic institutions—NIT Warangal (Telangana), IIITDM Jabalpur (Madhya Pradesh), IIT Guwahati [108] (Assam), NIT Patna (Bihar), IIT Kanpur (Uttar Pradesh), IIT Roorkee (Uttarakhand), and MNIT Jaipur (Rajasthan). The scheme targets to train 92,800 faculties.

To address RQ2 (Section 1.2.1), we have discussed various process innovations in MOOCs in India either through the initiatives of the government or the MOOCs providers like SWAYAM/NPTEL. Some of these like credit mobility, domain certification, online graduation, local chapters, and multilingual support are proving to be game-changers and need to continue in the future roadmap.

³⁵ The NITI Aayog (*Policy Commission* or National Institution for Transforming India: <https://www.niti.gov.in/>) serves as the apex public policy think tank of the GoI

³⁶ Byju's (<https://byjus.com/>) is an Indian multinational educational technology company, headquartered in Bangalore, India. It was founded in 2011 and as of March 2022, it is valued at US\$22 billion and the company claims to have over 115 million registered students.

³⁷ Ministry of Electronics and Information Technology: <https://www.meity.gov.in/>

³⁸ <https://www.meity.gov.in/scheme-financial-assistance-setting-electronics-and-ict-academies>

4. Impact of MOOCs in India

NPTEL completes 20 years in 2023. This by itself is a strong corroboration of the impact it has been making in MOOCs-based education. Over the past decade, a lot has been written about the impact of SWAYAM/NPTEL by several researchers including Chauhan et al. [139], Jaganathan et al. [41], Haumin et al. [33], Varyani et al. [44], Pant et al. [43], Singh et al. [45], Mishra [15], EdNet [38], Sharma et al. [39], and Amit et al. [40]. Most of these cover more or less the same ground or discuss similar points. So we will not repeat them here, the reader may check the references. Rather, we will present a few representative impact points from NPTEL.

4.1 Quantitative and qualitative assessment of impact of SWAYAM/NPTEL

While earlier work highlight various positive impacts of MOOCs in India (primarily SWAYAM), data and analyses on different impact factors are not available for most of its programs (or, for IITBombayX/IIMBx/mooKIT) with the exception of NPTEL. Most programs in SWAYAM (except for NPTEL) started only in 2016. So with resource mobilization, content creation, and delivery, these have been on ground for a few years only. In contrast, NPTEL is a long running program having several data points. So we appraise the NPTEL experience.

4.1.1 Quantitative metrics of impact of SWAYAM/NPTEL

For quantitative metrics of impact let us consider the growth of courses, enrolments, and registrations for examination (**Figure 3**). We observe healthy steady growth in each except for a brief pandemic-induced slowdown at the end of 2020. It is also interesting to analyze the reasons behind choosing NPTEL (MOOCs). Learners of NPTEL are asked the reason/s for taking the courses and are given six options. The summary of the learners' responses over five semesters from July 2020 to July 2022 are given in **Figure 4** and are ranked from high to low:

1. To earn credit
2. To learn and update knowledge

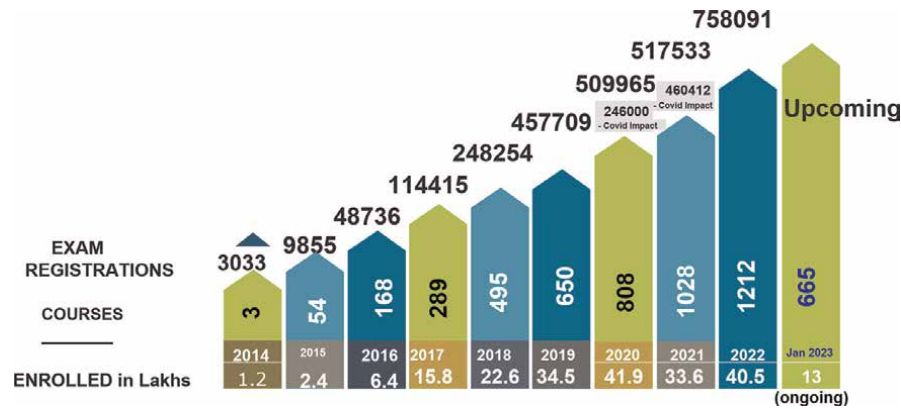


Figure 3.
Growth of NPTEL course offering: 2014–2022.

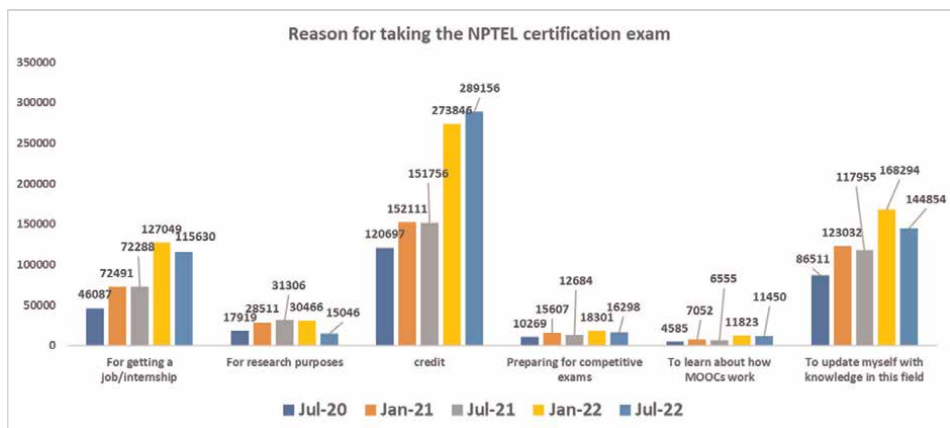


Figure 4.
Why do students study NPTEL courses and take certification examination?

3. To get job/internship
4. To empower for research
5. To prepare for competitive examination
6. To understand how MOOCs work

So learners choose MOOCs for credit mobility (compensate for non-available or low-quality courses in parent institutes), to update knowledge (possibly driven by a large group of learners who are teachers of different colleges), and for better placement opportunity (that is, industry-appropriate skilling). Contrary to expectations, preparing for competitive examination (being NPTEL, the only major examination is GATE which is also taken for job opportunity in government) is a less favored reason compared to empowerment for research.

4.1.2 Qualitative observations on impact of SWAYAM/NPTEL

There have been some qualitative studies on the impact of NPTEL. Notably, a white paper from the Department of Humanities and Social Sciences, IIT Madras [140] and an interview with Prof. Andrew Thangaraj [141]. In summary:

- Better education and learning
 - 80% of the enrolment through NPTEL local chapters in 4000 colleges
 - Fills in gaps for lack of good teachers
 - Students and colleges value the certification from the IITs
 - 82.9% colleges feel students gained confidence on technical interviews & technical assessments

- Employment focus of NPTEL
 - Recognizes active learners as NPTEL stars
 - Provides free soft skills training to course toppers and stars
 - Conducts: Employability assessment, Online mock interviews, Live video sessions, and Personalized feedback session for improvement
 - Exam Preparatory: “NPTEL videos have been greatly helpful for cracking examinations such as the NET and GATE”—Mr. Sandeep Kumar, an Assistant Professor in Electronics and Communication in PSIT Kanpur

We do observe a strong alignment between the qualitative and qualitative assessment of impact.

4.2 Quora speak

The assessment of impact presented above are based on data from NPTEL team or analysis carried out with the direct involvement of NPTEL team members. So we wanted to explore independent public perspective from the Internet. For this we searched for questions asked on Quora about the credibility of NPTEL and the value of certificates earned from NPTEL. We observed several positive trails on a variety of questions. As indicative samples, we quote two responses each from two questions below:

- Are NPTEL certificates good for a job and resume?³⁹
- S Chetan Pandit, Tech Evangelist, IIT Graduate, Works for Qualcomm. Sep 16, 2020

“I am in high tech industry for more than a decade now during this time I have worked with several top MNCs, done many fresh graduates (IITs/NITs/BITS/DCEs etc) campus hiring and also experienced (lateral) hirings. so let me give you a hiring manage perspective.

As an hiring manager, you would only look for skillset and gauge if the candidate has the relevant knowledge of the field, aptitude and softskills to fit in your engineering team and deliver.

If all matches then he/she is good to hire. therefore, look at NPTEL courses as an opportunity to acquire new knowledge (primarily), for sure certificate is also helpful but mainly to get you shortlisted and bring you to the interview table, beyond that only learning/knowledge will help. so according to me.

JOB = 20% Certificate + 80% Knowledge (learnt during Course)”

- Abhinav Ankit, Entrepreneur, Trader, Investor, YouTuber. Oct 11, 2020

“Yes, of course, yaar it is NPTEL certificate. It adds an uncomparable value to your life.

³⁹ <https://www.quora.com/Are-NPTEL-certificates-good-for-a-job-and-resume>

But yes, This is absolutely right that you will not get the job only on this certificate but it 100% adds a special value in your resume and due to that you will get job first in comparison to your competitors for a particular job.

Ok, you do one thing, that I am leaving here one video link in which there is complete knowledge given about NPTEL and about its certification program and its value addition in any individuals life and this video contains every information which you want to know about NPEL.

So, You go through this video [142] and get rid of your all questions and confusions.”

- Do certificates from NPTEL courses hold any value?⁴⁰
- Ashutosh Singh, Subject Matter Expert in CSE. Nov 19, 2021.

“Yes, if your score is more than 90%, you become very desirable.

It is relatively easy to get certified by NPTEL (scoring the minimum marks required for getting the certificate), but it is very tough to get more than 90% over all score. My highest score till date is only 83%.

Marks matter a lot! When it's a matter of recruitment. A GPA of 4.5 from a tier-II engineering college is better than a GPA of 3.5 from a tier-I college.

Till date (starting from 2016) I have done 7 certificate courses in the discipline of Computer Science & Engineering from NPTEL (totaling to 60 weeks of course duration), for which I have recently been recognized and honored as NPTEL Discipline Star for Dec 2019.

... (images of certificates)

SWAYAM-NPTEL is perhaps the best thing done in Indian education system so far. Providing free and fair access to world class education to anyone, anywhere, who wants to learn.”

- Yogesh SP, Product Evangelist at Guvi. Oct 5, 2018

“I am giving my perspective with respect to NPTEL certificates.

Currently, I had 2 NPTEL certificates one for IMAD and another one for Data Mining.

I am also appearing for two more exams. I had worked for MNC's and startups before.

The interviews I had seen considers skills more than your certificates.

Learning is a continuous process and it doesn't end with a certificate.

NPTEL is a great learning ground so make use of it in your college days.”

A search for negative responses on NPTEL did not produce any credible and consistent trail.

4.3 Benefit to students, teachers, and colleges

The key benefits accrued to students, teachers, and colleges are:

- Students are able to learn from good teachers; can take courses that are not available in their respective colleges or courses that do not have right faculty; can

⁴⁰ <https://www.quora.com/Do-certificates-from-NPTEL-courses-hold-any-value>

benefit from comprehensive learning material—presentations, videos, transcripts, and from internship and placement opportunities through industry partners

- Several teachers have been attending NPTEL courses to learn how to teach different subjects well, how to set assignments, etc.
- Colleges suffering from shortage of teachers are listing various elective and at times the core courses for credit mobility
- Economies of scale in maintaining a good domain coverage. So NPTEL can offer courses across multiple domains even for less than 10 exam takers.
- NPTEL model shows how to manage a multi-institution project without losing focus on the Open Learning agenda.
- The affordability and accessibility of higher education is tackled by MOOCs in India. SWAYAM/NPTEL is supported by GoI while IITM BS Program [65] uses corporate philanthropy (by scholarships). Both of these programs have low entry criteria (none for NPTEL and Qualifier for BS program).

We point to various prior studies and present quantitative data and qualitative observations to show that MOOCs in India is having a significant transformational impact. This addresses RQ3 (Section 1.2.1) from the output perspectives and partly from outcome perspectives. We discuss more about outcome in the next section.

5. Roadmap for MOOCs in India

While announcing the setting up of NDU (Section 2.6) during the Union Budget 2023–2024, Ms. Nirmala Sitharaman, Finance Minister, GoI has pronounced the country's vision on MOOCs far and firm. We quote [92]:

“A digital university will be established to provide access to the students across the country for world-class quality universal education with a personalised learning experience at their doorstep.”

We have long and strong tradition in MOOCs. We have been continually innovating to customize MOOCs and strengthen the ecosystem. We have made significant impacts. Next we need a roadmap to attain the vision and reap dividends from our demography. Understandably, there are challenges, challenges galore, on the way to the attainment. But, India has the will as well as the skills to conquer them. And the chief arsenal for this is technology—emerging technologies in which India is already one of the leaders.

We first review the recent use of technology in MOOCs and then map their use to address the imminent challenges of the space in India.

5.1 Emerging technologies for MOOCs

Technology has been contributing to various aspects of learning, specifically MOOCs [47], for a long time. Recently, Ahmad et al. [143] review the literature since

2014 to observe that the work on MOOCs is dominated by AI/ML (23%), Big Data (20%), Gamification (17%), Internet of Things (11%), Blockchain (9%), Metaverse (8%), and Digital Twin (7%). Mutawa et al. [144] also suggest strong integration of AI with MOOCs. Nunzio [145] feels “MOOCs can prove to be a good business decision,” if online content can be developed more affordably using AI. So, we take a walk-through of a few AI technologies in education.

MOOCs is the business of knowledge. Hence, *Knowledge Graphs*⁴¹ (KG) play a dominant role in its efficiency and effectiveness. Coupled with KGs, *AI-powered MOOCs* are facilitating aspects of delivery, management, and personalization.

5.1.1 Knowledge graph for MOOCs

Since 2007, knowledge graphs have been applied to education and many other disciplines [146]. In MOOCs, they help to solve varied range of problems including personalized recommendation, learning feedback, and learning path.

1. *Building KGs for MOOCs*: A KG for MOOCs is an organized collection of unified MOOC resources and course concepts for learners. It can be used to discover learning resource from several platforms and used for various research tasks. Consequently, several KGs [147–153] have been built in the last 5 years. The first large scale KG, *MOOC-KG*, has been built by Dang et al. [148] in 2019. It represents 28,591 instances with relations, includes 4 platforms⁴², 604 universities, 18,671 teachers, and 9312 courses. In 2021, Dang et al. [150] extend this to represent five classes, 11 kinds of relations, and 52,779 entities with their corresponding properties, amounting to more than 3,00,000 triples. Notably, 24,188 concepts are extracted from text attributes of MOOCs and linked directly with corresponding Wikipedia entries. In 2019, Liao et al. [149], also applied knowledge graphing in MOOC and SPOC (Small Private Online Courses).

- *Knowledge Extraction for KGs from transcripts and video captions*: While most KGs are built by mining text information from course description and metadata, a lot of knowledge stays embedded in multimodal sources like course outlines, transcripts, and lecture videos. Fareedah et al. [154], in 2018, identify a concept dependency graph for a MOOC through unsupervised analysis of lecture transcripts. Das et al. [155], 2019 propose a system that performs topic-wise semantic segmentation and annotation of MOOC lecture videos. Later in 2020, using semantic similarity and contextual relationship between different concepts, they analyze [156] how the instructor changes concepts during topic change. In 2021, Huang et al. [157] propose a method for automatically constructing a course KG by extracting course concepts from video captions in the context frame of the course outline, and then embedding the concepts back to the frame.

⁴¹ Knowledge Graphs organize data from multiple sources, capture information about entities of interest in a given domain (like courses, lectures, learners, instructors, or platforms), and forge connections between them *via* linking and semantic metadata. KGs provide a framework for data integration, unification, analytics, and sharing.

⁴² Coursera, EDX, XuetangX, and ICourse

2. *Course recommendations using KGs*: Course recommendations in MOOCs⁴³ is inherently more complex compared to the traditional course advisory due to the self-driven nature, high flexibility, easy availability, and diversity of MOOCs. Hence, KG-enhanced recommendation systems are appropriate for addressing the course recommendation problem for MOOCs. Zheng et al. [147] use ML in 2017 to construct a high educational KG by crawling courses information from several MOOC websites and performing entity and relation extraction to help learners study easily from MOOC courses. In 2020, Wang et al. [159] propose a GNN⁴⁴-based *Attentional Heterogeneous Graph Convolutional Deep Knowledge Recommender* (ACKRec) that aligns learners' interests in different concepts with concepts embedded in different courses to recommend courses to learners. Chen et al. [151] propose an automated construction method for course KG in 2021 by annotating the pre-knowledge of each course and calculating the similarity between courses and study learning path recommendation algorithms. Jung et al. [160] propose a framework in 2022 for *Knowledge graph enhanced Personalized Course Recommendation* (KCPR) where internal information of MOOCs is integrated with an external knowledge base through user and course-related keywords. KCPR also uses a level embedding module that predicts the level of students and courses for better recommendation. Zhang et al. [152] propose *Knowledge Grouping Aggregation Network* (KGAN) in 2023 that uses the course graph, having relations between courses and facts, to estimate learners' potential interests automatically and iteratively.

3. *Learning Feedback and Learning Path Planning using KGs*: Besides being recommended on right courses, learners often need to assess how well are they actually learning the concepts in a course. KGs play a strong role in such learning feedback and path planning. Pan et al. [161], in 2017, propose to learn candidate concepts *via* an embedding-based method and rank them based on the learned representations. They evaluate the method using XuetangX and Coursera. Jiang et al. [162] present *MAssistant*, an interactive personal knowledge assistant for MOOC learners, in 2019. MAssistant helps users to trace the concepts they have learned in MOOCs by presenting important concepts as they watch the videos, to build their own concept graphs and explore them later. In 2023, Zhang et al. [153] design a KG with the visual search and display of knowledge points to provide learning feedback, to update feedback with the learning situation of learners, and to improve the learning efficiency through learning path planning.

4. *(Missing) KG for SWAYAM/NPTEL*: With the exception of [155, 156], none of the above work use the SWAYAM/NPTEL platform. This is surprising in a country like India which leads the world in various facets of AI/ML and emerging ICT. Interestingly, a number of initiatives like domain certification of NPTEL (Section 3.2.2) and extension courses (Section 3.6) like NPTEL GATE project, NPTEL FDP, and NPTEL++ have been built with manual analyses of course and

⁴³ For example, the *Find your next course* service at Class Central [158] is based on simple metadata (subject, university, provider), keywords (from course titles, abstracts), filters (duration, language, level), or manually curated guides. This does not consider course interrelationships, preparedness / ambition of the learner, etc.

⁴⁴ Graph Neural Network

content metadata. *It is important to build KGs of SWAYAM through automated methods and use for addressing several integration and quality questions of SWAYAM.*

5.1.2 AI-powered MOOCs

With the increased focus on online education, researchers started to study how AI can power MOOCs to *scale with quality and yet remain financially sustainable*. Yu et al. [163] consider issues and solutions for AI-powered personalization in MOOC learning. Fauvel et al. [164] present a survey in 2018 for the goings-on in AI-powered MOOCs with the following taxonomic classification of the papers (**Table 7**).

They identify *Redefining openness in MOOCs* (to provide open infrastructure for content creators besides content consumers), *Complementing AI with human effort* (human-in-the-loop systems), and moving from *Engagement to Knowledge* as some of the priorities for research. Jordan et al. [165] also provide a nice survey of studies over 2012 to 2022: The Decade of the MOOC.

The face of AI capabilities in education (and in several other areas) has been redefined from November 2022 with launch of ChatGPT⁴⁵. With *Generative Pre-trained Transformers* (GPT) for *Large Language Models* (LLM) being widely and publicly available, we can now build future generations of digital pedagogy with better elegance at ease. For example, Yilmaz et al. [166] present the framework for *SMIT - a Smart MOOC integrated with Intelligent Tutoring*. It is adaptive and dynamic, and is supported by learning analytics that aims to integrate *Learning Management Systems* (LMS) and *Intelligent Tutoring Systems* (ITS). A new era of convergence and integration has started. Agarwal et al. [167] have developed a system for *MOOCs for Lipreading* which can be a great aid for the hearing impaired. Recently, Khan Academy has launched *Khanmigo* [168–170] as a personalized tutor for every student, a planner and assistant for every teacher, and a writing coach for all. Several more will follow soon.

We have immense opportunity for AI-powered MOOCs to address most of the challenges⁴⁶ including *Personalized and Adaptive learning*, *Adaptive assessments*, *Automated evaluations*, *Natural Language Processing* (query answering, translation, etc.), *Content Creation and Curation*, *Fraud Detection* (plagiarism), *Predictive Analytics*, and *Intelligent Tutoring Systems*.

Finally, we analyze the challenges of MOOCs in India—as mentioned by researchers and also as observed by the author as a MOOCs faculty for nearly a decade—and discuss the possible resolutions for the same using technology wherever possible.

Learner Modeling	Improving Learning Experience	Learner Assessment
<ul style="list-style-type: none">• Modeling Learner Engagement• Modeling Learners' Knowledge	<ul style="list-style-type: none">• Intelligent User Interactions• Community Building	<ul style="list-style-type: none">• Auto-grading• Peer Grading• Learning Skill Assessment

Table 7.
Taxonomic classification of the papers in AI-powered MOOCs, Fauvel et al. [164].

⁴⁵ A large language model trained by OpenAI based on the GPT-3.5 architecture
⁴⁶ This list is accumulated from three regenerated responses from ChatGPT on “How can AI improve MOOCs in India?”

5.2 Challenges and resolutions

The challenges of MOOCs in India have been noted and analyzed by several authors including Chauhan et al. [139], Jaganathan et al. [41], Haumin et al. [33], Varyani et al. [44], Sagar [36], Pant et al. [43], Mishra [15], EdNet [38], Sharma et al. [39], Amit et al. [40], Aldahmani et al. [21], and Saxena et al. [171]. Many of them have suggested possible roadmaps too. We present a summary of these (and others from the author's experience and interactions) from the perspective of this chapter.

5.2.1 Digital infrastructure for MOOCs

The ecosystem of MOOCs relies heavily on the digital infrastructure for the learner, for the provider, and for the connectivity between the two.

Internet Connectivity for Learners:

A learner needs good internet connection to attend MOOCs courses.

Roads ahead:

- To alleviate this issue, lecture videos are made available in multiple resolutions to allow for easy downloads even over weak connectivity.
- Telecom in India is on a fast track with BharatNet [172] connecting villages at a fast rate. Its Phase 2 (of 3) is ongoing. Data services of Jio densely spreads across the length and breadth of India [173]. Thus, the number of Internet users in India is expected to grow [174] to 907 million (64% population) by 2023 from 398 million (29% population) in 2018.

Digital Devices for Learners:

A learner needs digital devices to attend MOOCs courses.

Roads ahead:

- While the availability of computers is perceived to be limited mostly to tier 1 and tier 2 cities, India has a deep penetration of mobile phones. During pandemic, India heavily used online education, even in schools, which deepened the penetration. Thus, it is expected [174] that the number of mobile users will grow to 966 million (68% of population) by 2023 from 763 million (56% population) in 2018.
- MOOCs providers should create contents in multiple form factors.

Infrastructure for Content Creation:

Institutions need good infrastructure comprising recording studios, trained manpower for recording and editing, and so on to create MOOCs content.

Roads ahead:

- SWAYAM has already taken several steps to widen the network of content creators through 9 different NCs in diverse areas. It is on its track to attain its plans for inclusion of institutions at multiple levels.

5.2.2 Digital pedagogy

MOOCs (and several other forms of digital, online, or hybrid education) have led to the *Digital Pedagogy*⁴⁷ where teachers create the courses, offer them to learners, and assess the performances of the learners in multiple levels of virtuality. Thus, teachers become their *digital twins*⁴⁸ under MOOCs, instructing the learners in *virtual tutoring* modes. Naturally, the success of this pedagogy depends heavily on the *adaptability of all the stakeholder* including teachers, learners, and teaching assistants; on the *quality, diversity, and multilinguality of contents* (lecture videos, transcripts, reading notes, assignments & solutions, and so on); on the *efficiency and efficacy of virtual tutoring and instructional processes*; and on the *quality of assessment, and evaluation*. MOOCs all across the world, including in India, fall short on all of these aspects.

Adaptability by the Stakeholders:

Teachers: The *teachers* of MOOCs record courses in the absence of the learners (lecturing merely to *virtual learners*). So most teachers, skilled in face-to-face and interactive pedagogy of delivering lectures fail to incite the excitement in their videos and often miss out to properly embed the necessary learning-by-example stubs. Further, the teachers are not trained to *look into the camera* and they get *little eye-contact* with the observer (learner). Also, most courses are recorded with presentation slides with the teacher sitting in a chair which *eliminates the communicative body language* of the teacher and makes it difficult to develop concepts step-by-step.

Roads ahead:

- All course creators need to abide by the *Guidelines for SWAYAM* [104], 2017. This standardizes the course plans. KGs of courses in SWAYAM and an AI-driven intelligent checker can improve compliance to the guidelines.
- While the guidelines are strong in terms of lecture and course planning, it does not talk about the presentation and communications. *Listener bots* or *bot-learners* may be created for feedback on these aspects.
- A MOOCs course on *MOOCs Pedagogy* should be created by the experts to train all teachers (could be an FDP) who offer MOOCs.

Learners: The *learners* of MOOCs watch the lecture videos in the absence of the teacher and the peers. They interact with the teacher, the teaching assistants, and the peers only in written form (using *course forum*—a *virtualized textual model of teachers, assistants, and peers*). This leads to the feeling of *isolation*, inadequate opportunity for honing skills of *verbal and interpersonal communication*, depends heavily on the *self-motivation* of the learners (which many may lack), and leads to overall *digital fatigue*⁴⁹. *Adoption of technology* itself can be a challenge for some of the learners.

⁴⁷ Digital pedagogy is the study and use of contemporary digital technologies in teaching and learning. It may be applied to online, hybrid, and face-to-face learning environments.

⁴⁸ A digital twin is a digital representation of a physical object, process, service, or environment that behaves and looks like its counterpart in the real world.

⁴⁹ Digital fatigue (aka, screen burnout) is a state of mental exhaustion brought on by the excessive use of digital devices.

Mithun Mohan et al. [175] examine the key factors that influence the behavioral intention to use MOOCs among 412 university PG students. They report that 41% students feel that lack of time from academic schedule is the key barrier⁵⁰ to MOOCs, while 33% felt that MOOCs are less effective compared to classroom teaching. Technology barrier (16%) and monotonous nature of MOOCs (10%) are the other factors.

Roads ahead:

- SWAYAM/NPTEL address these through online course forum (for discussions with the teachers/TAs and/or peers), local chapters (SPoC in colleges to mentor students), weekly live tutoring sessions by PMRF scholars, and monthly live sessions with the teachers.
 - *Alarmingly these measures are becoming less effective with time.*
 - In Jul 2022, 96% courses in NPTEL had <100 learners on forum [103].
 - Most courses are getting few students on live sessions.
 - Pass percentage in several courses is low even for LC students.
 - Is digital fatigue starting to cripple MOOCs in India? In-depth research is needed to understand the learners and their learning behavior better.
 - Personalized bots like *Khanmigo* [169] can greatly improve engagement.

Quality, Diversity, and Multilinguality of Contents:

Quality of Content: Quality contents need highly skilled teachers, good infrastructure, and trained support man-power. At India's scale MOOCs, these are stiff barriers and solutions should constantly be sought with AI.

Roads ahead:

- *Guidelines for SWAYAM* [104] should be followed by all contents. Absent compliance-check or audit process⁵¹ can be put in place using KG and AI.
- *Quality Reference Framework for MOOCs (QRF)* [58] has been released in 2018 to analyze the needs and demands for MOOCs, to design, develop, and implement new MOOCs, and to evaluate and improve existing MOOCs. It consists of three dimensions: *Phases, Perspectives, and Roles*; and provides the *QRF Key Quality Criteria* and the *QRF Quality Checklist* for designing and developing MOOCs. **SWAYAM guidelines and processes should be strengthened with the adoption of QRF.**

⁵⁰ It may be noted that this study was carried out in 2019 before the credit mobility was implemented across HEIs to alleviate exactly this specific issue.

⁵¹ Digital quality guarantee processes, however, are conducted on all videos and transcriptions.

Diversity of Content: MOOCs in India have piggybacked on NPTEL which focused on engineering domain, relied on the expertise from IITs and IISc, and performed several techno-social innovations to bring MOOCs in India to its present state. As SWAYAM diversifies MOOCs to other domains, to broader sections of learners, and wider academic levels, the need for diverse contents (subject matter as well as form) becomes a priority. This is a huge challenge given the weak institutional bandwidth in various domain areas.

Roads ahead:

- A possible resolution may focus on and grow with public-private partnership in edTech some of which are already underway [89–91, 111].
- Generative AI may be used to create selective contents for some subjects.

Multilinguality of Contents: With 22 scheduled languages (and several more practiced ones) and deep diversity of culture, Indian MOOCs need to strongly support Indian languages besides English.

Roads ahead:

- As discussed in Section 3.7, NPTEL has started this translation process with the help of LCs. Nearly 300 courses in 11 languages having 40,000+ lectures for 10,000+ hours [103] are available.
- With the advances in Natural Language Processing (NLP) for Indian languages (especially Hindi), automated translation (like Google Translate), automated transcription and captioning, and Knowledge Graphs (see Section 5.1.1), accelerated automated processes should be setup for translations of the languages of the videos and transcripts.
- Beyond the (translated) language of the contents, the overall process of engagement in MOOCs needs to be made multilingual.

Efficiency and Efficacy of Processes:

MOOCs are created by digitally aided record-deliver-evaluate processes with focus on creating digital equivalents of physical systems of learning. It often does not ensure if the virtual tutoring and instructional processes are efficient and effective from the socio-psychological aspects of learning and learners. For example, the completion rate is taken as the metric of success and not the outcome of learning.

Roads ahead:

- While MOOCs advocates increased *Self Regulated Learning* (SRL) capability of a learner, the NPTEL model shows how processes (Weekly Release, Deadlines, Grading that permits flexibility) along with group/external regulation helps in increasing uptake of online courses.
- “By strategically aligning the technology and processes, we can really attempt to solve the larger issues of learner diversity and sustainability (of learning) at scale.” – Dr. Jayakrishnan M, Senior Scientist, NPTEL

- *Stickiness of learners*⁵² (at ~85% retention) is ensured in IITM BS program [65] with a team of instructors and a dedicated operations team.
- Deep research in digital pedagogy and use of AI are needed to obtain the desired outcomes (Section 5.1.2).
- MoE has launched NEAT [90] as a PPP model (Section 3.8.1) to showcase Technology Products using AI for customized learning or e-content in niche areas having highly employable skills.

Quality of Assessment and Evaluation:

Assessment and evaluation is one of the weak areas of MOOCs (and many forms of online education). The assignments and examinations are based on Multiple Choice (MCQ), Multiple Select (MSQ), Short Answer (SA), and Fill-in-the-blank questions. This limits the ability to test the breadth and depth of the understanding of the learners. For example, in a programming language course offered by the author for over last 8 years, actual programming assignments could never be part of the evaluation process. This also is a major hindrance for various social science courses including law where descriptive answers are a necessity as a learning measure. Overall, MOOCs provide only a few assessments and little feedback. Hence, it is not possible to assess knowledge for cognitive skills beyond mere information retrieval or to handle abstraction or to take complex decisions, and so on. Marks scored in assignments have very low credibility due to rampant plagiarism⁵³. Hence, proctored physical examinations are needed for credible evaluation. This limits the scaling of MOOCs and with only one such proctored examination in a course, the students do not get the required learning practice.

Roads ahead:

- Major MOOCs platform use multiple technology-driven strategies to address the problem of plagiarism. These include remote proctoring by humans invigilators (or smart machines?), and use access to microphone and camera of student's computer to make random recordings during examinations (and screen using surveillance software) during exams. IoT may provide some solutions in future.
- Research and interventions are needed to improve the processes of semi-automated/automated evaluation to scale MOOCs with quality.
- *Robust, complete, scalable, and flexible* processes for assessment and evaluation are possible today with AI (Section 5.1.2). LLMs with course KGs and pre-trained transformers may be built to evaluate subjective answers and provide feedback.

Digital Pedagogy in India is still in its infancy. And success of MOOCs in the longer run and national scale critically depends on it.

⁵² Learners taking courses consistently in subsequent semesters after the initial exposure

⁵³ As the NPTEL team observed in [103], in July 2022 courses, many students had high average assignment marks scored only less than 10% marks in final examination.

5.2.3 MOOCs in principle—Not on paper

Retention/Completion Rate:

MOOCs in India usually have high enrolment but low retention/completion of the courses. In NPTEL only about 10% of the students (**Figure 3**) who enroll actually go on to complete the course [103, 120]. In 500+ SWAYAM courses through the CEC, UGC, and IGNOU till 2019, only 30–40% students who took the examination actually passed and completed the course (**Table 8** in [43]). While this is a global phenomenon (e.g., Chiappe and Castillo [176] report completion rate of MOOCs between 5 and 15%), India needs to address it effectively to improve the effectiveness of its investments. *At 10% does MOOCs in India remain Massive or is it simply Large?*

At this point, may we question how should the retention/completion rate be estimated? Five distinct measure points have usually been considered by the researchers. We compute various ratio metrics using the data of NPTEL [103, 120] during Jan-Apr 2019 to Jan-Apr 2022 in **Table 8**.

There are three large losses in the table: (a) $nEnrol \rightarrow nOneWeek = 65\%$, (b) $nOneWeek \rightarrow nRegister = 65\%$, and (c) $nAppear \rightarrow nFail = 25\%$. (a) may be ignored—it is the check-out time expected in any open flexible system. These are students who did not even get engaged to complete the first assignment. (c) is not alarmingly high. It can improve only with the quality of the courses and offerings—a slow process. (b) needs specific attention:

Metric	%	Remarks
$nOneWeek/nEnrol$	= 35%	• 65% students leave within a week
$nRegister/nOneWeek$	= 35%	• Further 65% students leave between 2nd week & registration
$nRegister/nEnrol$	= 12%	• 88% students leave between enrolment & registration
$nAppear/nRegister$	= 85%	• 15% students register, but do not appear. This is higher, yet commensurate with non-MOOC courses
$nPass/nAppear$	= 75%	• 25% failure rate is not particularly high
$nPass/nEnrol$	= 8%	• <i>This is alarming</i>
$nPass/nOneWeek$	= 22%	• This is better, yet too low
Typical metrics or measure points as used in Table 8 in [43, 103, 120, 176]		
$nEnrol$	=	# of students enrolled
$nOneWeek$	=	# of students who completed the first assignment, that is, 1 week
$nRegister$	=	# of students who registered for the final examination
$nAppear$	=	# of students who appeared for the final examination
$nPass$	=	# of students who passed the course
$nFail$	=	# of students who failed the course = $nAppear - nPass$

Table 8.
Retention rate for NPTEL: 2019–2022.

- These students left the course at some point after completing the first assignment. So did they take the decision to discontinue after getting the evaluation of the first assignment? To understand this, it is necessary to track how many of them submitted the second assignment. Those students should also be clubbed with (a) and ignored.
- So the students who left the course after the second (or third, or later) assignment/s, may have done so for the reasons outlined in Section 5.2.2 in terms of various shortcomings of the digital pedagogy including lack of engagement with the teacher, lack of self-motivation, lack of English language, skills, digital fatigue, and so on. We need to know.

Roads ahead:

- An in-depth analysis for the case (b) for SWAYAM/NPTEL is necessary.
- Declining enrollments in MOOCs worldwide is leading to MOOCs 2.0 [43] to explore freemium⁵⁴ models (like NPTEL+), offering a mix of free and paid courses. MOOCs in India should check out as well.
- Several innovations mentioned in Section 3 including interactive forums, local centers, and live sessions are targeting to improve retention.
- In the IITM BS program [65], a team of instructors along with a very capable operations team helps to ensure near 85% retention. It is exploring Peer-Learning and Peer-Support models for sustenance.
- AI-driven solutions discussed in Section 5.1.2 including personalized tutor, TA-bots, and explainer tutorials can improve retention. For example, Sharma [177] apply *learning analytics* on NPTEL data to build a model to predict dropouts (and hence, design measures to reduce it). Dalipi et al. [60] use *sentiment analysis* of students' feedback on MOOCs for understanding dropouts. More such studies are needed.

Learning Outcomes:

While under the *Guidelines for SWAYAM* [104], every course needs to specify the learning outcomes of the course *a priori*, there has not been any study on the *a posteriori* learning outcomes for the finishers of the courses. In a related question, Sharma et al. [39] asks for a direct comparison of MOOCs credits to classroom credits. She argues if two students earn the same set of credits—one from an institution with payment and the other from NPTEL-NOC—will the former be able to differentiate herself from the latter. If not, *Tragedy of the Commons*⁵⁵ will occur where, moving forward, no learner will be willing to pay for the course anymore. Singh and

⁵⁴ Freemium is a business model in which a company offers basic or limited features to users at no cost and then charges a premium for supplemental or advanced features.

⁵⁵ The tragedy of the commons refers to a situation in which individuals with access to a public resource (called a common) act in their own interest and, in doing so, ultimately deplete the resource.

Kakkar [124, 125] show that while credit mobility draws more students to SWAYAM, the certification rate is poor and SWAYAM fails in its desired outcome goals.

Roads ahead:

- Specific studies should be instituted to understand the learning outcomes of various SWAYAM/NPTEL courses in different domains.
- KGs of SWAYAM courses should be build with models of learning outcomes by concepts for a detailed analysis to improve outcomes. Employment history should also be tracked in this regard.

Gender Gap:

Sharma et al. [39] report gender disparities in the enrollment rate of MOOCs by quoting other researchers. However, no data is provided to support the claim. An indirect indicator of this gap can be observed in NPTEL [103] where since 2016, 15–25% more male students have registered for examinations compared to female students. *So, while MOOCs in India is Open by structure, is it only partially so under societal dynamics?*

Roads ahead:

- Specific studies should be instituted to understand the gender disparity, if any, in various SWAYAM/NPTEL courses in different domains.

Thus, restructuring of the MOOCs platforms, using emerging technology for better ecosystem, is needed to match the changing needs and requirements of our students' present and future demands.

We have presented a brief survey of key emerging technologies that can immediately benefit MOOCs. We then explore various challenges of MOOCs in India with quantitative data and qualitative observations. For every challenge we outline possible resolutions using adoption of technology, processes, standardization, collaborations, and innovations. This addresses RQ4 (Section 1.2.1). Further, we stitch the vision with the challenges and resolutions in a flow to present a roadmap for MOOCs in India for a decade and address RQ5 (Section 1.2.1).

6. Conclusions

We have taken a deep look into MOOCs in India starting with an evolutionary review of the last 50 years (1974–2023) on how MOOCs not only started and grew, but is fast becoming a leading education system in India. This evolution and emergence of strength has been possible due to a number of unique innovations that have resulted in huge impacts—mostly positive—which we have assessed from primary and secondary sources. We have also elucidated the challenges with pointers to possible resolutions from various studies by researchers coupled with the first-hand experience of the author with multiple MOOCs. We finally outline a roadmap with the immense possibilities of development and growth in both quantitative and qualitative terms using AI-powered MOOCs.

Pandemic catalyzed rapid growth and adoption in the space of MOOCs. While schools and colleges shut down for several months, India continued to learn in domains where MOOCs had presence. Sagar [36] argued in 2021 that MOOCs would

be the future of education in India. As open and free models of MOOCs started to crumble in parts of the world with major players like Coursera and edX turning commercial [178], SWAYAM stood a ground of strength with the escalated support of NEP 2020 at a national scale. In 2022, Shah et al. [118] predicted a powerful wave as 60+ Indian Universities started offering about 500 degrees online degrees and Amit et al. [40] emphasized on the need of deeper use of technology for engaging academic materials through animation, illustrations, and video descriptions to MOOCs reach to its potential in target markets.

The most recent shot in the arm has been wider public availability of powerful LLMs and GPTs over the last few months with private free players like Khan Academy [168–170] coming out with innovative personalization of online learning. India has inherent strengths in software, AI, innovation, and start-ups. With focused research



What is the future of MOOCs in India for the next decade?



MOOCs (Massive Open Online Courses) have gained popularity in India in recent years, and their future prospects look promising. India has one of the largest populations of students globally, and the government has also been focusing on promoting online learning in the country. Here are some of the potential trends for MOOCs in India over the next decade:

1. Increase in the number of users: With the increasing internet penetration in the country, the number of users accessing MOOCs is expected to increase significantly. The government's push towards digitization and the availability of affordable smartphones and internet connectivity will likely make MOOCs accessible to a larger audience.
2. Expansion of courses: MOOCs in India are expected to expand beyond traditional subjects and include courses on emerging technologies, management, and vocational skills. This diversification of courses will cater to a wider audience and help bridge the skill gap in the country.
3. Blended learning: While MOOCs are popular for their flexibility, they are also criticized for their lack of personalized learning experience. To overcome this, MOOCs are expected to adopt blended learning, where students can combine online learning with traditional classroom learning.
4. Corporate training: MOOCs are also expected to expand their reach to corporate training. With businesses looking for cost-effective and flexible training solutions, MOOCs can provide training on various skills, including leadership, management, and technology.
5. Collaboration: MOOCs are expected to collaborate with universities and other institutions to offer credit-bearing courses. This collaboration will help students get recognized degrees and certificates from reputed institutions.

In summary, the future of MOOCs in India looks bright, and they are expected to play a significant role in transforming the education and training landscape in the country.

Figure 5.
Responses from ChatGPT on “what is the future of MOOCs in India for the next decade?”

to power MOOCs with AI, India can alleviate several of the current challenges within the next 5 to 10 years. Thus, it can emerge as a leader in the balanced blend of MOOCs and traditional systems of education for its young global workforce.

Before we close, let us note what ChatGPT has to say on “*What is the future of MOOCs in India for the next decade?*” (**Figure 5**). Ironically, it humbly does not (cannot) predict the strong role it itself is expected to play in the process.

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Abbreviations

ABC	Academic Bank of Credits
AI	Artificial Intelligence
AICTE	All India Council for Technical Education
CBSE	Central Board of Secondary Education
CBT	Computer-Based Test
CC	Class Central
CEC	Consortium For Educational Communication
CET	Centre for Education Technology
CII	Confederation of Indian Industry
CMU	Carnegie Mellon University
DIKSHA	Digital Infrastructure for Knowledge Sharing
DL	Deep Learning (in AI)
DL	Digital Library (in Library and Information Sciences)
DTH	Direct To Home
ERNET	Education and Research Network
ELNet-3 L	Electronically Networked – Life Long Learning
ET	The Economic Times
FICCI	Federation of Indian Chambers of Commerce & Industry
FOSS	Free and Open-Source Software
FOSEE	Free/Libre and Open Source Software for Education
GATE	Graduate Aptitude Test in Engineering
GER	Gross Enrolment Ratio
GIAN	Global Initiative of Academic Networks
GoI	Government of India
GPT	Generative Pre-trained Transformers
HE/HEI	Higher Education/Higher Education Institution
ICT	Information and Communication Technology
IGNOU	Indira Gandhi National Open University

IIT	Indian Institute of Technology – IITM (Madras), IITKGP (Kharagpur), IITB (Bombay), IITD (Delhi), IITK (Kanpur), IITG (Guwahati), IITR (Roorkee)
IIM	Indian Institute of Management – IIMA (Ahmedabad), IIMB (Bangalore), IIMC (Calcutta), IIML (Lucknow)
INFLIBNET	Information and Library Network Centre
ITS	Intelligent Tutoring Systems
JNU	Jawaharlal Nehru University
KG	Knowledge Graph
LLM	Large Language Models
LMS	Learning Management System
MCQ	Multiple Choice Questions
MSQ	Multiple Select Questions
MHRD	Ministry of Human Resource Development
ML	Machine Learning
MoE	Ministry of Education
MOOC	Massive Open Online Course
NAD	National Academic Depository
NCERT	National Council of Educational Research and Training
NDLI	National Digital Library of India
NDU	National Digital University
NEAT	National Education Alliance for Technology
NETF	National Educational Technology Forum
NEP	National Education Policy
NIOS	(The) National Institute of Open Schooling
NITTTR	National Institute of Technical Teachers' Training and Research
NKN	National Knowledge Network
NLP	Natural Language Processing
NMEICT	National Mission on Education through Information and Communication Technology
NOC	NPTEL Online Certification
NPTEL	National program on Technology Enhanced Learning
OER	Open Educational Resource
PDS	Plagiarism Detection Software
PIB	Press Information Bureau
PTI	Press Trust of India
PPP	Public-Private Partnerships
SPoC	Single Point of Contact (in NPTEL)
SPOC	Small Private Online Courses
SLM	Self Learning Material
STEM	Science, Technology, Engineering, and Mathematics
SWAYAM	Study Webs of Active-learning for Young Aspiring Minds
TLP	Teaching-Learning Process
ToI	Times of India
UGC	University Grants Commission
V-C	Vice-Chancellor
VC	Video Conference
VCTEL	Virtual Centre for Technology Enhanced Learning
VSNL	Videsh Sanchar Nigam Limited
WOTEL	Workshop On Technology Enhanced Learning

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Perspective Chapter: Open Online Courses in Pakistan – Current Practices and What Needs to Be Done?

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Abstract

The chapter highlights the existing course recording processes in Pakistan and addresses the need for futuristic approach toward building a platform for Massive Open Online Courses (MOOCs). Virtual University of Pakistan is a state-of-the-art first of its kinds online University of Pakistan that has its own satellite channels for asynchronous mode of distance education. The chapter entails the utility of already available resources of VU in providing MOOCs for Pakistani audiences. The chapter further discusses the barriers of online learning and MOOCs from different studies around the world. The prospects concerning what needs to be done are discussed at length with especial focus to Pakistan and in general to the overall future trends in MOOCs.

Keywords: online courses, current practices, future trends, Pakistan, MOOCs, asynchronous, distance education

1. Introduction

Massive open online courses (MOOCs) are a relatively novel concept and the academic world has seen a peak in its utility after the unprecedented COVID-19 outbreak [1]. It is very helpful in distance education. Distance education is a mode of learning where students and teachers are not physically present simultaneously. Distance education is not bound by time and space as well. It further has two categories; synchronous and asynchronous modes.

1.1 Synchronous mode

A kind of distance education where students and teachers join at the same time is called as real-time or near-real-time. The participants can be geographically dispersed or available in the same vicinity [2]. However, Hewett [3] suggests that synchronous modes also require asynchronous modes to distributing and collecting course material and learning activities.

1.2 Asynchronous mode

A type of distance education where teachers and students do not join in the same time and at same location is called as asynchronous mode of learning. The teaching learning process is not real-time rather it is ICT based. It is more likely to offer self-paced learning [4].

Virtual University of Pakistan is the only online University in Pakistan that provides education through online mode. It has been working since its creation in 2002 in different degree programs, for which it records the courses and uses a Learning Management System (LMS) for teaching-learning process [5]. However, with the unprecedented outbreak of pandemic COVID-19 the whole world has suffered a lot, especially in the field of education. The world has become a global village and now it is high time to create knowledge-sharing platforms for each country and developing countries are in dire need of such resources.

Pakistan being a developing country and with only 57% of literacy rate, and above 60% of youth rate it is predominantly essential for it to develop such resources for the youth. Virtual University is the platform that has the basic infrastructure of course recording and developing for Pakistan however, with the changing times it needs better outlook, better research and inculcation of international standards and competitiveness. The need of the hour is to strengthen the resources of Virtual University and further expand them to incorporate changes occurred at international level. Virtual University has developed LMS based on asynchronous mode of learning. The MOOCs also work on asynchronous mode. One criticism from academia on asynchronous mode is about the quality of education [6]. Virtual University despite seeing exponential growth in admissions still struggle to achieve the hallmark of quality education provider. Though this is attributed to nothing other than the mode of education it offers. Latest admission history of Virtual University shows that high achievers are preferring to get admission there. This is a foundation stone in changing the mindset of general masses and academia toward quality education through asynchronous mode. Having said this, uplifting the level of quality of education is an uphill task. This requires fundamental changes and conformance to the international practices of course recording and module development.

Therefore, this chapter is planned to design a model of course development for Virtual University that is relevant to international standards of online and distributed learning. This research will focus on reviewing the international standards of course development for different levels. Compare them with that of Pakistan, and then propose a model for the University to adopt. The core goal of this research work is to develop a massive open online courses (MOOCs) setup for Pakistan.

2. Types of tools used in asynchronous and synchronous modes

As aforementioned both types have significant difference in the modality of content deliverance and learning activities, tools required by the two are also significant different. **Table 1** illustrates separate tools for the two modes.

Khalil and Ebner [7] report that MOOCs offer a few technical subjects and courses in social science domain that are increasing on a day-to-day basis but still the courses are not enough. There are similar platforms like MOOCs such as Udemy, Udacity, Brilliant, Coursera, edX, Khan Academy, Mind Valley, Skillshare, and DataCamp [8]. All these platforms are paid, with a slight option of free courses of general attraction. According to Yanxuan [9], XuetangX is a non-English MOOCs provider platform in

Asynchronous tools	Synchronous tools
Email	Text-based chat
Discussion/message boards	Voice-based chats
Blogs/Vlogs	Audio/video conferencing
Social media sites/applications	Web conferencing
Streaming audio/video	Virtual worlds
Wikis	White boards
Non-real-time document sharing	Real-time document sharing
e-tickets	Adobe connect/zoom/meet/teams applications

Adapted from Mick and Middlebrook [2].

Table 1.
Tools used in synchronous and asynchronous modes.

China with 400+ courses and 5Million + users which has also developed android and IOS applications for learners. Alison is considered to be first platform for MOOCs used in Ireland that offers free of cost online courses [10]. Schettino and Capone [11] reported that in 2021, 220 million learners accessed MOOCs alone. It is important to design MOOCs that include active learning experiences which use several resources and tools in order to foster learners’ engagement [12]. In the literature, it can be found that majority of the work done on MOOC is related to learning and learner-centered [13].

3. Objectives of this research

Very specifically, this research has the following objectives.

1. Reviewing the current practices of course development in Virtual University of Pakistan.
2. Compare the international standard practices of MOOCs.
3. Propose a futuristic model for MOOCs in Pakistan.

3.1 Significance of the study

The research will be significant for the Virtual University of Pakistan—the first state-of-the-art information communication and technology (ICT) based university—that provides online education through asynchronous mode, in developing a platform such as MOOCs which can facilitate not only the formal degree program based higher education but also cater to the needs of out of school children (OOSC). The outcome of this research will offer a comprehensive platform that will be useful to entrepreneurship elements, IT industry, and skill-based modules for masses. It will also be helpful for all universities in Pakistan that are planning to adopt online education mode or blended learning mode. This will further increase the higher education ratio in the country. The need of the changing time is to offer flexible learning to students which the proposed platform will take care of. The platform will be made global as at

present the outreach of Virtual University of Pakistan is worldwide, hence the resource developed by the University will benefit the students and masses across the map. It will further provide basis for policy decisions on micro-credentials and their adoption in regular degree programs against grade point averages (GPA) in the scheme of studies.

3.2 Methodology

As this study peculiarly focused on Virtual university, an evaluative case study research method was used. Case study is a research type where a unit is selected based on the significance of that unit and all aspects of that unit are minutely observed [14]. Evaluative case study further evaluates the pros and cons of that unit. There are instances where a whole phenomenon is taken as a case and evaluative case study method is applied, for example, see [15]. Driven in the qualitative approach of research, case study helps in getting detailed information and experiences of the case under study. Chadderton and Torrance [16] used the term case study for a whole phenomenon, which is later followed by many researchers globally.

3.3 Sampling design

In evaluative case study, the case is studied from all aspects for (a) having an insight into the tiny details of the case; (b) to evaluate the existing practice; and (c) to propose changes. The Virtual University has different useful resources which help in its teaching-learning process. The list of such important resources is pasted below:

1. VU website (www.vu.edu.pk/)
2. VU LMS (administrative view—for faculty)
3. VU LMS (student view)
4. VU Virtual Information System (VIS)
5. VU examination system
6. OpenCourseware

All these sections are online available. There are five faculties of Virtual University namely (1) Faculty of Arts, (2) Faculty of CS & IT, (3) Faculty of Education, (4) Faculty of Management, and (5) Faculty of Science and Technology [17]. There are more than 400 courses offered in these five faculties. The research belonged to the Faculty of Education. There are 72 theoretical courses in Faculty of Education and 16 practical courses. The researcher viewed 50% of the theoretical courses from Education faculty. Apart from education, 2 courses from each other faculties were always reviewed by the researcher.

3.4 Instrument

Research being a faculty member of the University for the last seven years, has observed the system closely, and hence served as an insider to this case study. The case study design requires *emic* view of the researcher [18] hence the data was reviewed

by the researcher based on the experience at the University, and for the objectives of this chapter, the researcher observed the above-mentioned resources again. The observations were not structures, rather open-ended to view and understand the phenomenon of this case.

3.5 Procedure

The researcher accessed the resources mentioned in the sampling design section. The VU LMS for students end is an interface which is used by students enrolled at VU. The students can get access to the video lectures, its handouts, pre-assessment, and post-assessment and other learning-related activities. The videos were watched and handouts were studied by the researcher, the videos are available on its OpenCourseWare [19]. The difficulties which the researcher faced were noted down by the researcher during this activity.

The VIS has mostly administrative and human resource data and information. The rules such as academic, examination, course recording, engaging with students, and data related to students' demographics and academic achievements are generally available in VIS. The data related to students was also accessed to see their demographics and learning achievements.

3.6 Analysis

Based on the review of the different sections of the University, the researcher analyzed the mechanism separately. For the clarity of writing, the analysis of all sections is merged and presented in the form of a report.

3.7 Current practices of course development at VU

It is pertinent to mention here that VU is providing Education in asynchronous mode. The lectures by senior and distinguished faculty members from across the country and from abroad as well, are recorded and then teaching-learning process takes place through a state-of-the-art learning management system (LMS) of the University.

The academic department submits request of course(s) required in the degree programs as per approved scheme of studies. The course development section of the university shares the pre-set procedure for resource person to apply for the procedure.

The procedure includes the following:

1. Three resource persons will be identified for the course development.
2. These 3 resource persons must have taught that subject at university level.
3. CVs of all resource persons.
4. Verified documents such as academic degrees and experience letters of all resource persons.
5. A score sheet having different section is used to evaluate the profiles of the resource persons.
6. After ranking the scores of resource persons, a meeting of course development committee is conducted where the scores are displayed and profiles are discussed.

7. After successful approval from the committee, the top scorer is shortlisted for an audition in the recording studio.
8. Audition team scrutinizes the appropriateness of visual and vocal quality of the resource person, if found okay then resource person proceeds with the course recording, and if the audition is not approved then the next resource person on the list of 3 is invited for the audition. In this way, if all three resource persons do not qualify the audition the same process is initiated again.

Once the resource person is selected the academics department requires a brief course outline. The outline is reviewed internally by the department with the Higher Education Commission guidelines for that degree programs and course. Any changes/ revisions are suggested by the internal review team.

After the revised course outline is approved by the department, the resource person is asked to send a detailed session plan of the course. This detailed session plan includes, learning outcomes for each topic and sub-topic. Reading material and reference books, assessment types and procedures, learning activities, and/or resources required for the content to be delivered. This detailed session plan is sent for external reviewers to domain experts outside the university. The external reviewer evaluates the detailed session plan. Changes if suggested are incorporated by the resource person and then formally course recording begins.

A faculty member from the department is associated with the resource person. This internal member is called as quality assurance (QA) person, who is responsible for checking and ensuring that detailed session plan is followed in recording.

After analyzing the existing system of Virtual University, the researcher reviewed the literature to have a comparative analysis of what problems the world is facing in delivering online education. This is done to view a comprehensive picture of the course recording, its barriers, and then recommend its plausible solutions.

3.8 Barriers to effective distance education.

Besides multi-lateral uses of distance education through online mode there are a few barriers to make online distance education as effective as it is. The review analysis of the literature helped the researcher identifying a few most commonly reported problems.

Student motivation—in asynchronous mode of learning is a basic barrier to learning [20] and in MOOCs where there is no external monitoring or pressure students need to have strong intrinsic motivation to continue the learning. Tuckman [21] explained that concepts such as autonomy are prevalent in distance education which directly affects the internal motivation of students.

Domestic distractions—with recent economic crises in Pakistan where Floods of 2022 have severely hit the lifestyle and infrastructure of almost 60% of Pakistan, and devaluation of currency with exponential inflation, the domestic distraction faced by Pakistanis is huge and worrisome. As per the press release of World Bank [22], Pakistan's flood damages are USD 14.9 billion and economic losses of USD 15.2 billion, and rehabilitation estimates are USD 16.3 billion.

Unreliable internet—as per Speedtest Global Index [23], Pakistan is in 152nd position out of 179 with 10.1 mbps speed in internet fixed broadband and on 119th position out of 138 in mobile internet global performance with 14.58 mbps speed.

Lack of technological resources to masses—PISA [24] reports that in Pakistan out of 200 million population only 23.2 million are smartphone users, which is only 12% in proportion.

Dropout—high-level dropout from MOOCs is also observed by Eriksson, Adawi and Stohr [25] in MOOCs owing to different perceptions students might have.

Language barrier—another barrier is language. There are different languages for different regions. The videos can be in English language for global outreach, or at maximum it can be bilingual: English and Urdu. The possible solution is to add google translator bar embedded in the platform or seek other resources to translate the language so that audience/students can translate the videos in their language of interest. Starting with four main provincial languages of Pakistan will serve this cause.

Security risk and safety issue—With online education there comes a barrier of phishing scam and online fraud [26]. Countries like Pakistan need to be more cautious while increasing the use of online technology, because of unawareness of most of the market users the chances of digital scam are inflated. A report published by United Nations [27] also highlights that many educational institutions faced and suffered from online attacks during COVID-19 transition of online education.

3.9 What needs to be done: take the future head-on

Following are a few considerations in making MOOCs in Pakistan futuristic.

3.9.1 Focus on skills

Academia has been making noise on the issue of knowledge-based education versus skills-based education for quite some time now. Academia-industry linkages also highlight the fact that graduates need to focus more on skills than theoretical knowledge only.

3.9.2 Activity-based learning.

Shrader et al. [28] through rigorous analysis of courses of MOOCs identified single-activity and multiple-activity courses and concluded that multiple activities such as watching lecture videos, being active in forums, quizzes, assignments, discussions, and others, increase the interest of students and keep them engaged in learning hence producing better results. This type further limits the gap between all types of learner discriminations and difficulties.

3.9.3 Project learning

A MOOC course needs to be project-learning driven. Since, it is presumed that MOOCs can offer skills-based education; the best way to evaluate such learning is to let the learners do a project as an outcome of the course [29].

3.9.4 Integrated learning approach

Najafi, Evans, and Federico [30] suggest in their research that integrated approach is best suited to students in MOOC courses as they can highly depend on self-study. By integrating the MOOC course with open courseware will increase learners satisfaction as well.

3.9.5 Micro-credentials accreditation

An issue at present faced in Pakistan is the accreditation of online degree programs. The accreditation councils need to take up this task at priority and come up with instruments to measure online education. After accreditation of online degree programs, next thing is to consider micro-credentials. Skill based education is the future. Having micro-credentials from different MOOCs should be considered by regulating body the higher education commission (HEC) of Pakistan. The world must consider shifting to global education having certain courses from different platforms to merge them in a degree program.

3.9.6 OpenCourseWare

OpenCourseWare (OCW) is a must for online platform to maximize the outreach of the diverse courses. For open accessibility and scalability these platforms need to be free for all.

Use and integration of artificial intelligence (AI) in the teaching-learning process in online systems especially asynchronous mode is one future trend that needs to be incorporated. The LMS of VU is facilitative of an interactive learning experience. The new LMS orientation of VU supports pre-assessment and post-assessment for each topic. To know the prior knowledge of learners on a topic pre-assessment is used. This is based on the idea of brain-storming session a teacher conducts before start of the lecture. The results of pre-assessment when compared with the results of post-assessment present a picture of learning by students.

Adding the feature of AI in the LMS will further help the learners in asking real-time queries while watching the videos and reading the handouts. This will clear the concepts of learners while studying and they would not have to post their queries in discussion boards.

3.9.7 Flexible assessment

Help in international assessments such TIMSS and PISA. Pakistan's performance in TIMSS in 2019 was horrible, as Halai [31] states Pakistan stood second to the bottom. Although MOOCs adopt peer assessment as an alternate method of evaluating assignments, yet it is still not an adequate measure of their performance [32]. Alternate method of assignment grading is still required; the use of AI can fill the gap.

3.9.8 Role of teacher as a facilitator

The teacher in this advanced set-up can claim all-knowing. The role of teacher for MOOCs needs to be re-devised as the mode of teaching, content, and assessment are also changed in it. Much of the new proposed outlook of MOOCs are like facilitation where learners can study on a self-pace. Asynchronous teachers need to be more facilitative as there is no direct communication only written conversations take place [33].

3.9.9 Cater to the needs to learners with special abilities

Students with special abilities are often deprived of most of opportunities. This MOOCs education has the provision of catering to the needs of such students.

With technology, every limitation can be overcome. Students with reading problems, auditory difficulty, mobility restriction or any physical injury can all continue their education through MOOCs platform.

Majority of the work done on MOOCs research is predominantly driven from United States, China, and India, respectively. Hence, it is high time for developing countries to take MOOCs as the next normal thing in education.

3.10 Future of course recording at Virtual University

After sharing the plausible solutions and improvement opportunities from the literature, Virtual University needs to revisit and re-plan its course recording process. The examples of Coursera and edX are great milestones to be followed. The interactive course recording process is imperative, because learners need to be active and participating in the session to learn skills. Along with the text and speech, the modules being recorded need to be enriched with multiple IT graphics tools and techniques. Hands-on activities need to be embedded in the course videos, even in theoretical courses. The old story-telling method needs to be eliminated at the earliest possible. If, VU has to take the lead of offering MOOCs in Pakistan, then it has to make a paradigm shift from only focusing on classroom lecture-based recording system to skill-based micro-credentials recording, and with multiple resource persons having specific expertise even in a single course. The concept of multiple resource persons also need to be incorporated as it catches and maintain interest during the course, and includes multiple assessment techniques.

Flexible assessment as mentioned in the “way forward” section above is the next big thing that will revolutionize the MOOCs in Pakistan. The use of AI in terms of identifying the learning gaps of the learners, and grading assignments will help in systematic identification of learners’ difficulties and also provide real-time feedback to them. The feedback is important but more important is the response time of that feedback; the earlier the feedback, the earlier will be learner improve. The AI needs to be embedded in the LMS of the students’ end, where they watch the videos, they can post questions and get their queries addressed at the spot.

4. Conclusions

It is about time for Pakistan to prepare a platform for a digital native generation who are born in a digital environment. The platform in itself has to create enjoyment in learning, value, and relatedness for students. Students remain the nucleus of all educational activities and research; therefore, the feedback and expectation of students needs need to be catered to. In Pakistan, where quality of Education and especially higher education is always under question, it is high time to launch MOOCs as it will provide an opportunity to vitalize education. While the history of MOOCs is reported to be as old as 2008 only [34], but almost all developed countries have developed their own platforms. Discussion of Open Education Resources (OER) and Blended Learning needs to be initiated alongside MOOCs, as students’ attention is still under question in current format of MOOCs. Adding blended learning feature in MOOCs will settle the issue of informal learning that students face during lack of external motivation, but expanding it beyond on-campus courses is the challenge for the future. Virtual University of Pakistan as discussed in the upper sections of

this chapter; can become a useful resource by becoming the platform of MOOCs in Pakistan and with its outreach across the globe; it can soon come in the queue of Edx, Coursera, MITx, etc. Continuous monitoring of MOOCs needs to be done to identify the trends of learners especially related to their engagement with courses and drop-out rates. Regular feedback from learners might also help further strengthening the MOOCs platform.

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Conflict of interest

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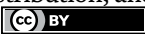
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The Content Modification within the Framework of the Massive Open Online Courses (Case Study: International and Russian Practices)

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Elvira K. Sabaeva and Nadezhda O. Samarkina*

Abstract

Massive open online courses (MOOCs) are the new form of educational experience that has emerged as a result of the distance learning development as well as the movement to open educational resources. We can talk about the fourth-integrative stage of E-learning evolution, which is based on a complex-virtual training technology. The foundation is the evolutionary way of providing information through the integrated implementation of advanced telecommunication systems enabling any possible transfer of any form of information to any part of the world as quickly as possible. The objectives are as follows: Describe the main strategies of countries' behavior in the MOOC market; analyze the positioning of countries in the international MOOC market; present possible activities in the international MOOC market for Russian providers. The following data sources were used: articles, reports, official documents on MOOC topics, and information from online platform sites; a database of quantitative data collected from two leading online platforms; a database of quantitative data from the Class Central aggregator, which provides information on MOOCs hosted on several large online platforms. This chapter analyzes the features, challenges, and perspective of the evolving massive open online courses in the context of the global information society or the knowledge-based society formation.

Keywords: distant technologies, massive open online courses, e-learning, web education, multimedia module, market research, analytical research, marketing analytics, business development trends, digital economy

1. Introduction

Nowadays, education is an integral part of life and also a quite significant asset. People are educated almost all their lives these days, from an early age, from

kindergarten, to (and sometimes not) varying levels of higher education, continuing education courses or retraining, since science and progress do not stay static, but are constantly evolving. As every year there are new needs that require learning new professions, new knowledge and skills are added to existing professions.

Currently, the system of higher education is undergoing major transformations, which are caused, in turn, by radical social, economic, technological, political, and cultural changes of a global nature. The evolution of knowledge-based economic systems and the emergence of a knowledge society, the globalization and internationalization, the increasing importance of innovative information as well as the communication technologies are among the most important factors that affect the modern university. The dynamic and rapid expansion of information and communication technologies is now becoming a worldwide information revolution, influencing all realms of society (including science, education, economics, culture, management, etc.) and shaping the transition to a new type of society – the information society, or, as it is also called, the “knowledge society”. The information society is a society with the increasing production and use of information and knowledge in all spheres of human activity. One of the major components of this society is its global character [1].

The concept of “information society” first emerged in the second half of the 1960s. The introduction of this term is attributed to Professor Y. Hayashi of the Tokyo Institute of Technology [2]. A number of well-known scientists (D. Bell, E. Masuda, T. Stonier, M. McLuhan, E. Toffler, P. Drucker, M. Castells, A.I. Rakitov, A.D. Ursul, N. N. Moiseev, etc.) have studied the problems associated with the information society. Some scholars believe that the information society is a new societal organization of people, and the processes of its formation have not yet been completed and must pass through several stages. Other scholars, on the other hand, believe that the information society has already been built in some of the most developed countries (the United States Japan, and Western European countries).

Since the 1990s, scholars have begun to focus less on the importance of information itself in diverse society spheres and more on its role, which has given rise to a number of new definitions of post-industrial society: knowledge society or knowledge-based society. At the same time, many experts note the need to ensure open access to information, without which, as N.N. Moiseev stresses, it makes no sense to talk about creating an information society – “a society of planetary collective intelligence” [3].

Therefore, the society which emerges as a result of the informational revolution is characterized by the special status of information and knowledge as the highest and most valuable form of all the gigantic array of information circulating in modern society. The knowledge acquired through open access to information and the ability to work with it becomes the main condition for the well-being of every person and every state [1]. The global trends that have emerged in the XX century will continually have a sequel in the new century, challenging human civilization. Under these circumstances, it is important to be competent to confront destructive trends and to support progressive trends on the grounds of priorities that correspond to the transformed realities of civilizational development. The challenge is highly specific to the educational sphere, which is urged to adjust its priorities considering the needs of human civilization in the XXI century [4].

Rapid development of information technology and ICTs opens up new opportunities and perspectives for improving the education system. This concerns both the improving hardware and HEI's approach to global educational resources, as well as the use of new ways and techniques, focused on the students' active cognitive motion.

Meanwhile, open educational resources and open distance learning are becoming particularly significant, facilitating more intensive knowledge exchange, considerably increasing people's access to higher education and lifelong learning, and providing opportunities for international cooperation and the role of universities in the world-wide educational system.

Open educational resources movement began in the last decade of the XX century, and in the year of 2001, it took on a worldwide scale when the Massachusetts Institute of Technology launched the Open Course Ware project, opening up free access to its course materials [5]. At the moment open distance learning courses, based on the usage of educational materials placed in the free access or published under a license that allows their free use, are offered on a free basis by various HEIs.

Since 2008, some online courses have been open to the masses, and the term "massive open online course" (MOOC) was coined in 2008 to describe that type of course. The term was coined in response to George Siemens and Stephen Downs' course "Connectivism and Connectivist Knowledge" held at the University of Manitoba (Canada) in 2008, which was attended by 25 students in the audience and another 2300 online participants [6]. Following this course, several more open online courses were held between 2008 and 2011, registering from several hundred to several thousand participants. The first MOOCs emerged within open educational resources and were inspired by the connectivism concept [7].

In this context, the current trends of Higher Education development in the global world and the university transformation challenges are focused on by many researchers [J.E. Willis, Y. Lincoln, M. Kwiek, P.S. Magrath, B. Brock-Utne, G.Y. Minenkov, etc.]. Challenges of higher education development are considered in the context of the knowledge society formation, in which expanded reproduction and dissemination of knowledge is assumed. Knowledge in the modern world has ceased to be exclusively belonging to the élites and extends to the whole society. Promoting education and learning in a knowledge-based society implies a transformation of the learning paradigm itself, focusing on the person who learns and on lifelong learning. Henceforth, education is no longer a process of transferring knowledge – the focus shifts to the ability of each and every person to learn and to master knowledge independently [8].

The year 2011–2012 can be referred to as a turning point in the development of MOOCs, as the idea of MOOCs finally took hold, first in the United States and then in Europe and other regions of the world. The three courses offered by Stanford University had a record number of participants (about 100,000 for each course) in the fall of 2011. For example, on the course "Introduction to Artificial Intelligence" 160 thousand listeners from 190 countries enrolled and, according to the submitted reports, 23 thousand participants successfully completed it [9]. Starting from that time the rapid development of mass open online courses began, which became the target of countless media publications and vigorous discussions in academic circles, and 2012 was even called "the year of MOOCs" [10]. Starting in early 2012, projects that implement mass open online courses have been rapidly expanding their services in the United States. These include Udacity, Coursera, MITx (later edX), and by the end of the year they are joined by Canvas, UM's Online High School, Udacity, Wedubox, and others [11].

The most popular MOOC providers are the American platforms *Coursera*, *edX*, and *Udacity*, as well as the British *FutureLearn*. National online platforms have emerged in many countries: *XuetangX* in China; *MiriadaX* in Latin America; *France Université Numérique (FUN)* in France; *EduOpen* in Italy; *SWAYAM* in India; the *National*

Platform for Open Education (NPOO) in Russia. Therefore, the robust advancement of massive open online courses is one of the significant trends in higher education in the modern world.

2. Methodology: research design

The research methodology for this study consisted of a review of published research and studies in the field of online teaching and learning, the range of which included literature reviews up to 2022 and empirical studies after 2012. Using a qualitative content analysis approach, this study reviewed 74 published studies and research on online teaching and learning since 2012, mainly focusing on the theory, practice, and evaluation applied to the online learning environment. This paper aims to provide practical suggestions to those planning to develop online courses so that they can make grounded decisions in the implementation process.

According to the findings, the authors state that effective international online learning depends on well-developed course content, motivated interaction between teacher and learners, well-trained and fully supported teachers; creation of a community sense of online learning; rapid technological development. Meanwhile, it is hoped that this will stimulate an ongoing discussion on effective strategies that can enhance the universities' and teachers' success in the transformation to online teaching. Within the current debate on the cost and quality of higher education, this research can help to improve higher education and student enrolment and retention.

2.1 Selection criteria and relevant data sources

The main sources of literature were journal articles and full texts. Motivated by our intention to study the evolution of online education and its impact in the years after 2012. The economic crisis led to a three-stage literature review, starting with pre-2012 literature reviews as the basis of our study in Phase I. Subsequently, using the descriptors of E-learning, Web-based learning and digital learning in Phase II, we conducted a search through empirical studies published since 2012.

On the basis of our initial findings from Phase II, we expanded our search descriptors in Phase III to include MOOC, online courses, and training; computer-based courses and instruction; e-learning, teaching and learning; Web-based teaching, teaching and learning; Internet-based learning and teaching; tele schooling, TV-based learning and tele-teaching; and video curricular learning, tutoring, and learnership.

The primary sources we used for data collection were online databases including ERIC, EBSCO, PsycINFO, ContentFirst, Google Scholar, SAGE Online, Project Muse, Education Full Text, and Academic Search Premier.

For large-scale implementation of MOOCs in HEIs, several questions need to be answered:

1. What are the main strategies of countries' behavior in the MOOC market?
2. What is the positioning of countries in the international MOOC market?
3. What are possible activities in the international MOOC market for Russian providers?
4. What organizational models are used to integrate MOOCs in Russian HEIs?

5. Whether it is effective to use MOOCs to fully or partially replace face-to-face courses, and if so, does this practice lead to a lower educational performance of students?
6. What skills do students need to be successful in MOOCs?

It is pointed out that education is about teaching and learning, and it is also true that what is effective in teaching can be equally applicable to learning. On account of the unique nature of online education, we intended to propose the second and third research questions in such a way that the views of students and teachers on the effectiveness of online education could be taken into account and emphasized.

2.2 Data analysis

Throughout our initial literature review, we began to note that themes of MOOC presence were emerging. We categorized the themes adhering to the theoretical framework developed by Garrison and colleagues, which emphasizes social presence, teaching presence, and cognitive presence in online learning and teaching [12]. We ultimately disaggregated the results into three main themes to answer our research questions, including the evolution of online education, effective methods and practices, strategies of countries' behavior and positioning in the international MOOC market, activities for Russian providers. Therefore, a qualitative content analysis approach was used to review the findings [13].

3. Background and literature review

From the outset, massive open online courses (MOOCs) were seen as a possible alternative to some traditional university sessions, allowing more personalized learning, reducing the course implementation costs, and reducing teachers' workload. With most universities shutting down physically due to the COVID-19 pandemic in the first half of 2020, distance learning became the main possible way not to break the educational process. Therefore, the role of MOOCs in providing quality distance education has increased manifold, as it is almost the only distance format that has been shown to be more effective than face-to-face learning [14].

The distinctive feature of MOOCs as an educational technology is that it can be taken by literally thousands and even hundreds of thousands of simultaneous learners [15]. Consequently, people from different countries and regions have the opportunity to enroll in a course with professors from the world's leading universities. Additionally, the MOOC offers its students, on the one hand, opportunities for communication with both course materials and fellow students, and on the other hand, a certain amount of autonomy in the extent and ways of involvement in the course [16].

According to experts, within the Russian higher education system, the use of MOOCs in the educational process will expand opportunities for constructing individual educational trajectories of students through offering a greater number of courses [17]. Furthermore, it is expected that the integration of MOOCs into university education will help to diversify the learning content, adapt the disciplines to the labor market needs [18], and reduce the educational services cost [15, 19].

In this regard, many experts have anticipated that the development and proliferation of massive open online courses would be crucial for the field of higher education

and would significantly reduce the inequalities in access to high-quality educational resources [20].

The radical attitude was that this educational technology would be “disruptive innovation” for the higher education market by providing a cheap alternative to expensive university degrees [21–24]. Furthermore, a more moderate position was that although universities should consider educational innovations such as MOOCs in their activities, they would not compete directly [25]. Or, even vice versa, some researchers see MOOCs as a way in which university degrees can be outsourced [26].

Some other researchers criticized the idea of the groundbreaking potential of MOOCs from the outset, suggesting that, from a pedagogical perspective, massive open online courses are not innovative and that the fact that they are produced by leading universities and renowned professors does not guarantee high quality and competitiveness compared to conventional traditional university disciplines [27]. In more recent work, there has been a decrease in optimism about the potential of massive open online courses in overcoming educational inequalities, due to the exposure the format has several limitations.

The MOOCs in particular have been criticized for:

1. the low proportion of students taking online courses to the end [28, 29];
2. the persistence of discrimination based on socio-economic status and other characteristics that traditionally have a negative correlation with educational outcomes [30–32];
3. the reduced opportunities for student–teacher contact, and
4. the limited availability of an automated assessment system, which does not always fully facilitate fair grading and feedback [27],
5. the low quality of pedagogical design [33].

Consequently, the possibility of using MOOCs as an alternative to face-to-face education in higher education remains a controversial issue. A number of experts believe that MOOCs would improve the university education’s quality by providing mass access to courses taught by leading professors from the world’s most prestigious universities [34]. This practice could prove cost-effective for universities, especially for those that cannot offer their students high-quality courses in a number of disciplines [14].

This is already present in a number of Russian [35, 36], and foreign universities in the form of individual initiatives [37]. However, there are also opposing views on the potential of using MOOCs as an alternative to traditional university disciplines. Challenges have been raised about the quality of online courses offered by leading universities compared to face-to-face learning [27]. Hence, despite the potential of using massive open online courses in higher education as a replacement/supplement to some traditional format courses, there are a number of unresolved issues for the large-scale implementation of this practice.

First, the MOOC use cannot be based on the existing models of educational process organization and university economic models, and new ones need to be developed and implemented [19, 35, 36].

Second, it is unknown how the transition to the use of MOOCs as the main or extracurricular material will affect students' knowledge and skills. Will this practice lead to a deterioration of their educational outcomes? How will students react to the new course format? And thirdly, it is not clear to what extent students are ready to take courses in an online format. How can the university help its students to be successful in massive open online courses? What skills can students develop in order to be successful in online courses?

This work is particularly relevant in the context of the urgent transition to online education in Russian HEIs, which took place in March 2020. It will help to answer some of the questions of teachers and staff who are currently forced to restructure their teaching using the online format in HEIs with little or no experience of integrating online courses into teaching.

4. MOOCs overview

The rapid spread of MOOC is due not only to the desire of universities to gain recognition in the international online education market. The possibility of monetizing their projects plays an important role here. Online platforms together with universities offer additional paid certification services, as well as the help of a personal assistant in taking an online course. Gradually, new models of MOOC monetization are being created and improved. In addition, in the conditions of high competition between universities worldwide, MOOCs have become a new tool for promoting the university brand among potential applicants.

Presently, three major university-level online course platforms can be distinguished: *Udacity Inc.*, *Coursera Inc.*, *Udemy Inc.*, and *edX Inc* (all based in the United States).

Udacity Inc. is a private educational enterprise founded by Sebastian Thrun, David Stavens, and Michael Sokolsky, with the expressed goal of democratizing education, providing access to high-quality higher education, and changing the future of education [38]. This project emerged after the successful implementation of the "Artificial Intelligence" course by Peter Norvig and Sebastian Thrun at Stanford University in the fall of 2011. It was a real breakthrough for the whole MOOC movement, since it was after the launch of Coursera, MITx / edX and other projects.

The *edX Inc. platform* is a non-profit academic venture run by the Massachusetts Institute of Technology (MIT) and Harvard University. More recently, it was joined by the University of California at Berkeley, the University of Texas System, the Australian National University, the University of Toronto, and others. The project offers online university-level courses in a wide range of disciplines on a free-of-charge basis [39].

Coursera Inc., a non-profit educational company founded in February 2012 by Stanford University professors Daphne Koller and Andrew Ng, leads the MOOC movement. As D. Koller notes, the project aims to use the best courses of the world's best professors in the leading universities and provide free access to them worldwide [20]. The Coursera project started with the collaboration of four American universities (Stanford, Michigan, Princeton, and Pennsylvania), but very soon other major universities (Johns Hopkins University, California Institute of Technology, Columbia University, Edinburgh University, University of Toronto, and others) joined it. By the beginning of August 2012, the first one million listeners from 196 countries had already been registered [40]. At the beginning of May 2013, the Coursera Web site

offered about 370 courses developed with the participation of 69 partners from diverse regions of the world (North America, Western Europe, Asia, and Australia), and the number of users exceeded 3.5 million [41].

The major outstanding attributes of these projects include the recruitment of professors from the world's top universities, free of charge, and, as a consequence, the massive and worldwide nature (thousands, tens of thousands, and hundreds of thousands of listeners from all over the world). In 2013, the beginning of the year was marked by the advent of massive open online courses in Europe. In February, the leading MOOC platform Coursera announced that 29 universities had joined it, including ten European universities [42]. These include, for example, such renowned universities as the University of Munich and the University of Geneva, the Ecole Polytechnique of Paris, and the Universities of Rome and Copenhagen.

In March 2013, the Berlin-based company *Iversity* announced the launch of a mass online course platform of the same name. Iversity's goal is to convince European academic communities that MOOCs are promising and consolidate universities in continental Europe to create their own mass online courses [43]. Meanwhile, *Futurelearn*, the platform for massive online courses created in December 2012, uniting more than 20 British universities, is gaining considerable momentum in the UK [44].

The first Europe-wide program offering massive open online courses was announced in April 2013. The program was initiated by the *European Association of Distance Teaching Universities (EADTU)*, with the support of the European Commission and the collaboration with partners from 11 countries. More than 40 free university online courses are offered in 12 languages on a wide range of subjects (from mathematics and economics to languages and climate science) [45].

The number of countries, primarily Asian – China, South Korea, Malaysia, today put forward the design of MOOCs, as well as their promotion on foreign online platforms as one of the main strategic tasks at the state level, hoping in the future to create a higher education system highly appreciated by the world community and able to compete with the world's leading educational institutions [46].

As a result of its large working and learning population, China is using digital learning technologies to improve the equity, quality, and efficiency of education. MOOCs became popular in China in 2013 with the launch of *XuetangX*, China's first MOOC platform developed by Tsinghua University.

The Ministry of Education of China and the National Commission of China for UNESCO have launched two online education platforms: *XuetangX* (www.xuetangx.com) and *iCourse International* (www.icourse163.com). Both platforms provide quality educational resources in English and other languages from the world's leading universities and reliable technical support.

XuetangX offers about 3000 online courses from world-class universities, including MIT, The University of California, Berkeley, Tsinghua University, and Peking University [47]. Seven years ago, Tsinghua University created *XuetangX*, China's first platform for integrating and interchange of high-quality MOOCs. The platform has already implemented 2966 online courses with top-notch universities around the world, including Tsinghua University, Peking University, MIT, the University of California at Berkeley, and others. The platform has attracted more than 58.8 million students, and the total number of students who have taken courses is about 163 million. To better serve users worldwide, *XuetangX* released an international version along with 109 online courses in English on April 20, 2020.

iCourse international (www.icourse163.com) was officially launched by China Higher Education Publishers on April 28, 2020. The platform provides online teaching and learning for international teachers and students worldwide. English is the main language of the platform. Launched with accumulated experience in course management and strong technical support from *iCourse* China University, which brings together top-notch universities in China, such as Peking University, Fudan University, and Zhejiang University, the *iCourse* international platform is based on the accumulated experience of course management and the strong technical support of *iCourse* China University. The platform provides 193 courses in English.

According to the Chinese Ministry of Education, there are more than ten MOOC platforms in the country, and more than 460 universities and colleges have introduced more than 3200 online courses through these platforms, which are watched by more than 55 million people. In addition, more than 200 Chinese online courses have joined international MOOC platforms. The Chinese online education market is developing under rigid regulatory conditions on the part of government supervisory structures, and the private players' expectations for the continued development of the Russian education market and its online segment, following Russian President Vladimir Putin's instruction to review the issue of the establishment of government regulation of the rotation of informational products for children placed in the info-telecommunications network Internet and use in the sphere of distance school education in Russia, are exceptional.

Russian universities are also actively developing and using online courses. However, there are few works that would investigate the MOOC market and its prospects in Russia. One of them is a study of the Russian market of online education and educational technologies conducted by *Netology Group*, but it examines the development of online education in general and does not describe in detail the international MOOC market. Other works by Russian authors concern the history of the creation and development of the MOOC, but do not explore the role and prospects of Russia in the international MOOC market [48–52].

In countries such as India, Australia, and many other Asian countries, MOOCs are becoming part of the education system, which is expected to boost the science segment. The MOOCs have gained popularity in India for more than half a century among students and professionals, especially in technology and engineering, who have struggled to improve their skills in the ever-changing and disruptive world of technology [53]. Therefore, platforms such as SWAYAM offer 155 engineering courses and 108 science courses [53]. Moreover, many companies claim that the recent COVID-19 outbreak and quarantine in many countries have dramatically increased the demand for science MOOCs. According to a 2019 Class Central MOOC report, India invested more than \$33 million in SWAYAM. In the place of this high cost of the platform being open, SWAYAM courses can be taken for free. In addition, India has increased its enrolment in higher education to 30 percent by 2021. According to Coursera, out of 35 million users worldwide, India has the highest number of students on the Coursera platform.

In April 2020, EPFL and the Mohammed VI Polytechnic University (UM6P) in Morocco launched the new online learning portal featuring 41 MOOCs developed at EPFL. The platform is the first result of a partnership deal struck between the two institutions shortly before the COVID-19 outbreak. In addition, at the time of the lock-in, the university reported that the program was attracting many students from the rest of Morocco's engineering schools.

The University of Cape Town (UCT) has recently seen a surge in participation in MOOCs since the start of the global lockdown. More than 10,000 people enrolled in “Understanding Clinical Research”, the course focused on gaining knowledge in medical statistics, in response to the COVID-19 pandemic. As of March 2020, “FUN” (France Université Numérique), the MOOC platform that dominates the French online course ecosystem, announced that a total of 31 MOOCs will be offered during 2020, divided into two collections: “ProjetSUP” and “RéussiteSUP” [10, 45].

5. International and national MOOC market

Massive open online courses, implemented with the cooperation of the major universities in the world, are developing dynamically on a global scale, expanding access to higher education and lifelong learning for people from all over the world and having a significant impact on the modern system of higher education.

Universities and other organizations from around the world that produce online courses in different languages are represented on the international MOOC market. The subjects of such a market are manufacturers of online courses from different countries and consumers of online courses around the world. Unlike the international market, providers of one or several countries that produce MOOCs in the state language are represented on the national market; for example, courses are placed

- on *MiríadaX6* in Spanish,
- on *FUN7* – in French,
- on *XuetangX8* – in Chinese,
- on *NPOO* – in Russian.

The subjects of the national market are producers of online courses in one or more countries with the same state language and consumers of online courses who are native speakers of this language. The creation and development of national platforms, as a rule, is subordinated to local goals. For example, the *FUN platform* distributes educational products of French providers.

Depending on either the international or national MOOC market across countries, two behavioral strategies for establishing and promoting online courses can be distinguished. In determining the market behavior strategy, the following sources were used:

- the official Web sites of the leading platforms (to assess a country’s market behavior strategy for MOOCs through its providers that host MOOCs on online platforms);
- official Web sites of national platforms that host MOOCs;
- articles and reports describing the country’s providers’ actions in the MOOC market (keywords such as “MOOC”, “online course”, “platform”, “developing

country”, “developed country”, and country names were used when searching for articles/reports);

- official documents that outline the country’s (its providers’) strategy of behavior in the MOOC market.

The First strategy involves positioning and promoting the country on the international MOOC market by creating and posting online courses on platforms whose users are citizens of different countries of the world. The leading international providers include the major American platforms *edX* and *Coursera*, which collaborate with institutions/universities from other countries¹ and which represent the largest number of students from different countries².

The Second strategy is the advancement of online education in the national market to solve regional problems. National platforms and/or resources of the leading providers can be used for its implementation. For instance, in the European region, MOOCs are used to ensure inclusion, to develop language and entrepreneurial skills, and focus here on the development of migrants’ skills, which will enable them to gain access to the labor market.

The First strategy is used mainly by countries in the Asian region (Malaysia, South Korea, and Japan), a number of European countries (Denmark, Sweden, the Netherlands, and Italy), and Arab countries (Egypt and Saudi Arabia). Within the scope of this strategy, online courses in the international language (English) in various subject areas, including courses from academic programs, and MOOCs focusing on the history of the country, its cultural characteristics, and language learning, are being created.

For instance, South Korean universities place English-language courses on international platforms for Korean language learners (“Learn to Speak Korean-1”), MOOCs on Korean history and politics (“Modern Korean History: Liberation, War and Nuclear Ambitions”) [54].

Universities in Japan have designed MOOCs on Japanese culture (“An Introduction to Japanese Subcultures,” “Visualizing Postwar Tokyo”) as well as a course on the characteristics of enrollment and university education in Japan (“Studying in Japanese Universities”) [55]. Strategy for the Development of the National Education System through the creation and expansion of the national universities’ MOOCs on leading platforms can be enshrined at the state level. However, it is not a strategy that can be implemented at the national level. As an example, in Malaysia, the Ministry of Higher Education in 2015 developed a national strategy for the online courses production and support, which aims to increase the brand awareness of the country in the global space [56].

According to this strategy, the first phase identifies the key areas in which the creation of high-quality MOOCs is expected, establishes partnerships with leading platforms, identifies free segments, and launches a national e-learning center responsible for coordinating MOOC creation and its promotion on the platforms [57]. Furthermore, at this stage, training programs are developed for the personnel who will create and maintain the MOOCs, and procedures are formed for re-crediting the results of MOOCs to integrate them into the curricula.

¹ Coursera platform has partnerships with 164 educational institutions from 29 countries.

² At the end of 2017, the total audience of Coursera and EdX reached 44 million users

In the second phase, MOOCs are established in selected core areas. The Malaysian government expects at least 15 online courses from each university to be hosted on leading platforms. Today, highly specialized courses in English from Malaysian universities, such as Malaysian Taxation, Naval Architecture, and Ship Building, are already available on the *OpenLearning* platform (The OpenLearning platform is an Australian provider of open online courses and hosts courses primarily from Australian and Malaysian universities).

At the third phase, progress in the strategy is evaluated, and, if necessary, adjustments are made. The Ministry of Higher Education of Malaysia expects that the creation of specialized MOOCs and filling the vacant niches on the leading platforms will allow, first, to increase the share of foreign students among the students of Malaysian MOOCs to 30% by 2022, second, to gain recognition of the Malaysian higher education system and achieve its inclusion in the top 200 Webometrics rating, third, to reduce the cash costs of course creation and get support from the providers themselves [57].

The Second Strategy in the MOOC Market is aimed at solving the state's objectives, and national platforms or the resources of leading providers can be used in the absence of financial and technical capabilities to ensure the functioning of their own platforms. The emergence of the national platform does not automatically lead to the disappearance of the online courses of universities in the country from the leading platforms, and the universities continue to position themselves internationally and prepare courses in a foreign language for foreign audiences. Both international and national platforms host their online courses, including the United Kingdom, France, China, India, and Russia.

The national platforms primarily offer MOOCs that are recorded in the national language and meet certain requirements in terms of subject matter and format. As a rule, the content of online courses is dictated by the demands of the national labor market and the demand of applicants and students. For example, most of the online courses posted on the Chinese platform *XuetangX* in Chinese are focused on engineering [58]: Engineering majors are most in demand among students at universities in China [59].

For example, the unified strategy for online course creation and hosting on India's SWAYAM platform [53], prepared by the Department of Higher Education of the Ministry of Human Resource Development of India in 2017. The distinctive feature of the strategy is the creation of an academic council that reviews applications for the design of online courses.

The Ministry appoints the national coordinators responsible for creating MOOCs for all levels of education. For example, the Consortium for Educational Interactions creates online courses for the undergraduate level, while the National Council for Educational Research is responsible for creating online courses for the secondary school level. The SWAYAM platform offers MOOCs that are part of educational programs and mandatory for students, as well as MOOCs aimed at developing further professional skills, which are offered to all interested users and are not mandatory to study.

State strategies for the formation and development of national platforms are being developed in some countries. Those countries that do not have the resources to create and maintain national platforms are benefit from the leading platforms where universities post MOOCs in the national language. The leading providers for hosting online courses in the national language are Latin American countries (Brazil, Chile, Colombia, Argentina, and Mexico), Norway, and Turkey.

Norwegian universities, for example, mainly use the resources of the English provider FutureLearn to promote their own MOOCs [60, 61]. The Norwegian government only finances certain local demands for MOOCs from universities and their students, so all MOOCs from Norwegian universities are created in Norwegian and are

provided to students for free, with the possibility of course credit if they receive a positive evaluation at the end of the course [61]. Therefore, the country uses MOOCs in the educational process offered by its universities without financial resources invested in the national platform.

The Russian universities and other organizations host their own online courses both on the leading platforms and on national platforms. At the beginning of 2018, 259 courses were posted on the National Open Education Platform. Under the current conditions, the advantage is given to large market players with significant financial resources, which leads to the displacement of less financially secure market participants from the market, to the activation of collaboration, mergers, and acquisitions. The MOOC market in Russia still has an extremely insignificant share in the total volume of the global market [62],

- 21 billion rubles in 2016,
- 30 billion rubles in 2018 (about 10 billion rubles was earned by the “Top 35 EdTech”),
- 47 billion rubles in 2019 (about 14 billion rubles was earned by Top-70 EdTech),
- 53.3 billion rubles in 2020 (about 34 billion rubles of revenue came from TOP-60 EdTech),
- 73 billion rubles in 2021 (Top 100 EdTech revenue).

Unfortunately, the share in Russia is still very small. Nevertheless, platforms such as edX and Coursera had been popular in our country as well. Coursera accounts for more than half of all Russian traffic. This platform is a world leader, as it cooperates with more than 149 universities worldwide.

The annual growth of the online segment of the Russian education market was about 40% on average from 2016 to 2021. According to the IT holding “TalentTech”, by the end of 2021, the track share in the further adult education in the online segment was already about half of the market volume, about 26% accounted for vocational school education (below the projected values), and 18% occupied higher professional education. The share of higher professional education in the overall structure of the MOOC market has decreased more than previously expected and predicted.

The demand for programs of individual segments of the direction of further online education for adults, according to the results of 2021, compared with the data of 2019, has practically not changed. The most popular programs of further education among adults in 2021, as well as in 2019, were programs in the field of information technology, business management, sales and marketing communications, as well as design. Basically, only the percentages of their share presence in the total market volume have changed – there has been the indicators alignment of the previously lagging segments relative to the indicators of the major directions. With one clear exception, the *Open Education* platform segment has become one of the leaders in the MOOC market of the Russian Federation.

The development of online learning technologies for several years has had a significant impact on the education transformation as a whole, altering its structure by changing the demand structure, forming new, already irreversible trends in its further transformation. Via the example of the revenue growth of the top ten educational services of the Russian MOOC market in the second quarter of 2020, it can be seen

that the increase compared to the same period in 2019 ranged from 24–625% [4], while the revenue growth of the five market leaders, who had already demonstrated significant revenue indicators a year earlier, on average for the second quarter and by the end of 2020, it amounted to over 150%.

The world MOOC platform market will register an average annual revenue growth rate of 39.8% in five years, and by 2026 the volume of the global market will reach \$29,360 million [63]. Several independent surveys show that European and American institutions of higher education are more actively involved in MOOCs than Russian institutions of higher education. European and American universities have a more positive attitude toward the development and implementation of MOOCs. There is also no information about the effectiveness of the integration of such MOOCs into the educational process of Russian universities.

However, Russian platforms work and have their own dedicated subscribers (see **Figure 1**). For example, the Russian Platform *Open Education* (1.2 million visitors per month according to SimilarWeb) is three times behind Coursera. However, considering that it was launched in 2015, the second place can already testify to quite effective development dynamics. Currently, the main players on the MOOC market for the Russian higher education system are as follows:

- *The National Platform for Open Education* [<https://openedu.ru>] offers online courses in the core academic disciplines studied at Russian universities. The National

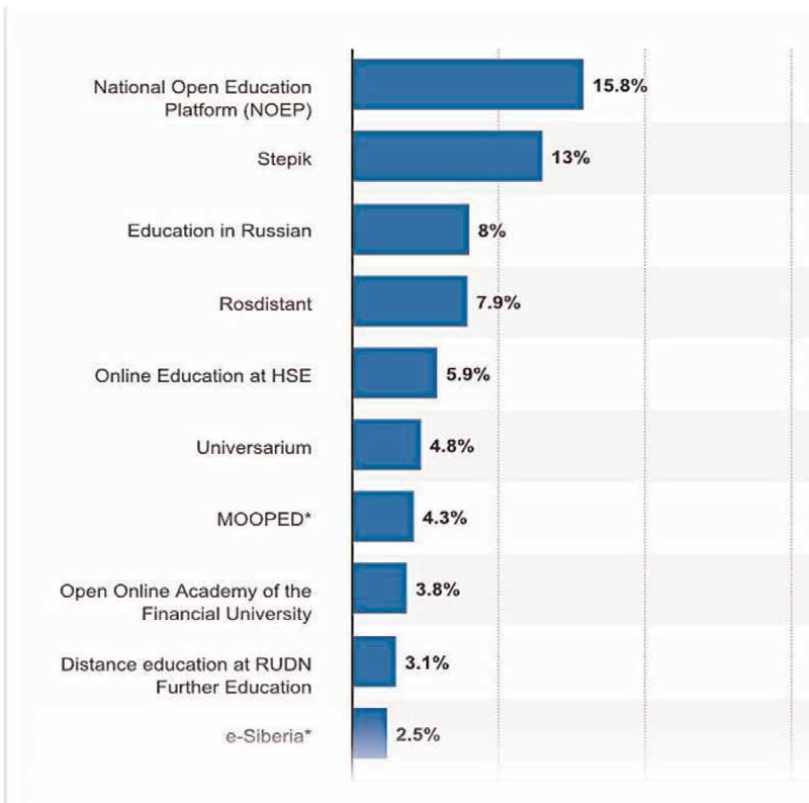


Figure 1. MOOC platforms used by universities in Russia 2021 [64] (Distribution of online courses published by HEI in Russia as of by October 2021).

Platform for Open Education Association is approved by the famous universities: SPbSU, ITMO, NRU “Higher School of Economics”, NITU “MISIS”, SPbPU, MIPT, UrFU, and Moscow State University. These courses have all been designed by leading Russian universities and are available free of charge and without any formal background requirements. At openedu.ru you will find more than 230 online courses in physics, chemistry, marketing, history, and other subjects.

- *Universarium* [<https://universarium.org>] is an open platform that provides free courses and academic programs by Russian universities and research and business experts.
- *National Open University “Intuit”* [<https://intuit.ru>] is focused on providing open and free access to courses in the following disciplines: information technologies, mathematics, physics, economics, management, etc.
- *Lectorium* [<https://www.lektorium.tv>] is an educational platform that combines a MOOCs hosting platform, a core publisher for MOOC development, and an open Russian-language archive of videotutorials.
- *Stepik* [<https://stepik.org/catalog>] is an educational platform that offers open access to online courses, as well as an opportunity to create your own educational course for any registered user, using videos, texts, and assignments with automatic testing and instant feedback.
- Moodle Open Education (*MOOPED*) [<https://mooped.net>] is the online education portal of the Volga Regional Center for Educational Cooperation, created at Volga Tech. This portal’s main objective is to provide a platform for educational enterprises, companies, and government agencies to create and promote online training courses in the educational space.
- *E-Siberia* [<https://online.sfu-kras.ru>] is the online learning platform of Siberian Regional Center for Social and Cultural Studies. E-Siberia online learning platform is the element of scientific and educational network of “Yenisei Siberia” regions, including Krasnoyarsk region, Khakassia and Tyva republics. This platform is aimed at fostering online learning, supporting the implementation of educational programs and projects that provide solutions to the strategic objectives for regional progress, taking into account the possibilities of the digital revolution. This platform was launched in 2018 and is maintained by the Siberian (Krasnoyarsk) Regional Center of Competences in Online Learning on the basis of the Siberian Federal University.

Also, there are specialized sites: *Lingualeo* is a leader in teaching foreign languages with 13 million users, *Geek-Brains* gives knowledge in teaching programming. Other examples include the *PhysicalTech Lecture Hall*, *ITMO courses*, *Total Dictation*.

6. Current trends and prospects of MOOC market development in Russia

The Russian Federation is one of the top ten countries in the world where there is the greatest interest in online courses [64]. It is not surprising that the so-called

MOOC platforms, where mass online courses are held, are gaining ground. Even though they have not yet become a real alternative to the traditional educational process, in a reality where accessibility, mobility, and an innovative approach are of great importance to learning, MOOC platforms definitely have a future [63, 65]. The development of MOOCs in the world has certainly accelerated significantly because of COVID-19. With the pandemic, consumer behavior has changed in all walks of life, and the major global MOOC players saw a 1000% increase last year [63].

In other respects, however, MOOC platforms in Russia still require a significant amount of advance in public interest, despite the fact that by joining these platforms one can study practically everything from computer science to transcendental poetry. The major obstacle to outreach to those who do not yet have access to education has little to do with access to technology. More likely, it is a common unawareness that there are free and inexpensive courses available.

When we talk about MOOC market, in particular about the capacity of the Russian market, we mean its hypothetical estimated value (the calculations consider the current number of potential consumers, the average cost of products and services, as well as the potential for the market development, considering available statistics and forecasted changes in demographics, and demand and sales volumes). The general trend of further development of the MOOC market in Russia is the *transition*, especially of private business from digitization (digitalization) of offline educational programs, and the creation of new training methods and tools, which is substantiated by the demands of increasing competition between market participants.

The user has already been “fed up” with the pseudo-innovative format of online education, felt the effects of marketing deception, including low quality service and communication support, discrepancy between advertising promises and learning outcomes, replication and repackaging of irrelevant training programs, faced with low-quality and simply outdated educational products.

New solutions and approaches, new methods and tools, new market players, who will probably be able to improve the quality and efficiency of educational programs and bring the education market to a higher quality level, are required in the emerging but already highly competitive MOOC market in Russia [62].

Nowadays education should provide novel experiences, prompt visual results, new social interactions, and the possibility to apply and consolidate the acquired knowledge and skills in practice as quickly as possible. Artificial intelligence, machine learning, big data, game mechanics, automation, microlearning, gamification, and virtual and augmented reality (AR/VR) are the education market development trends that “lie on the surface”.

The formation of the combinatorial configurations of these trends is the way to form a new, modern, relevant, innovative education. Leading trends in the future education system are associated not only with the search for new learning formats, but also new roles for all participants in the educational process.

Continuing Education, or Lifelong Learning. The concept of Lifelong Learning is not an unreasonable one in the rating of educational emerging trends of the future. In fact, it appears to be a necessity, without which it is impossible to imagine the quality of modern man’s life. Technology is updated at an incredible speed, new information is emerging, people are being replaced by robots, and the need for previously unknown professions is growing. All this makes us constantly being trained, just to sustain the necessary proficiency level.

Full digitalization. Digitalization is another important tendency in present-day education that is sure to stay with us for a long time. The phenomenon includes not

only the transfer to distance learning, but also the increasing role of mobile technology and the emergence of a new digital world for students. Globalization and the substantial student growth are the main reasons why learning is shifting to the digital world. For universities, it is much easier to launch courses online than it is to enroll everyone who wants to study face-to-face. However, it is also good for international students, who no longer have to travel huge distances to get a degree from a prestigious university.

Massive open online courses (MOOCs) are more effective than the previous two. Massive open online courses have effectively accomplished two tasks:

- provide access to up-to-date education to the largest possible number of people;
- facilitate an open and interactive process of learning.

Educational platforms like this, where courses from even the most prestigious universities in the world are available, are not only abroad, but also in Russia. For example, on a single MOOC platform, you can find modern study programs in data analysis, design, marketing, IT development, English and management. You can even find free courses and courses for children.

Gamification. “All the world’s a stage, and all the men and women merely players; they have their exits and their entrances” – Williams Shakespeare’s words in the XXI century take on particular importance, since now the game becomes an essential educational element [66]. A special term – Edutainment – has even been coined, combining the concepts of “education” and “entertainment”. Edutainment is the practice of involving children and students in the learning process, developing creative thinking, “soft skills”, which are so important in today’s world, as well as finding ways to interact with the other participants in the process [66].

Virtual and augmented reality (AR/VR). Gamification logically leads to another tendency – the use of virtual and augmented reality technologies. These allow us to look at the educational process in a novel way and make it more three-dimensional and captivating. Techniques of virtual reality not only increase the illustrative value of the studied material, but also extend the perception boundaries, helping to bridge the gap between theory and practice as closely as possible. VR and AR technologies’ effectiveness is confirmed by various experiments that are actively conducted both abroad and in Russian institutes [67, 68].

Dynamic Design Processes. With modern technology, we can access any information in one click. At the same time, real life and business do not depend on theoretical knowledge, but on skills. These two factors require a profound restructuring of the educational process. Therefore, students’ independent work is becoming increasingly important. Currently, they can find the required information before the study session and do their own research. Faculty members spend considerably less time on explanations and more on organizing group interaction and collaborative project work [69]. The emphasis is on case studies, problem solving, project development, brainstorming, and creative solutions [48]. The benefits: get a real-life hands-on experience; practice the skills they have learned; practice the obtained knowledge and skills; improve information absorption; participate and collaborate with others; maintain a high-level motivation for learning. Projects are a great alternative to boring lectures, after which students graduate from their alma mater feeling more motivated and prepared for real life [8].

Agile and Scrum technologies. Modern tendencies in educational process include not only new formats, but also new strategies and approaches to the organization methods. The implementation of Agile and Scrum technologies is one of them. Agile and Scrum in education enables the educational process to be divided into short segments, to enhance project teamwork and to monitor the training results. Agile methodology teaches university students to provide themselves with continuous feedback, handle each stage responsibly, and maintain high motivation. And considering that Agile and Scrum are, as a rule, the main methods of work in IT-companies, students acquire beneficial skills, which will definitely be useful for rapid professional growth.

The adaptive learning. The adaptive learning is increasing in importance all around the international world. The idea that education should be adapted to the student's needs has been known since ancient times. However, this idea became truly real with the development of artificial intelligence. The adaptive systems allow to set up the most individualized trajectory, considering the cognitive features of the student, his/her perceptive methods, and the initial level of training. Currently, adaptive programs have their limitations: they are not very suitable for the humanities and those areas that are subject to constant change. But these are areas for further technological development.

Integrated Approach. The integrated approach in both education and life implies interdisciplinary learning. Within traditional medicine, disease is a physical condition that must be treated with medication or surgery. The specialist who uses the integrated approach considers the disease not only from the perspectives of the physical body, but also considers the mental state of the patient, his or her relationships with others, family history, and is aware of alternative therapies. It is worth thinking about the multidisciplinary skills that will allow us to understand the subject from different perspectives if you want to be a truly in-demand specialist.

Shifting the teacher's role and chatbots. The important tendency that will only increase over time is the changing role of the teacher. He or she is no longer the only knowledge provider. Now, he becomes a facilitator who creates and supervises the educational process. On the educator's shoulders fall such tasks: engaging students in learning; keeping them motivated; devise and manage interactive projects; train how to think and critically perceive information. So who will do the assessment of knowledge? So far, this is also the task of the instructor. There are already services for developing chat-bots, which can automate the process and facilitate the teaching work.

Certainly, these are not all the novelties that are already actively used in education. But regardless of what technology comes into our lives, tests, term papers, thesis, and other types of work will definitely be part of the educational process.

7. MOOCs challenges

The MOOC is called “the most crucial experiment in higher education,” and this form is beneficial for the teachers and educational institutions themselves – it is sufficient to record the course once, the information does not need to be duplicated, and no personal presence is required. For those who take the courses, the benefit also seems obvious: They can be taken online, at any convenient time from anywhere in the world.

Currently, though, the MOOC market in Russia is stagnating. This applies both to educational products created by various universities and to those produced by independent third-party market players. Based on the expert estimations only a small part of leading Russian universities purchases such courses in significant amounts – about 20 million rubles a year [70]. In the next few years no significant growth in the number of mass open online courses for students of higher educational institutions is expected. One of the reasons is the lack of funds for the purchasing of these educational products and the lack of university administrations' interest in creating courses for the long-term and with a more strategic outlook. It is difficult for organizers to monitor the real progress made by students, to evaluate their involvement and their motivation, and to support them in timely manner. The major problem with MOOCs is that they are impersonal.

Although there are few practices of MOOC integration [35, 36] there is currently a legislative framework as well as the first successful examples. For example, Ural Federal University (UrFU) has become the first university in Russia to undergo state accreditation of educational programs incorporating various models of online course integration. In accordance with Article 15 of Federal Law No. 273-FZ dated December 29, 2012 "On Education in the Russian Federation", some educational programs can be implemented within network forms of implementation using the resources of other organizations in the MOOC format [71].

However, the lack of widespread application of MOOCs in higher education can be explained by several reasons.

First and foremost, this practice requires a restructuring of both the educational and administrative processes of the university [72]. To begin with, the university should have staff or separate units responsible for supporting students' online learning and monitoring the results of the learning process. The important aspect here is the change in the management of the university's teaching staff. For instance, by replacing an academic discipline with MOOCs, teachers are freed up their working time, which can be used for research activities [73]. It is worth noting that at the moment there are discussions on the time reallocation of university teaching staff due to the replacement of face-to-face courses with MOOCs.

Secondly, in order to re-credit the MOOC learning outcomes, it is necessary to adopt additional normative documents, which regulate this process. This would imply verifying the content of MOOCs, as well as the validity of their certificates [19]. Finally, the functionalities of the online platform providing MOOCs should allow students and teachers to track the learning process of the course [35].

Currently, three types of integration models of online courses into the educational process can be distinguished in the Russian higher education space [74]:

1. integrating MOOCs into a blended learning format;
2. replacement of the part of face-to-face courses of an educational program by online courses;
3. creating an online Master's program in which all courses are delivered in MOOC format.

As a rule, there are thousands of students who sign up for one section with one instructor. Occasionally the instructor is not even the one who created the course, and sometimes there is no instructor at all. Assignments designed to be more interactive, such as group discussions, can enhance the impersonal nature of these large courses.

In some subjects, especially those that are difficult to learn, such as math or science, this is not a major problem. However, arts and humanities courses are traditionally based on in-depth discussion and debate. Students often feel they are missing something when they learn in isolation [72]. For traditional classes, teacher interaction feedback is not just about ranking students. Ideally, they would be learning from the teacher's feedback. Unlike most MOOCs, unfortunately, it is impossible to get detailed feedback. Most instructors teach for free, and even the gentlest are simply not able to correct the hundreds or thousands of papers per week. Occasionally, MOOCs provide automatic feedback in the form of quizzes or interactives. However, without a tutor, some students make the same mistakes over and over again.

The high number of students on MOOC platforms can also be misleading. It can be very easy to get a class of 1000 when enrolment is just a few clicks away. Individuals find out about open courses through social media, blog posts, and sign up in just a couple of minutes. But they soon fall behind or completely forget that they are taking any course at all. On many occasions, this gives the student a chance to try out a course without any risk. But for some students, this means that they simply cannot handle the course on their own. Not all people are goal-oriented internally; some succeed only in a more structured environment with set deadlines and personal motivation [74].

The MOOC platforms do face serious problems, especially when regarded from the perspective of a new tool in higher education. The greatest threat to the continued existence of MOOCs, however, is the significant cost of creating excellent courses and the low probability that these costs will be quickly recouped, at least under the current revenue models of platforms in Russia [75].

There are several solutions to this problem. For example, MOOC platforms can create new revenue streams by offering training solutions to corporations. They can also charge more for professionally oriented courses and use that to subsidize their other offerings. Operating on the other side of the equation, universities can use various methods to reduce the production costs to create new platforms. Automating the MOOC process and training faculty can create new courses quickly and affordably, even with a small staff.

Finally, the government can get involved in the development of MOOCs. Some countries are already engaged in funding national platforms (examples include the French platform FUN or Israel's Campus-II). The Russian government starts investing in MOOCs so that platforms remain free. And the government has also made itself known [71]. The company "Rostelecom", on the technology platform of the social network "Vkontakte" group of companies "VK", has created and modernized the online platform for education and communication of high school students "Sphereum". In any case, if such support does not happen, the user will pay for everything. In the future, MOOC platforms will learn to better monetize their content, of which there will definitely be more.

7.1 Case study: high-priority project "Modern Digital Educational Framework in the Russian Federation"

Each year the information society is expanding. There are currently a large number of online learning and credentialing platforms, but, unfortunately, the existing diversity of courses is nowhere to be found in a centralized way. Generally, online courses are placed directly on the site of the educational institution, which implements and maintains them, and the participant, who is not a student of this institution, has no access to the presented list of online courses. Addressing this problem, a priority

project “*Modern Digital Learning Environment in the Russian Federation*” [62] was initiated, the main concept of which is to provide access to online courses, developed, and implemented by a variety of institutions on multiple platforms of online learning, to all categories of people and educational providers at all educational levels. This portal is designed to address the following challenges [64]:

- Implementing unified authentication using the “unified identification and authentication system”.
- Conducting a course search in the directory of online courses, an aggregator of online courses of different platforms.
- Performing quality assessment of online courses.
- Execution of online courses ranking.
- Generating digital student portfolios and recognition of online learning results by educational organizations and employers.
- Integrated authentication system using “unified system of identification and authentication”.

Implementing this challenge will allow users to authenticate themselves on the Portal, using the accounts in the state information system “unified system of identification and authentication”. Unified authentication technology makes it possible to use a single login on the portal, information systems of educational organizations, and various online learning platforms. Consequently, after a user has been successfully authenticated on the portal, when trying to navigate through the content of an educational institution’s online course on an existing online learning platform, no login to that system will be required.

7.2 Online course registry

The Online Course Registry subsystem collects and displays up-to-date information about online courses posted on various online learning platforms, including their main attributes and settings (course title, course description, link to the learning platform where the course is hosted and the competencies to be formed). The Registry enables the categorization of online courses and supports their versatility in order to maintain the online course modification history. An important function of the Registry is the automated data exchange with educational organizations’ information systems, online learning platforms, and the other informational systems about the online courses available for study.

7.3 Quality assessment

The “quality assessment of online courses” module ensures the preliminary compliance analysis of the published online courses with the minimum requirements of the system, the quality assessment, and its content by the experts. The expert review is formed by the multitude of rankings, assessed for their compliance with the accepted criteria (course effectiveness, practical relevance, in-depth development, interactive elements, instructor status, the possibility of broader use of the results,

societal relevance, etc.). The online courses may also be assessed by the participants who have completed the courses. Therefore, this sub-system allows the accumulation and storage of evaluations of quality, validated by experts and participants of online courses.

7.4 Online course rankings

On the basis of the online course rankings indicated by experts and participants, as well as on the similarity level of the considered at a particular moment online course with other online courses placed in the Registry, the calculated rankings of online courses are carried out. An algorithm for comparing competencies and learning outcomes, online course ranking visualization modules, as well as the storage of the rating history to ensure the data integrity at any point in time are used to ensure the correct calculation and display of rating values.

7.5 Digital portfolio

On the “Russian Federation’s Modern Digital Learning Environment” portal, everyone has the opportunity to create their own digital portfolio, which they can share with employers and academic organizations. This digital portfolio is integrated with various online learning platforms, and university and employer information systems, and enables users to view their results for online courses, Olympiads, accomplished projects, register their full academic records, generate a CV including the results of online courses, certificates, personal achievements, and educational background information. Each user can also specify and confirm the information about their work activity and career achievements, view certificates earned and the completed training activities, as well as receive appropriate feedback on personal development, career opportunities, and trainings.

7.6 Case studies of the Russian EdTech start-ups’ launch and development

7.6.1 Case study: EdTech

EdTech literally translates as “educational technology. Do not confuse it with the distance-learning technology that pampered parents during the pandemic. This is more than that online courses, learning enhancement, and training platforms all in a single bottle. The EdTech companies compete with each other by the presence of certain methods and tools. These enable you to obtain a high-demand profession, such as developer, marketer, or designer, in a matter of months. However, this is not the only advantage of *Edtech*.

In the current environment, the priority is given to large market players with significant financial resources, resulting in the displacement from the market of the less financially secure market participants, to the intensification of the collaboration processes, mergers, and acquisitions. In the period from 2015 to 2021, several large *multistructural EdTech conglomerates* were formed in the online education market of Russia as part of consolidation and consolidation, with total revenue of over 32 billion rubles in 2021. (44% market share of top 100 EdTech companies [30]). (see **Figure 2**).

Leading market player in online education in 2021, *VK Group* (former Mail.Ru Group), which includes *Skillbox Holding* (*Skillbox*, *GeekBrains*), *Skillfactory*, *CASPA*



Figure 2.
Annual Russia and CIS EdTech 100 recognizes the most promising EdTech innovation start-ups based in the region across the market [30].

(English language school), “Uchi. Ru” (“TutorOnline”, “CodeClass”, “Your Lesson”, “YaKlass”), “Algoritmika” (children’s programming school), “Tetrika” (online preparation for the EGE and OGE and classes in school subjects), “Umskul” (online school exam preparation), and the Brazilian language school “Mentorama”, 90% of the share of which is owned by “Skillbox”. The aggregate revenues of the group of companies “VK” in 2021 amounted to about 17 billion rubles (23% share of the total market share of online education of the top 100 EdTech companies) [64].

Group of companies “Skyeng” includes “Skysmart” (children’s segment) and the online university “Skypro”, which runs the programming school “Kodium” and the online marketing and design school “QMarketing”. The second major multistructure market player, with revenues of about 10 billion rubles in 2021, is a multistructure player with a 14% share of the total market of online education in Russia (top 100 EdTech companies) [30].

IT-holding “TalentTech” includes: “Netology”, “Foxford”, “EdMarket”. The third major multistructure market player by enterprise turnover, with revenues of about 4 billion rubles in 2021 (5% share of the total market of online education of the top 100 EdTech-companies) [30].

The company “Yandex” with the online platforms “Yandex.Practicum” and “Yandex.Tutorial” with revenues of about 4 billion rubles in 2021 (5% share of the total market share of online education) divides with IT-holding “TalentTech” in honorary third place.

It is necessary to note separately the activity of “Ultimate Education” company founded by “Ultimate Capital” investment fund in 2020 and incorporating EdTech projects in the following areas: design (Bang Bang Education), marketing (MAED), gamedev (XYZ), psychology (Psychodemia), and fashion (Fashion Factory).

The Company, with a relatively low, in comparison with the large EdTech conglomerates, the total revenue for 2021 in accordance with the official financial statements of about 500 million rubles, represents a promising multi-structure market player who owns a well-balanced portfolio of investments with high growth potential [64].

The Russian companies actively continue to expand into the international market. Besides start-ups initially created as international, “NovaKid”, “EBAC Online”, “MEL Science”, “Edstein”, “SpeakerGuru”, “Diductio”, “BeSavvy”, “Vectorly”, “Hinted”, “IntellectoKids”, and others, more than a quarter of the top 35 Russian EdTech companies already operates abroad, and investments into the international expansion the Russian educational online projects are a major investment trend in 2021.

The international market for online education already includes “SkyEng” (operating in Spain since 2019), “Skillbox” (in 2021 gained a 90% share in the Brazilian online school “Mentorama”, the first Russian EdTech project launched in 2020 in Brazil), “Uchi. ru”, “Algorithmika”, “Yandex.Praktikum and “YaClass,” “iSpring,” “Internet Lesson” (launched in Kazakhstan), “TutorOnline” (launched in Turkey and Brazil), and other Russian EdTech companies [76].

In terms countries and revenue among Russian EdTech projects, the leadership was seized by children’s online schools for foreign languages, mathematics, and programming, including:

- “NovaKid”, an online English language learning school, a developer of educational apps, online courses in math, foreign languages, and science and art;
- cartoons for preschoolers and their parents “IntellectoKids”;
- “Kodland”, an international online digital skills school for children and teens;
- an international programming school for children “CODDY”;
- children’s gadgets in the form of teddy bears “Mishka AI” (Smart Bear);
- “Algorithmika”, an international mathematics and programming school.

Major EdTech market operators (see **Figure 3**) [77] in Russia working in the business-to-consumer field can be conditionally divided into three clusters with sub-groups:

- For the youngest: smart interactive toys, pre-school training.
- For schoolchildren: distance learning, Internet services, platforms for preparing for the Russian State Examination, collaboration with tutors, doing homework online, programming courses, and advanced education services.
- Adults have EdTech platforms such as multidisciplinary online universities, training programs and online simulators, languages, humanities, wellness, and lifestyles.

Slightly less than half (40%) of EdTech companies in Russia are engaged in b2b, including vendors in the IT-sphere, platform developers, and specialists’ services for academic and business institutions:

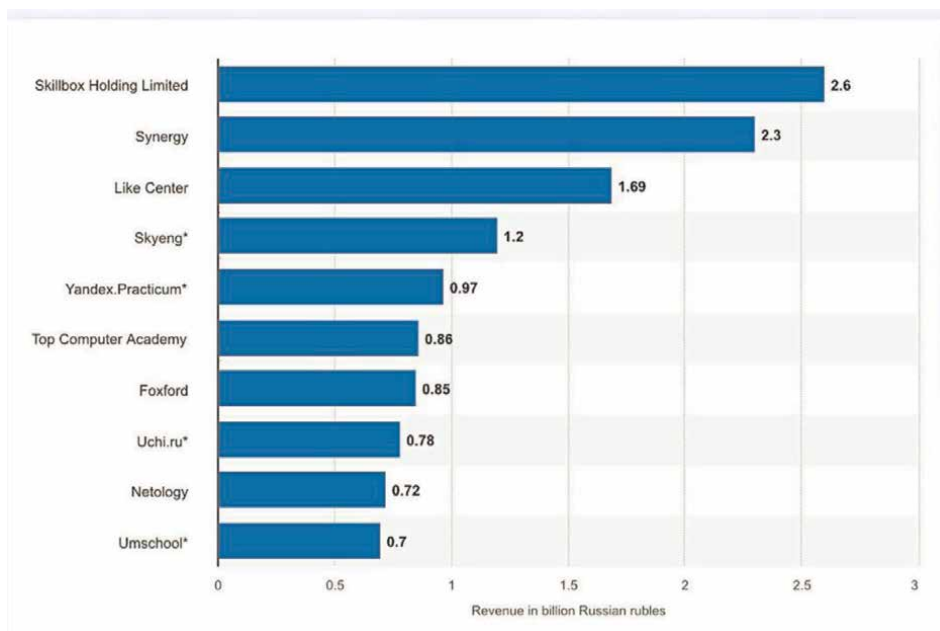


Figure 3.
 Leading EdTech platforms in Russia in 3rd quarter 2022, by revenue (in billion Russian rubles) [77].

- VR/AR-technology vendors in the education field;
- constructors of examination monitoring and observation systems;
- platforms for corporate training;
- solutions for launching online schools and training courses;
- the developers of equipment for education, and others.

As it can be seen, Russian EdTech is developing in the global trend.

EdTech, both in Russia and abroad, involves an ongoing analysis of the educational process in order to incorporate in its commercial proposal to bring trainees to a specified result.

The following techniques are extensively practiced while designing EdTech programs [78]:

1. *Game-based technique*. Which facilitates better learning by both children and advanced professionals due to considerable concentration of attention. At the moment it is used in practically all EdTech projects.
2. *Virtual Reality and Augmented Reality*. Possesses a high degree of visualization. VR and AR provide great potential in process visualization. For instance, while demonstrating chemical reactions in class, flasks and retorts are completely

virtual. No danger of inhaling poisonous fumes in case of mistakes – everything is demonstrated in VR with a thorough interpretation of what is happening. The Russian Railways also actively uses virtual reality technology: Training sessions for drivers and other categories of employees are held in the training centers.

3. *Artificial Intelligence*. That technology helps to make learning individualized. The curriculum is selected based on the analysis of the student's abilities. For example, when training novices' learners in business, the emphasis is initially placed on the formation of a core knowledge; but for those who have a specific experience, the curriculum is tailored-made to enable them, for example, to acquire the financial accounting nuances, the databases details, or the sales cycles construction.
4. *E-learning* is not even exactly a revolutionary trend, but rather a highly relevant method of providing training. One should not confuse it with distance learning, although there are certainly similar features. The E-learning takes place with extensive use of IT technologies and devices (virtual reality simulators, platforms for EdTech conferences, and software for smartphones). At the same time, teachers and students can be close to each other. E-learning radically changes the usual educational process itself. Actually, any course or workshop can be studied based on one's own preferences of place and time. It is possible to get a bachelor's degree online now as well since such programs are accredited, a "virtual" diploma is just as much accepted as a traditional face-to-face one.
5. *Microlearning*. The information environment of the contemporary world is extremely saturated. We are constantly exposed to streams of the very diverse information, and constant switchover from one to another discourages us from concentrating on anything specific for a long period of time. Classically educated adults are somehow able to absorb lengthy lectures, but young children raised in a culture of hyperattention begin to get bored and distracted after only six minutes. Splitting a considerable amount of material into several separate parts and presenting these modules as microlectures is a way to overcome the problem and is another type of educational countertrend in 2023. Microlecture is an information-rich lecture, usually lasting three to ten minutes. It discloses the concept of the area in question, provides terminology, etc. Table formats and infographics are used; to consolidate the material learned, there is often a test or practical assignment at the end. Providing the material in the form of distinct blocks encourages students to analyze information and to look for connections and correlations.
6. *Mobile learning*. However, including the already becoming mainstream online education is not really in demand among the young generations who cannot imagine their lives without a smartphone. They are interested in velocity, focus, and interactivity. It is not convenient to listen to an online lecture or other educational course from your phone, and the power may not be enough until the end of the event. A number of EdTech options offer an optimal solution to this problem. Many companies develop and actively implement educational programs for smartphones. Generally, the format of educational content in such applications is similar to the popular teen platform TikTok.

7. Subscription-based training. Before the massive pandemic lockdown caused by the COVID-19 pandemic, online courses were very popular. Individuals were actively using the products provided in the education market, absorbing the material, and receiving feedback and certification. However, such system has the significant drawback. Frequently, the purchasing courses online looked like buying “a pig in a poke”. On hearing the first lecture, the consumer suddenly becomes aware that the subject is of no interest to him, and the material itself is boring. Generally, in this case the money paid will not be returned, and the training efficiency without desire will be about zero. EdTech corrects the situation by introducing a subscription-based learning method. In this way, the users have access to the platform’s educational database. They can independently choose the courses they need at a given moment, combine, and change the course sets. Alternatively, they can stop learning altogether, without spending extra money on lessons they no longer need.

By analyzing current countertrends in EdTech companies, industry experts predict exponential growth in EdTech, at least for the next five years. History itself dictates the pace of global changes in the education industry which includes pandemic and other challenges. By the mid-twenty-first century, the demographic situation is believed to be one in which the number of graduates (both schools and universities) will be increased from the present number by two billion [75]. It is already forcing a radical re-evaluation of the methodologies, facilities, and entrepreneurial models of the education system. It will be necessary to solve complex problems under conditions of staff shortage and inadequate funding.

7.6.2 Business diversification by means of the international education market

Under the current conditions, business extension by entering the international education market seems more justified to business owners than development within the Russian market, including the possibility of attracting financing from international investment funds for a non-Russian venture jurisdiction.

7.7 “NovaKid”

As the most successful example at the moment, it is worth mentioning the international online school of learning English “NovaKid” [79] from the top 15 participants of the Russian market of online education with revenues estimated by Smart Ranking at 1.5 billion rubles for 2021. Founded in 2017 in Russia, “NovaKid” online English language school expanded into Turkey and Poland in 2018, in late fiscal 2018 – the legal entity was registered in Delaware, United States, and in 2019, the school began operating in Western European markets: Italy, Spain, and Germany. In 2020, NovaKid expanded into the North Maghreb and Middle East markets. According to public sources [79], the company’s revenue from “NovaKid” was about \$500,000 in 2018, \$2 million in 2019 and \$9 million in 2020, with the European market being the source of about 80% of the school’s revenue, the Asian market about 6%, and the rest of the revenue coming from the Middle East. The company’s estimated value in 2021 was in the \$150 million range. Over a four-year period, with an estimated 2021 value, “NovaKid” attracted about \$40 million in investment, mostly from foreign investors, including: BonAngels, Leta Capital, PortfoLion, LearnStart, TMT Investments, Owl

Ventures, and Goodwater Capital. However, “NovaKid” was originally created as an international company [80].

7.8 “EBAC online”

It is worth mentioning Russian businessmen’s Brazilian educational project, the online school of digital professions “EBAC Online” [81] which opened in 2020 and already generated monthly revenues of \$1.3 million in November 2021. Through 2021, the company has generated \$12.5 million in investments. Throughout 2021, the company attracted \$12.5 million in investments from the following investors, including foreign ones: Baring Capital, Begin Capital, AngelsDeck, and Sergey Solonin. The approximate value of the company in 2021 was in the range of \$82 million. “EBAC Online” opened an office in Mexico in 2021 and was targeted to expand into Colombia, Chile, Argentina, and Peru in 2022. According to an analytical company “HolonIQ,” “EBAC Online” was one of the top 100 promising Latin American EdTech start-ups in 2021 and is one of the EdTech leaders in the Latin American market [82]. Moreover, investment in the region has quadrupled from 2019 to 2021, from \$73 million to \$299 million, according to “HolonIQ.”

7.9 “MEL science”

The Russian–British educational company “MEL Science” (learning chemistry and physics through practical experiments using AR/VR technologies), launched in 2015 and currently operating in more than 40 countries, but focused more on the US market, has attracted about \$14 million in extra investment in 2020. Among the company’s investors: Yandex, Sistema VC (Sistema), Mubadala Investment Company, TMT Investments, Channel 4 Ventures, and Russian–Chinese Venture Fund (“RCIF”) [83].

7.10 “Algorithmika”

The company was founded in 2016, after two years worked in seven countries, and at the end of 2021 is already present in 37 countries and plans to enter the markets of Latin America and South-East Asia. The company develops by the franchise network under the same name. “Algorithmika” revenues were about 80 million rubles in 2017 and 155 million rubles in 2019. In 2019, the company was acquired by Mail.ru Group (VC), and in 2021, Algorithmika raised \$10 million in investments from two investment funds. In 2021, “Algorithmika” attracted \$10 million in investments from two investment funds: the Russian–Chinese Technology Investment Fund (RCTIF) and Winter Capital Partners Investment Fund. Over two years, from 2020 to 2021, the company’s revenue more than doubled, amounting to about 434 million rubles at the end of 2021.

7.11 “IntellectoKids”

The company “IntellectoKids”, the first mobile app for children, was launched in 2017 by Russian developers, and at the end of 2021, according to representatives of the company from open sources, the company’s applications are in the top ten Apple App Store (category Kids 5 & Under) in 40 countries and translated into more than 30 foreign languages. The main activity is concentrated in Europe and the United States,

and there is a slight expansion into the Chinese market. In 2020, “IntellectoKids” was raised as an investment in the first round of about \$ 3 million. It has raised about \$3 million from a number of investors, including: Allrise Capital, Genesis Investments, VERSHINA Capital, and QUONOTA Investments. Genesis Investments, meanwhile, has already invested \$1 million in the company. Genesis Investments invested \$1 million earlier in 2019.

7.12 “Kodland”

“Kodland” (which, according to public sources, is an alumnus of start-up Netology Group) was launched in 2018, raised \$1.5 million as an investment. It raised \$1.5 million in 2020. In 2021, “Kodland” expanded into the markets of Malaysia, Indonesia, Argentina, Spain, and India.

7.13 “CODDY”

The Russian programming school for children “CODDY” was launched in 2016. By the year 2020, “CODDY” launched a representative office in New York, and the company plans to expand into the markets of Spain and Italy. Franchise partners of the same name work in Russia, Ukraine, Belarus, Kazakhstan, Kyrgyzstan, Moldova, Armenia, Azerbaijan, Georgia, Israel, United States, Germany, Latvia, Estonia, and Uzbekistan.

7.14 “Mishka AI”

“Smart Bear” (i.e., Mishka AI) was launched in 2018, the first external investors were the accelerator company “Starta”, the investment fund “Tiltech”, and a number of individuals. The start-up won the accelerator “Sber500” in 2019 and subsequently participated in the “500 Startups” program in the United States. In the period from 2020 and 2021, “Mishka AI” launched the localized version sales of the product in the US market under the brand name “Smart Teddy”. At the end of 2021, with revenues of \$1.3 million, the company had an estimated value of \$1.3 million. The company’s estimated value was about \$15 million.

7.15 “Lectera”

The international educational online platform “Lectera” started operating in 2020 simultaneously in several countries, having launched branches in Russia, the UAE and the United States. The platform’s educational programs are based on its own specially developed Fast Education methodology and use the “Money Education” principle (i.e., learn to earn). During the year of launch, according to “HolonIQ” and “EdCrunch”, “Lectera” became one of the 100 best EdTech start-ups in Russia and the CIS. In 2021, Lectera was awarded the prestigious international EdTech Breakthrough Awards as the best platform for continuous learning. Initial investments in the project from the pool of private investors from Europe amounted to about USD 2.1 million, and by the end of 2021, “Lectera” is one of the few independent EdTech companies, 100% share of which is owned by one owner. During the period from 2020 to 2021, “Lectera” attracted about 200 thousand users from fifty countries and, according to the company’s representatives from open sources, reached the revenue of over 5 million US dollars in 2021.

7.16 “Educate online”

The Russian online platform “Educate Online”, launched in 2018, helps everyone from 4 to 19 years old to learn foreign languages, subjects of interest or get a complete high school education abroad in the United States, Canada, Britain, and Switzerland, in a remote format, and obtain two diplomas of complete secondary education: Russian and foreign. “Educate Online” also implements training and admission programs for higher education institutions abroad, career planning programs, and overseas internships.

In 2020, Educate Online raised \$650,000 in investments from “Angelsdeck” members, with the support of “Altergate.vc”, the Singapore-based investment fund that syndicated the deal. In 2021, “Educate Online” raised an additional \$4 million in investments. “Educate Online” raised an additional \$4 million from a number of investors, including: “Xploration Capital”, “TMT Investments”, “Flyer One Ventures”, “Softline”, and “Angelsdeck”. The funds raised, in addition to the further technological project development, should be used to expand market into Latin America, Asia, and the Middle East, as well as to create an international students’ community. According to “Crunchbase”, “Educate Online” cumulatively attracted investments in the range of \$5.4 million from 2018 to 2021. In the Russian online education market, “Educate Online” will further compete with the “StudyFree” platform as it develops the track of admission to foreign universities.

7.17 “StudyFree”

The platform for grants and scholarships abroad “StudyFree” was launched in 2018, during the year with the help of the accelerator program of the “Internet Initiatives Development Fund” (IIDF) reaching an average monthly revenue of 2 million rubles. According to open sources, StudyFree reached self-sufficiency in four months of its existence in 2018. Subsequently, it participated in the accelerator company “Fiztech.Start” and won the international competition “Seedstars”. In 2020, the “StudyFree” platform became the participant in the American accelerator company “TechStars NYC” (New York) and “Berkeley SkyDeck” (San Francisco) and attracted \$2.9 million in investments from international venture capital funds, including “Acrobator”, “TMT Investments”, and “I2BF Global Ventures” at the end of 2021. In addition to the Russian market, the company also operates in the markets of Africa, Brazil, the United States, and India. One of the strategic partners is the student loan company “Prodigy Finance”. The main competitor of “StudyFree” is the Canadian company “ApplyBoard”.

7.18 “Buddy.ai”

The virtual English tutor “Buddy.ai,” in which a cartoon robot “Buddy” helps the user learn words and practice pronunciation, was launched in the United States by Russian developers in 2018. In 2020, the start-up “MyBuddy.ai.” won the international competition “Global EdTech Startups Awards. The app “Buddy.ai” is an international project with its own know-how in voice technology and artificial intelligence, which works worldwide without any restrictions, helping children and adults to practice spoken English. Learning in the app is based on the use of game-based learning and spaced repetition methodology. In 2020, “MyBuddy.ai” merged with another start-up with Russian roots, “Edwin“, which developed adaptive learning

technology and created educational courses in English for foreigners using Facebook chatbots and a tutor. The new company kept the name “MyBuddy.ai.” and attracted \$1 million in investment in the same year, 2020. The company, “MyBuddy”, raised \$1 million from the Russian venture capital fund “Leta Capital”. “Edwin”, founded in 2016, had also already attracted investments of up to \$1.5 million during its period of operation prior to the merger. The company has also attracted investments of up to \$1.5 million from a number of investors, including: “General Catalyst”, “Y Combinator”, “Google Assistant Investments Program”, and others [84].

7.19 “GetCourse”

The market of Brazil has attracted the greatest interest from Russian EdTech companies in 2021. In addition to the above-mentioned companies already operating in the Brazilian market, the “SaaS” platform “GetCourse”, according to open sources, is considering Brazil as the priority for market expansion, similar to the Russian market in terms of the amount of the average check and similar volume of the economy. In 2021, “GetCourse” plans to invest at least 25 percent of the \$50 million raised as an investment in international development [83]. The significant investments in “GetCourse” draw attention to another track in the online education market, in addition to increased competition and the Internet promotion cost, market consolidation, and the expanding Russian companies into foreign markets: the share growth of the “creator economy” market segment. The revenue of online courses by independent authors and online schools on the “GetCourse” platform showed a two-fold growth in 2021, and in the next few years the number of producers and the number of consumers of online courses may increase tenfold. According to “GetCourse”, in 2015 every third platform user bought a new educational product from the same online school repeatedly, in 2016 already 40% users made the repeated purchases, and in 2020 the share of such users grew to 50%. In 2021, shares in “GetCourse” were acquired by investment funds: “Winter Capital”, “Goldman Sachs”, and “Baring Vostok”.

8. Conclusions

In this paper, indirect data were used to define the potential demand for online courses of Russian universities by international market. In order to obtain objective indicators, it is necessary to conduct additional research on the MOOC market demand, which would analyze data from platforms on the specified topics, as well as the surveys of potential online courses consumers.

These examples of the successful launch and development of Russian EdTech start-ups, including those in international markets, show the powerful potential of the Russian entrepreneurs and developers, including the intellectual potential as well. Moreover, in Russia there are successful examples of creation and development of large local players and multistructure companies that won in the local market in competition with global international players, although not without the instruments of support from national legislation and state protectionism: VKontakte, which locally beat Facebook and Yandex, locally dominating the Russian search traffic market, in relation to Google, for a long period of time.

The global EdTech market of online education, for the most part, is dominated by global players, including Coursera, Udemy, EdX, and LinkedIn. Large local foreign

players, similar to such companies on the Russian market as “SkyEng”, “SkillBox”, or “Like Center”, are virtually absent from the international market.

A number of Indian, Chinese, and American companies may be considered as an exception, which, according to “HolonIQ”, are among the largest global EdTech companies “Unicorns” [84], but Chinese, American, and Indian companies are growing mainly due to the rapid growth of the local market, which, in no small part, is focused on the US labor market. At the same time, the US and Chinese online education markets occupy leading positions in the total volume of the global market, respectively, while the Chinese market, being extremely complex and highly competitive for external participants, supports its own national projects as a priority, including at the expense of strict state regulation. Thus, the conditions of the global technology market create prerequisites and opportunities for the successful international development of Russian technological projects, including in the online education market.

Even taking into account the current situation in international relations, access to the international market is possible, and the world has not changed completely, the world is, the world is spinning and life goes on.

1. there are post-Soviet countries, the BRICS countries, and Asia as a whole, which was discussed in the article with numerous examples of the entrepreneurial and developer success of educational and development projects. I am even sure that while we are reading this article, at least a dozen more projects by our fellow citizens are entering the international market. Well done, keep it up!
2. there are many projects that have already emerged, which continue to emerge and are already working well, even in countries whose leadership pursues an anti-Russian policy. The international project under foreign jurisdiction – “money past the cash register” somewhere, as it would seem, but this is life – business works where the opportunities are created for it.
3. with any course of events, except a global world catastrophe, there are those who lose, and those who find – someone leaves the business in a state of crisis, someone, on the contrary, uses this situation to develop business, himself, the country, and the world community. The worst thing in life is to give up and admit defeat. You are struggling, too: you read, you responded, you wrote a comment, you criticized, you did not show indifference – that is fine, that is life.
4. every event affects our lives, and I will say more, I believe that every single act and action we take affects our lives.

Everything changes and everything passes – it is not worth getting used to anything.

9. Recommendations

It has become clear in the XXI century for MOOC education to enter the mainstream and become a growing market as it continues to expand access to learning for more people [85]. Consequently, online educators and students are required to summarize subject information in order to critically weigh up significantly different perspectives and incorporate different demands. However, they need to create such opportunities by providing critical learning spaces where students are encouraged to

increase their capacity for analysis, imagination, critical synthesis, creative expression, self-awareness, and intensiveness in action. Only well designed and effectively delivered MOOC courses can survive to realize the possibility of blending classroom boundaries and connecting formal learning with wider spaces and broader social concerns through a vibrant MOOC learning community. Ultimately, education is about encouraging different ideas, different perspectives, and a cacophony of voices.

Web-based instructors are widely seen as facilitators [86], who are supposed to facilitate the merging of different theories and vibrant impressions. Instructors should encourage students to associate their discussions, assignments, and group work with their own experiences, the perspectives of others, their subjects, and their own learning and work. The current MOOC education is largely a one-size-fits-all standardized curriculum model that ignores students' needs [87, 88], and more attention should be paid to exploring how online offerings can meet the needs of individual students and provide differentiated online instruction through course design.

Furthermore, there is a need to know more about students' online experiences and what motivates students to participate in online learning. After all, online education is about students – their learning, academic performance, and much more. Better knowledge about the online process and the people involved will enable online educators and institutions to better design their courses, meet students' needs, and position themselves in a competitive global marketplace. Ke (2010) in his study pointed out that *a group of friends can dominate online discussions, thus intimidating newcomers*. From now on, facilitators should make a greater effort to appreciate the differences that exist in the online classroom, regardless of race, gender, class, ethnicity, sexual orientation, learning ability, experience, and socio-economic status. The focus should be on finding ways to strive for diversity to bridge differences, eliminate divisions, and promote these goals in the online environment. Instructors should try to create, facilitate, and promote an environment in which all students can learn from each other.

Eventually, instructors of MOOC courses deserve more research attention in order to explore their learning paths and professional development needs. It was reported that a large number of higher education teachers were reluctant to teach online courses, and those who did teach online courses reported that online lessons took much longer than face-to-face mode. Conversely, a common misconception is that online learning is easier than traditional classroom instruction. Considering the fact that MOOC is a new dynamic for beginners and experienced teachers alike, appropriate professional development is needed, which may include effective course design, coaching, implementation, and evaluation.

This review was initiated with the intention of the authors to design and teach MOOC courses, based on knowledge and information from the existing literature, but the authors sought to contribute to the field by discussing best practices and effective evidence-based strategies in online education. It can be useful for individual programmes and educators who want to design online courses and individualize course instructions and personalize academic learning. The research may also be useful for institutions that want to institutionalize online education in an era of fast-growing technology and increasing austerity. Individual institutions have their own vision and mission, and this research may enable them to create innovations for teaching and learning.

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Perspective Chapter: Implementation of MOOCs for Microcredentials and European University Alliances

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Philipp Leitner, Sandra Schön and Behnam Taraghi*

Abstract

MOOCs are seen as an important measure to open up universities to new target groups. In this chapter, two new variants of the usage of MOOCs in European higher education are highlighted: First, openly licensed MOOCs can be used as part of microcredential offers with university accreditation. Second, openly licensed MOOCs can be made available to other universities as an integrated resource and offer within European University alliances. This chapter discusses legal (such as copyright issues), organizational (such as processes), and technical issues (such as LTI, eduGAIN) for these new developments. An important requirement for this is that MOOCs are available as open educational resources (OER): Open licenses that allow the reuse, modification, and republication of educational resources (“open education resources”) are another opportunity to open up and share university offers. This chapter is based on experiences of the national Austrian MOOC platform iMooX.at, the microcredential implementation of Graz University of Technology, as well as first ideas concerning the integration of openly licensed MOOCs within the unite! University alliance of nine European technical universities.

Keywords: open educational resources, opening-up, open education, MOOCs, micro-credentials, university alliances

1. Introduction

Open education is a vague term for many different developments and movements that are currently underway in higher education institutions and universities worldwide. Openness has various meanings but is frequently related to opening-up processes, offers, or resources to people who are not traditionally considered relevant target groups (see **Figure 1**) [1, 2].

In practice, opening-up can address, for example, the issue of educational resources that are typically proprietary but can also be made available as open educational resources (OER; [3]). Open licenses then allow to modify and reuse these

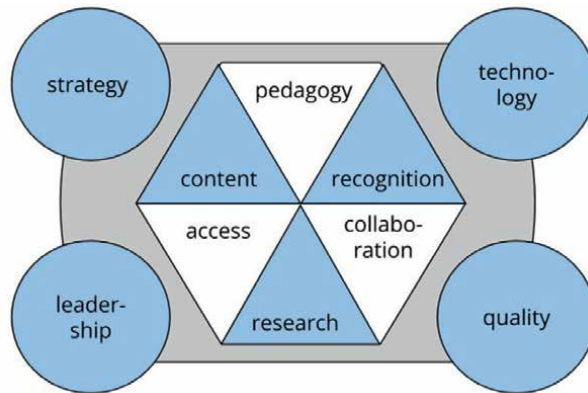


Figure 1.
The 10 dimensions of open education according to Inamorato dos Santos, Punie & Castaño [1]. Own illustration.

	RESOURCES	TEACHING	CERTIFICATION
TRADITIONAL TEACHING IN HIGHER EDUCATION	Limited to own students or proprietary educational resources	Limited to own students	Limited to own students
MEASURES TO OPEN-UP TEACHING	Open educational resources allow modification, re-use	Participation at MOOCs is possible for everyone, externals serve as lecturers	Microcredentials are accessible for non-students as well.

Figure 2.
How traditional teaching in higher education is opened-up. Source: Own illustration.

resources. Teaching itself is traditionally limited to the university’s own students, supported by own lecturers. MOOCs, for example, now open up the possibility of university teaching to everyone, including those without formal university qualifications [4]. Another issue for more openness is assessment and certification: Traditionally, this has also been an offer for the university’s own students, but lifelong learning departments have supported access to university further education for several decades now. What is new now is that short study programs and the so-called “microcredentials” are being introduced, which offer university accreditation of certificates for non-students as well (Ebner, Kreuzer, Schön, see **Figure 2**).

In this chapter, we would like to take a closer look at two aspects of MOOCs for which we see greater relevance in the future:

Firstly, we would like to present which role MOOCs currently play in the discussion of microcredentials and how they are used for microcredentials in the case of TU Graz.

Secondly, we are concerned with the question of how MOOCs can be used systematically, e.g., as a transition to Joint Programs within the framework of European MOOC alliances and how a MOOC platform can be well embedded in the technical infrastructure of a university alliance.

We discuss both questions here against the background that we would also like to present our internal discussion to a broader professional audience in order to stimulate and maintain the exchange about (future) developments.

2. Methodology

This contribution describes two future developments in which we believe openly licensed MOOCs play or might play an important role: in the context of microcredentials and European University alliances.

Methodologically, the status quo is introduced with the help of simple literature reviews on the topics and then, the current state of discussion at our institution is presented in the form of a case study. Case studies are typically used as a research method if elaborated models or theories are not yet available, in order to develop a clearer understanding of complex issues in real-life contexts [5], which is often the case in the field of applied IT issues [6]. Particularly for the topic of integrating MOOCs into a European University alliance infrastructure, we cannot build upon an existing implementation and can therefore only describe the current and preliminary state of the discussion. The presentation and comparison of legal, technical, and organizational challenges and the respective possibilities is based on the authors' discussions and reflects the current state of affairs.

The chapter shares experiences of the national Austrian MOOC platform iMooX, at the microcredential implementation at TU Graz as well as first ideas concerning the integration of openly licensed MOOCs within the Unite! university alliance of nine European technical universities. We therefore systematically highlight and discuss legal issues (such as copyright), organizational issues (such as processes), and technical issues (such as LTI and eduGAIN) related to the usage of MOOCs for the two cases described.

3. MOOCs as a basis for microcredentials: development globally and in Austrian higher education

At an international level, the debate about microcredentials is largely driven by MOOC platforms, especially those originating in the US and affiliated to higher education institutions [7]. Contributions frequently explore how MOOCs can be recognized in higher education (e.g., [8]). In the European context, MOOCs currently play only a small role in the debate on microcredentials [7, 9]. However, there are several developments that consolidate the idea of microcredentials for the European area [10]. MOOC platforms are also becoming active in the discussion about comparability and standardization of microcredentials. The European MOOC Consortium (EMC), a consortium of six European national MOOC platforms, has published the so-called "Common Microcredentials Framework" in 2019 [11]. Recognized European developments such as the European Credit Transfer and Accumulation System (ECTS) or the European Qualifications Framework (EQF) are used to describe the requirements for microcredentials [12]. The MOOC platforms have so far used this framework on a voluntary basis. In the long term, however, the aim is to develop opportunity for formal qualifications and standards that can be used by a broader group of European Universities.

In 2021, the European Commission launched Europe-wide consultations in preparation for a "Council Recommendation on Microcredentials for Lifelong Learning and Employability". Looking at the comments together, there is only one reference to a MOOC, namely "Una Europa," a MOOC on sustainability that can be recognized at partner universities ([13], p. 58). The outcome of the consultations was then formulated by the Council of the European Union in June 2022 as a "Recommendation on

Microcredentials”: This calls on Member States to develop a common approach to microcredentials, i.e., as proposed by the EMC and others, a common definition and principles, and to apply EU standards [14]. MOOCs are not explicitly mentioned in the recommendation.

In Austria, too, the process for a joint position finding of the different higher education organizations on microcredentials was initiated and a joint statement 2021 was presented by the Federal Ministry of Education, Science, and Research. The possible parameters for microcredentials include the possibility of different learning locations, but MOOCs are not explicitly mentioned (“online, on-site, or mixed,” BMBWF 2021, own translation, p. 2). The position paper also emphasizes that microcredentials should be reserved for higher education, just as “the application of ECTS credits is reserved for recognized post-secondary educational institutions” ([15], own illustration p. 2). It is also pointed out that microcredentials can have a positive impact on cooperation between higher education institutions, especially in the European Higher Education Alliances ([15], p. 4). However, to our knowledge, microcredentials have not yet been offered by any Austrian university till autumn 2022, so presumably MOOCs have not yet been used for this purpose either.

In the following, we would like to trace the development of MOOCs in Austria. In 2014, the Austrian University Conference (uniko) published its first article on MOOCs, their criteria, and guiding principles. The platform iMooX.at was founded in 2013 by Graz University of Technology and the University of Graz with the aim of offering “education for all.” The platform’s MOOCs enable all Austrian universities to offer free, open online courses for their own students as well as the public and lifelong learners [16]. This provides the opportunity for new collaborations between universities and opportunities for learners to learn with MOOCs from other universities. From the beginning, it was determined that all course components—videos, documents, etc.—must be licensed with a Creative Commons license, as must the entire course itself. Therefore, the entire platform offers online courses for a large mass of learners at university level as an Open Educational Resource (OER). Since 2013, more than 200 courses from different research areas and at different educational levels have been offered. In 2020, the MOOChub consortium was founded by TU Graz with the idea of bringing together all MOOC platforms in German-speaking countries. Subsequently, a common standard for MOOC descriptions was developed and coordinated between the different providers. As a result, the moodhub.org website now features more than 700 online courses that are searchable by topics, providers, and interests. The Austrian national MOOC platform iMooX.at has also been a member of the European MOOC Consortium since 2021 and has thus also agreed in principle to use the Microcredentials Framework.

Until fall 2022, no microcredentials could be earned on the iMooX.at platform or with the platform’s MOOCs, as already written. In the years before, there were already some examples of how MOOC achievements were recognized at universities. However, these credits were only awarded to regular students at the respective university as (partial) credits for lectures or certificates. In addition to the recognition of participation in MOOCs on the iMooX.at platform at individual universities (as part of courses), there was also recognition in the context of continuing professional development, e.g., participation was recognized by the Austrian Health and Nursing Association (ÖGKV) or, in the case of several MOOCs, recognition was granted by the Continuing Education Academy (wba) ([17], p. 6). So that no misunderstandings arise: Again, these are not awards of “microcredentials” but recognition of educational achievements by third parties.

TU Graz has been operating the national MOOC platform iMooX.at since 2013 and has already recognized the strategic potential of OER for the organizational unit “Life Long Learning” (LLL) before and officially strategically anchored it [18]. Thus, it was also obvious that MOOCs from the platform iMooX.at could be used when the introduction of microcredentials was considered at LLL [19]. The academic continuing education offerings of the LLL organizational unit at TU Graz were reorganized and restructured with the continuing education offensive in the area of “Digitalization and Digital Transformation.” The learning offers and the certificates of completion are now organized into “modules,” which comprise learning achievements equivalent to five units of the “European Credit Transfer and Accumulation System” (ECTS). The learning effort for such a LLL module is thus calculated to be about 125 h hours (1 ECTS = 25 h). As shown in **Figure 3**, it combines blended learning activities such as a MOOC or an online course, face-to-face training (which can also take place online), and a transfer task to demonstrate the application. If all components are demonstrably and sufficiently fulfilled through an appropriate performance assessment, microcredentials will be awarded for them in the future.

The first courses for awarding microcredentials were announced on the microcredentials.at website in October 2022 and will start in February 2023, as **Figure 4** shows. In each case, MOOCs will be used or explicitly created for continuing education, and lecturers from Graz University of Technology (TU Graz) will subsequently take over the on-site training, the supervision of the transfer phase, and the final performance or competence assessment.

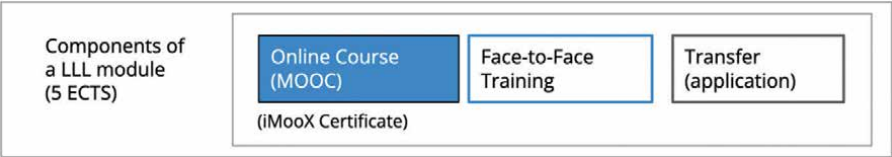


Figure 3.
Components of an LLL module and a microcredential. Source: [7], Figure 3.

mc microcredentials.at

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Figure 4.
Announcement of new LLL offering: Microcredential.at. Source: Screenshot from <https://microcredentials.at/> (4.11.2022).

Although we cannot already share first experiences with the implementation of these MOOC-based microcredentials, we want to describe challenges and possible solutions we have already addressed for those who have similar plans.

4. Challenges and potential solutions for using MOOCs in microcredentials

In the following, we present organizational and technological challenges for the use of MOOCs in the context of microcredentials for (European) universities (see **Table 1**). To start with legal issues, one of the main challenges is that the reuse of MOOC materials on other platforms or the (commercial) use of MOOCs is usually not possible or allowed due to copyright and/or restrictive user terms of the MOOC platforms. If MOOCs and their components are published with open licenses (such as CC BY 4.0 International), a clear legal framework is provided, and the MOOC (re)use is explicitly permitted. This includes the reuse of materials, for example, for presentation in face-to-face sessions as part of the microcredential course. But of course, both issues—user terms and licenses—need to be carefully considered.

Many MOOC platforms use user data, also commercially, and not fitting concerning European GDPR and the need of public universities. European MOOC platforms, especially provided by European University, are fully aware of GDPR issues and will not—for example—sell learners’ data to private companies.

Organizationally, MOOCs should be available, started, and organized fitting to the microcredential schedules so that the participants can benefit from other learners and the potential international environment and multi-perspective insights. Cooperation with the MOOC organizer and/or the MOOC platform is therefore essential. Although the microcredential assessment and certification are based on separate assignments and assessment, it would be helpful if the MOOC platform itself provides reliable certificates or insights into the learning processes. These can be, for example, the usage of a unique assessment for a specific e-mail address. In the case of iMooX, open badges (Mozilla foundation) are implemented [20, 21]. Interesting future developments might be the European Digital Credentials Infrastructure [22] or learning analytic insights

	Challenge	Potential Solution
Legal	Copyright issues, restrictive user terms.	Open licensed resources.
	Use of user data for commercial purposes, not fitting to European requirements (GDPR) and university standards.	European MOOC platforms are fully aware of GDPR issues.
Organizational	MOOCs should fit to the microcredential needs.	Cooperation with the MOOC organizer and platform.
	Reliable/valid certificates.	Open badges, digital credential framework.
	Insights into learning activities.	Learning analytics of microcredential participants.
Technical	Simple registration needed.	EduGAIN.
	Possible exchange of user data.	Learning tools interoperability LTI.

Table 1.
Challenges and potential solutions for using MOOCs in microcredentials for (European) universities.

for microcredential participants. Technically, the usage of an external platform usually needs new full registration. EduGAIN enables an easier way to register, if the organization already supports it [23]. This is already the case at many European universities, where it is especially used for access to the wireless Internet access “education roaming” (eduroam) [24]. Learning tools interoperability (LTI) might be another base to support exchange of user data between a MOOC provider and the learning management system of the university offering a related microcredential [25].

5. MOOCs for (European) university alliances

If MOOCs are to be used not just by one university in the context of a microcredential, but by several different universities, the challenges and potential solutions are generally similar, but not in detail. Within the European Union, more than 40 the so-called “European University alliances” have been established in recent years. Within the “Erasmus+” program, several of them developed their cooperation co-financed by the European Union [26]. The European University alliance Unite! [27] presents itself as a European University alliance “of innovation, technology, and engineering of nine universities connecting European regions of economic prospect, entrepreneurship, and innovation.”

Since autumn 2022, TU Graz is a member of the alliance and responsible for the work package “digital campus” within the new Erasmus+ project (2022–2026). A Moodle-based the so-called “metacampus” has been implemented as infrastructure to support virtual mobile learning and teaching, easy access for Unite! students and staff is supported by EduGAIN. As a next step, TU Graz is interested in bringing its existing MOOC experiences and the iMooX platform into the metacampus. The following chapter illustrates the first considerations and plans.

6. Challenges and potential solutions for using MOOCs in European university alliances

In general, the challenges and potential solutions for using MOOCs in European University alliances are similar to, but not identical with the challenges presented for using MOOCs in microcredentials (see **Table 2**).

Legally, the use of the MOOC for multiple partners must be permitted and contractually regulated. Since MOOC contents might also be reused in lectures and assessments, the reuse of materials should also be legally permitted. As the European Universities use different languages, translation might also be required for application in lectures and curricula. Providing these possibilities for all Unite! Universities, and thus also for lecturers and students, could be achieved by contracts within the alliances, but a simpler way would be the use of open licenses for MOOC content.

Organizationally, MOOCs that might be applied or are applicable to many different curricula and university (systems) need to be aligned with the requirement analysis of all potential partners and users, such as: What are relevant topics, methods, time efforts for learners? Additionally, a joint development and organization of a MOOC also requires clarification of the workload and responsibilities of lecturers as well. Helpful frameworks in Europe to support these discussions are standards such as the European Credit Transfer and Accumulation System (ECTS). An organizational issue is also the user support of MOOC learners from different universities and with

	Challenge	Potential solution
Legal	Usage of content and MOOCs must be permitted (by a contract e.g.).	Allowed usage, if openly licensed.
	Translation of the materials should be possible.	Allowed usage, if openly licensed.
Organizational	Different curricula and MOOCs need to be aligned.	Standards as ECTS and other curriculum framework might help.
	Multilingual user guidance and support.	Staff of partner university might be integrated in user support.
Technical	Simple registration needed.	EduGAIN.
	MOOC content and achievements should be accessible for partner universities.	LTI interfaces need to be developed and adapted for all universities and/or a common campus. A federated LMS instance might be helpful.
	Clarify the possible exchange of user data.	Needs a clear description of ALL existing systems and potential interfaces and/or a common campus according to GDPR.

Table 2.
Further challenges and potential solutions for using MOOCs in European university alliances.

different first languages; multilingual user guidance and support typically cannot be provided by a MOOC platform itself. Thus, co-operations with the relevant partner universities to establish technology-related user support in all relevant languages will be an issue as well.

Technically, there are several issues as well: To facilitate access to the MOOCs, easy access and registration are crucial. Again, EduGAIN is one way to allow easier enrollment if all alliance universities already support it. Additionally, MOOC content and data (such as achievements) should be accessible in the local learning management system (LMS) of partner universities. Therefore, learning tools interoperability (LTI) interfaces need to be developed and adapted. Then, such technical solutions will influence the exchange and storage of student and lecturer data. According to European Union's General Data Protection Regulation (GDPR), these issues need to be clarified, named, and taken seriously in the case of shared digital infrastructures. The connection to a MOOC platform used by a European University alliance might be easier if an (existing) shared digital campus is already available as an interface.

In the case of the Unite! alliance, a federated Moodle instance might also be helpful. This is an installation of Moodle that can connect to other installations of Moodle to form a shared pool of courses, users, and resources. Federated Moodle instances can also be connected through Learning Tools Interoperability (LTI) tools, enabling the exchange of content and resources. This allows courses and materials to be managed from a central platform and used in different Moodle instances.

7. Discussion: opening-up with openly licensed MOOCs for microcredentials and European university alliances

While the organizational and technical aspects discussed in our previous comments may be understandable, the strong emphasis on open licenses and the demand

for OER in this paper may not be as clear. We would like to acknowledge this aspect here in the concluding discussion.

As the most important argument, it is first necessary to clearly present again what alternatives there are: What is the alternative for the use of MOOCs in microcredentials and for common teaching content in European University alliances? In both cases, learning content might be developed and used, which is regulated by appropriate contracts. In the case of European alliances, this is required between universities from different countries and legal systems.

From this perspective, the usage of open licenses might be a pragmatically easier way to clarify legal issues related to the reuse of content within microcredentials as well as the use of MOOCs in European alliances. As we have seen in our introduction, open educational resources (OER) and MOOCs are seen as measure for opening-up higher education [28]. So openly licensed MOOCs should thus have similar effects as OER in general. According to a white paper by the Austrian e-learning in higher education network “fnma,” these are, for example, potential teaching innovations, higher impact, new co-operations, and less copyright infringements (because everyone is better trained in copyright issues) and more [29].

Although there are several funding programs where the development of OER is obligatory, especially from the European Commission, the development of sustainable business models for MOOCs and MOOC platform within Europe is still an open issue. This is a particular challenge in European countries where access to higher education is virtually free of charge; here, “return-on-investment” models, especially those of commercially oriented U.S. universities, cannot be implemented [30]. This is also the case in Austria. Currently, the national platform here is co-financed with project funds from the Austrian ministry, but it is necessary to also consider other possibilities of refinancing so that the creation of MOOCs retains or gains attractiveness.

From this perspective, the use of MOOC in microcredentials is an attractive opportunity for further business model development. In principle, MOOC providers want to bring content into the world and are pleased when the materials are used and have an impact. Particularly numerous participants and use are experienced here as a goal and actively supported. If MOOCs are used in microcredentials, usage and impact increase. Conversely, microcredentials, for which the participants pay, also open (re)financing possibilities for the (renewed) implementation of a MOOC, its adaptation or even creation within the framework of a microcredential. From the perspective of the microcredential provider, the MOOC is then the opportunity to attract potentially interested parties for the associated microcredential, i.e., people who are interested in in-depth training and official university certificates. If the model is accepted, the creation of further microcredentials offerings will in turn create updated or new MOOCs—the MOOC platform offering can thus also be co-financed.

In the case of jointly offered MOOCs in European alliances, there are other effects which in turn also have an impact on the business model of the MOOC creators and MOOC platforms. If MOOCs are used in European University alliances, content standards are implicitly set, resources can be used more sparingly (there is a somewhat greater one-time effort for the partners and less for everyone). And then the European alliances also promise didactic-methodical and content-related impulses through the cooperation of the teachers and from the meeting and joint learning of students.

To sum up, openly licensed MOOCs can be seen as a base for opening-up certification schemes and alliance offers and are a great resource to be used within university

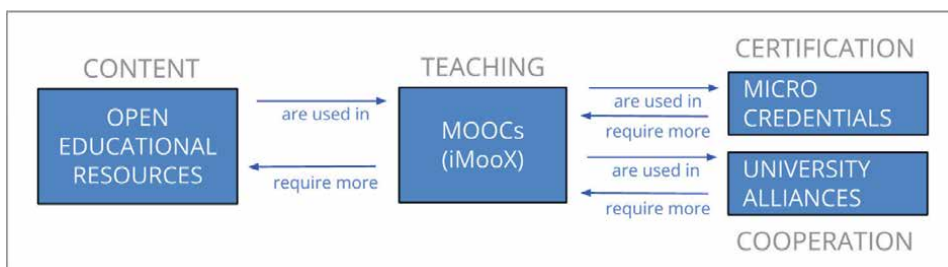


Figure 5.
OER and MOOCs as a base for new certification and cooperation possibilities. Own illustration.

co-operations or alliances. As shown in **Figure 5**, the sketched usage will additionally positively influence and foster *vice versa* the development of openly licensed MOOCs and OER.

Therefore, from our point of view, the usage of openly licensed MOOCs is not only a potential solution, especially for legal issues, for microcredentials, and European University alliances, but also a potent driver for opening-up European Universities, with relevance to business models for content development and delivery on university-level for everyone.

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Conflict of interest


The authors state no conflict of interests.

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Perspective Chapter: The Efforts to Increase Students' Understanding of Prayer through the Use of Audiovisual Media during the COVID-19 Pandemic in Elementary Schools

Suharsiwi, Muhammad Choirin, Anis Setiyanti, Siti Rahmah and Busahdiar

Abstract

Audio-visual media is an effective tool for teaching prayer to grade I children due to their preference for visual stimuli and ability to imitate movements seen in videos. This approach can replace direct classroom instruction and promote better learning outcomes. The research employed class action research at SD Ar-Rahman Motik, South Jakarta, specifically in class IB. The aim was to enhance students' understanding of prayer. The study began with pre-cycle activities to assess students' abilities, followed by teaching prayer using audio-visual media during the cycle. The results demonstrated improvement after the implementation of audio-visual media. Prior to its use, only 11% of students demonstrated a good understanding of prayer readings, while 89% had sufficient or lacking ability. In terms of prayer movements, 5% exhibited good proficiency, and 95% had sufficient or lacking ability, falling short of the Minimum Completeness Criteria. However, after the intervention, 94% achieved good proficiency (39% good and 55% very good) in prayer readings, and 100% exhibited good proficiency (39% good and 61% very good) in prayer movements. Only 6% (1 child) showed a deficiency in prayer reading. Overall, 80% of students met the criteria, eliminating the need for Cycle II.

Keywords: prayer, audio, visual, KKM, pandemic COVID-19

1. Introduction

At the end of 2019, the world was shocked by the transmission of an epidemic called Corona Virus Disease 2019 (COVID-19). COVID-19 first appeared in the city of Wuhan, China at the end of December 2019. The COVID-19 virus is a new type

of virus whose transmission speed is faster than previous viruses such as MERS and SARS [1]. This reminds us that we should not underestimate the types of diseases that are sweeping the world. This pandemic has affected the world of education, so the government has made a policy to implement distance learning in all corners of the country. The government's sudden decision to close or move the learning process from school to home has confused many parties [2]. It is not without reason that the government imposed this regulation because the spread of the Coronavirus can easily infect crowds of human activities such as offices, markets, houses of worship, and also education [3]. Schools' unpreparedness to carry out online learning is the main factor in this chaos, even though the government is providing alternative solutions in assessing students [4] as a condition for promotion or graduation from educational institutions during an emergency like today [5].

This transition to learning methods forces various parties to follow the path that can be taken so that learning can take place, and the choice is to use technology as an online learning medium (In the Network). The same is true for educational institutions at Ar-Rahman Motik Elementary School, program activities that should have been planned such as National Examinations, Art Performances, and Class 6 farewells. Graduation and a series of programs had to stop suddenly. It was canceled, and everyone was shocked and almost did not accept this situation. This was no exception in a series of superior programs at SD Ar-Rahman Motik, especially in the habituation of carrying out moral formation and routines of worship which are continuously instilled in schools every day.

Based on the learning evaluation for approximately 4 months (March–June 2020) as well as input from parents of students, all teachers made breakthroughs to make learning as effective as possible, by completing learning facilities and infrastructure and using online-based technology. For even better learning in the 2020–2021 Academic Year. The activity program has been well structured, and flagship programs are still scheduled such as the Khatam and Tahfidz Programs, one day one father's Memorizing program, learning programs to read the Koran in grade 1, and even art programs are also implemented such as the Dance Club. Everything is carried out with the approval of the parents of students and still refers to government policies while continuing to carry out online learning from home. Everything is going quite well, because the school is also trying to complete the need for adequate facilities and infrastructure to be used when learning from home, such as increasing the school's internet quota from 8 to 20 Mbps. Each class is equipped with a PC that is connected directly to the InFocus and highlighted on the wall to depict the children staying at school with the teacher. Another facility is the use of the paid Zoom meeting application to conduct virtual learning, as well as several other supporting applications, such as Google Classroom, Google Drive, Quizziz, Wordwall, Jamboard, Kazoot, Teacher's Room, and YouTube.

Parents are also very proactive and supportive of school programs, every child is equipped with Information Technology tools for effective teaching and learning to take place. At first, they were not ready to equip their children with these information technology facilities because they were worried that they would be abused, but over time and equipped with information in utilizing technology they finally equipped learning facilities in the form of laptops, gadgets, and the like for the learning process which took place from 07.00 to 10.00 morning. Everything went quite well, although not optimally, there were some problems until this writing was made, namely how the prayer habituation program, which should have been carried out in grade 1 since the beginning of semester 1, could be carried out in the following semester, like the implementation of other subject matter.

Prayer is an obligation that must be carried out in Islam, namely prayer because prayer is one of the pillars of Islam. By praying 5 times a day, children will get used to discipline and have good character. This is because in prayer children will practice concentration, humility, and patient in carrying it out [6]. In the Qur'an, there are instructions related to the process of educating children which are not free from challenges and obstacles and require a long time. As explained in [Q.S. Thaahaa (20):132] which means: "And instruct your family to establish Prayer and be patient in doing it." We do not ask you for sustenance, We are the ones who provide sustenance for you. And the (good) result is those who are pious [7]. Prayer must be practiced from an early age so that in adulthood it will become a necessity that will never be abandoned [6].

Regarding prayer activities, currently, it has quite a long impact, especially on children's understanding of reading and prayer movements which must be trained in students in grade 1 SD Ar-Rahman Motik. Some of the obstacles experienced by teachers in learning-from-home situations include: (1) Limited knowledge and ideas of teachers in choosing the right methods and programs for activities that require direct practice; (2) The prayer program has a quite long impact on children's understanding which includes reading and prayer movements that are trained for first graders of SD Ar-Rahman Motik; (3) Not all parents get used to their children praying at home; (4) Additional study time related to the student prayer understanding program which is usually only conducted from 07.00 to 10.00 pm; (5) Readings: prayer readings that use Arabic. And some students feel that the vocabulary is a new vocabulary; and (6) Other constraints such as the internet network which is sometimes unstable.

Based on a needs analysis, at SD Ar-Rahman Motik regarding reading comprehension and prayer movements for grade 1 SD Ar-Rahman Motik as follows:

No	Prayer readings and movements	Student mastery		
		Dominate (%)	Less master (%)	Not master (%)
1	Prayer readings			
	Prayer intention	18.20	45.50	36.30
	Iftitah prayer	13.60	31.80	54.50
	Ruku prayer	40.90	22.70	36.40
	I'tidal prayer	18.20	27.30	54.50
	Sujud prayer	40.90	13.60	45.50
	Prayer sitting between 2 prostrations	13.60	31.80	54.50
	Early Tasyahud prayer	18.20	18.20	72.70
	Final Tasyahud prayer	9.10	18.20	72.70
2	Prayer movements	57.10	42.90	0

Table 1.
Data on students' prayer ability mastery.

Information:
Prayer readings.
Dominate: Memorize, smoothly.
Less master: Not fluent, Need guidance.

Not master: Not at all. In dire need of guidance.
Prayer movements.
Dominate: Know the names and sequence of prayer movements.
Less master: Knows the names and sequences of prayer movements, but is not perfect, and needs guidance.
Not master: Cannot do it at all, really needs guidance.

Table 1 shows the results of initial observations of students' prayer abilities which show that reading and movement achievement is still less than 70%. So the role of the teacher in facilitating students in learning to pray is still very much needed. Moreover, for grade 1 elementary school children who still really need guidance and direction from the teacher. We also believe that teachers have an important role in the education of children apart from their parents. However, for children aged 7–8 years, learning must be done while having fun [8]. So it is suggested that children must be able to develop golden age assets to be successful in the future, and discipline can be applied from an early age [9].

In distance learning situations, teachers are required to be able to make learning materials offline, which means that a learner or student can study without a teacher directly at home to optimize learning from home [10]. Parents can also accompany their children with media prepared by the teacher in the form of pictures, audio, visuals, audiovisual, and also prayer video tutorials related to the readings and prayer movements [11]. The reason for choosing Audio-Visual-based media in the learning process of teaching prayer is important because it is an effort by teachers to facilitate student learning online, especially through the use of audio-visual.

The focus of this research is: efforts to improve students' prayer understanding through the use of audiovisual media. The formulation of this problem is: (1) How to improve students' prayer understanding through the use of audiovisual media in grade 1 SD Ar Rahman Motik Jakarta and (2) How is students' understanding of prayer in grade 1 SD Ar-Rahman Motik Jakarta. The results of this study are expected to be able to add insight and can be used as a reference in enriching the scientific repertoire of Islamic education and can be used as a measuring point in implementing learning to understand students' prayers using audiovisual media during the COVID-19 pandemic. For schools, as input to other schools, especially the principal who will make policies in implementing learning while studying from home using audiovisual media. For writers, as material for knowledge and experience in compiling research so that they can add scientific insight. For parents, it becomes a lesson material for educating children and parental involvement in their child's learning process in situations that demand more of their role as parents. For readers in general, the results of this study are expected to provide insight into learning knowledge in the COVID-19 pandemic situation.

Many studies have been conducted on the use of audio-visual media in practical learning in schools Based on their research, audio-visual media can improve students' competency in seizing pictures subject [12], audio-visual media can be used optimally to help students achieve learning goals [13], in civic learning [14], cooking practice [15], writing skills and learning abilities [16], boost students' motivation and enthusiasm for learning during online classes [17–19], and reading skills and prayer movement [20].

The study of learning to pray in early childhood is an important thing to teach in the family environment since the child is 7 years old [6]. Although it is not yet an obligation to pray. However, when the child starts to turn 10 years old, it has become a habit and becomes his obligation to pray. And if the child leaves the prayer, then

beat the child with an educational punch that doesn't hurt him following the hadith of the Prophet. During teaching prayers, parents should pay attention to the level of development of children, so that children can understand optimally [7].

2. Research method

The research method uses classroom action research (CAR). is research conducted by teachers in their classes by planning, implementing, observing, and reflecting on collaborative actions and participation to improve their performance as teachers so that student learning outcomes can increase [21]. The reason the authors chose the Kemmis & Mc Taggart Classroom Action Research model is that the research model is simple, easy to implement, and considered appropriate to the author's abilities, besides that the use of the model each cycle includes one action [22]. The research setting is at SD Ar-Rahman Motik, which was established in 1985, located on Jl. Setiabudi No 1.2.3. South Jakarta. SD Ar-Rahman Motik has a total of 267 students with a total of 26 teachers and 1 school principal. 6 staff, 4 employees, 2 security, and 1 driver. Has 12 study groups, and each study group has 2 teachers.

In this study, the subjects of the study were students in grade 1 at SD Ar-Rahman Motik, because the introduction to prayer practice at SD Ar-Rahman Motik was carried out in grade 1 in semester 1. However, there were constraints due to the presence of COVID-19 so action research would be held. Classes that will start in semester 2. Grade 1B students at SD Ar-Rahman Motik are children who have an age range of 6–7 years. With a total of nine boys and nine girls. Children aged 6–7 years tend to play because they are a transitional age from Kindergarten. Still happy to be praised and like to compare himself with others, usually still not thinking about achievement and study obligations [23].

The action scenario to be performed is as follows:

2.1 Introduction

- Researchers first conducted interviews with related parties, in this case, the principal and teachers of SD Ar-Rahman Motik grade 1 to request permission to conduct Classroom Action Research regarding the prayer learning implementation program in grade 1,
- Next, the researcher will socialize the program that has been arranged for the students and also the parents of grade 1 students so that it can be implemented as well as possible.

2.2 Cycle

a. Planning phase

- The teacher/researcher prepares learning media in the form of audio, visual, and audiovisual prayer material.
- Audio in the form of voice recordings of prayer readings Visual in the form of pictures of complete prayer movements audiovisual in the form of videos of prayer movements and readings

- The researcher made an assessment instrument for audio, visual, and audio-visual learning media for three experts including the advisor, principal, and teacher. If the media can be said to be feasible then the media will be used during learning.
- The teacher makes a prayer lesson plan (RPP) using audio, visual, and audiovisual media.

b. Implementing phase

Learning media in the form of audio, visual, and audiovisual which have been assessed and validated will be carried out in the implementation of action research in Class 1 SD Ar-Rahman Motik Jakarta as follows:

- Activities carried out for 3 weeks in a row.
- Learning activities using the Zoom meeting application.
- The material explanation phase was carried out for 1 hour (60 minutes) (prayer material, quizzes, worksheets).
- Implementation of prayer practices carried out for 20 minutes.
- Implementation of prayer practice is carried out after learning ends at 10.00–10.20.
- Prayer practice activities are monitored by the teacher in stages, starting with prayer readings, prayer movements, and finally carrying out complete prayer movements using prayer tools.
- Monitoring of the implementation of the obligatory prayers is also carried out using a prayer achievement card which must be filled in by the parents and signed.
- During the implementation of prayers at home, students can use audio or audiovisual media that have been previously provided through GCR.
- At the end of the study, students were asked to document readings and prayer movements through videos which had to be sent to the GCR.

c. Follow-up

This activity is carried out to strengthen students' understanding of the material that has been delivered using the media. In addition, this activity aims to measure the effectiveness of learning that has been implemented. Activities that can be carried out include discussions, observations, experiments, exercises, and adaptation tests.

d. Observation/observation stage

The teacher/researcher observes and occasionally helps and reminds students when needed, and records events during prayer.

e. Reflection stage

The teacher/researcher reflects on the implementation of prayers, holds questions and answers, and gives appreciation to students who can carry out prayer activities well and humbly. Giving award stars, these stars are collected to be exchanged for attractive prizes.

Educators create teaching materials and media, which are then evaluated by experts based on their appropriateness in terms of content, visuals/audio, and quality. The evaluated learning media that meet the criteria are deemed suitable for teaching prayer to elementary school children. The implementation of teaching involves online resources, and researchers work together with teachers and principals to assess the learning process in schools. To improve the teaching plans, reflection is used to identify areas for improvement. If corrective action is not successful in addressing the issue, data analysis and reflection are utilized to re-evaluate the plan and potentially create a new one [24, 25]. Through discussion, reflection provides a basis for improvement plans. Reflection (contemplation) is an activity of analysis, interpretation, and explanation of all information obtained from observing the implementation of actions [26].

2.3 Conclusion

The teacher/researcher takes an assessment of all the processes that have been carried out from the beginning of the research to the end of the research, evaluates the results of the students by giving the task of videoing the prayer complete with readings and movements and sending it to the Google Class Room.

Data collection is done through observation and interviews. The raw data that has been collected needs to be broken down into groups, categorization is carried out, manipulated, and squeezed in such a way that the data has meaning to answer problems and benefits for testing hypotheses [27]. After the data is organized into groups and the relationships that occur are analyzed, it is also necessary to make interpretations of the relationships between the phenomena that occur and compare them with other phenomena outside the research. Based on the analysis and interpretation made, useful conclusions are drawn, as well as implications and suggestions for further policy. Analysis activities (qualitative data) begin with data collection, data reduction, data presentation, and drawing conclusions or verification.

3. Result and discussion

3.1 Research finding

- a. Pre-cycle (research preparation) Before the cycle was carried out, the researcher made the following preparations:
 1. Permission to Conduct Research: On December 24, 2021, the researchers met with the principal of SD Ar-Rahman Motik to ask permission from Ms. Ernawai, M.Pd. to conduct research in class 1B. She supports the efforts that will be made by the teacher in this research activities.
 2. Outreach to parents of students: At the initial meeting in semester II which took place on January 4, 2021, in class 1B, it discussed learning and activities to

be carried out in semester II, all parents were invited to attend the meeting via zoom meeting before learning for children took place, as well as the socialization of researchers towards research activities on the ability of students to understand prayer activities. Overall, parents are very supportive of the activities that will be carried out in this second semester. After the meeting with parents is over, the activity continues with learning as usual.

3. Observation of Student Ability: In the early stages the researcher made observations of students by asking them directly about prayer material. Have they ever done it, never done it, or have they always done it? The next step is that the researcher provides a questionnaire that must be completed by parents about their son's ability to understand prayer, both reading and prayer movements. The questionnaire was made in the form of Google Forms.

Finally, the researcher conducted a direct assessment of students by contacting them one by one about their ability to carry out prayer movements and readings. This the researchers did to obtain more accurate data on the questionnaire that had been given to the parents

1. Make learning media. Prayer learning media is urgently needed in the context of this research, in fact, this school already had several prayer learning media long before this research was conducted, such as the Daily Assessment book in which there are guidelines on how to carry out prayers and the readings used, but researchers need other media to maximize this research. and the media that researchers make are: In the process of making it researchers are not alone researchers get help from several colleagues who are experts in the field of technology. Especially in terms of editing the media that is created.
2. Conducting an assessment of the quality of learning media. In maximizing the research process, the researcher conducted a quality test of the learning media that had been made. Because it is still the COVID-19 Pandemic, the researchers are again making an instrument for assessing the quality of learning media through Google form. The parties involved in this were the Principal (Mrs. Ernawai), colleagues/ Teacher (In Herlina), and Thesis Supervisor (Ms. Siwi). It is hoped that through this step the researcher will get input for the perfection of the learning media made.
3. Make a learning implementation plan (RPP). All learning media have been made, it is time for the researcher to make the next step, namely to make a Learning Implementation Plan (RPP) which contains the overall activities from the beginning of learning to the end of learning, the day and date of research implementation.
4. Create assessment instruments. After all research needs are made, researchers still need several instruments that will be needed during the research process. These instruments include:
 - Media audio assessment instrument (link and hard copy)
 - Visual media assessment instrument (link and hard copy)
 - Audiovisual media assessment instrument (link and hard copy)

- Teacher teaching assessment instrument (Researcher) (link and hard copy)
- Instruments for assessing students' prayer comprehension abilities (link and hard copy)
- RPP assessment instrument

a. Cycle 1

After all the preparations made were considered ready, the researchers took action in the form of Cycle 1. However, the implementation was delayed from the initial plan, originally the research was to be carried out at the end of February but these activities were constrained due to the Mid Semester II Assessment, so the cycle could be carried out in early March 2021. The research was conducted within 3 weeks, as follows:

1. Week 1

Day 1, Thursday, March 4, 2021

The first day takes place on Thursday, March 4, 2021. Learning takes place from 08.30 to 10.00. The activity took place according to the RPP that had been prepared long beforehand. The activities that took place at that time were documented by the teacher (Researcher).

The teacher (researcher) greets students with greetings and takes attendance students in a friendly manner as usual. Thank God, class 1B students are indeed students who are generally diligent students so that almost every day they are always present and join in the learning even though sometimes they are sick (dizziness, flu, and diarrhea) they still take part in learning with enthusiasm, so they like permission not to open their videos while studying. And this time all are in good health so they can follow the lessons with enthusiasm.

The teacher gave an ice-breaking in the form of a "Spirit" clap to the students to break the atmosphere to make it more lively and enthusiastic. The activity continued by asking about last week's material about the stories of the Prophets, as well as explaining today's material, namely about prayer. The learning video in the form of PPT Camtasia is played, during the video playback the teacher pays attention to students one by one through their video images, occasionally the teacher reminds students who are starting to break their concentration, but overall students can observe the video in an orderly manner. Playing prayer learning videos: The video playback activity ends by watching the process of prayer activities from start to finish complete with readings and prayer movements that researchers have taken from YouTube. Some of the children enthusiastically followed the reading, especially Habibie who had almost mastered the prayer readings, but not many of them were very new and unfamiliar with the prayer readings played by the teacher.

After the material was played the teacher held questions and answers about the material they had just watched together, the students looked enthusiastic in answering the teacher's questions directly and together both in the form of pictures and direct questions. For learning not to be boring, the teacher has prepared a game that not only hones students' abilities but is also able to drive away boredom and make them happy and challenged in answering questions directly and invites them to compete to find the best and fastest in answering the questions the teacher gives. The game is in the form of the Quizziz application. This application is a game application

that can be adapted to the needs of the subject matter. But it is a shame that at the end of the broadcast, there were a few signal problems so the winners could not be shown on the screen, they felt a little disappointed, because usually, they would feel happy and proud if they managed to become the top three in the match.

The next activity is that the teacher allows students to ask questions about the material that has just been given, and immediately closes by giving a conclusion to the prayer material to students, not forgetting that the teacher explains to students to practice praying at home and also practice praying every day through zoom meetings with teachers at the end of each lesson starting from Monday to Thursday at 10.00–10.15. the teacher has also provided prayer tutorials in the form of audiovisuals in the Google Class Room (GCR) so that parents can easily view and save them for practicing at home. The lesson was closed by saying *hamdalah* together, reading Q.S. Al 'Asr, the prayer after studying, the prayer for riding a vehicle, and the prayer leaving the classroom.

Day 2, Monday, March 8, 2021

As previously stated, the prayer practice will continue every Monday–Thursday together after learning ends at 10.00–10.15 via zoom meeting. Practice in the first week is focused on memorizing prayer readings, while prayer movements will be focused on the following week. On the first day of the additional prayer practice for approximately 15 minutes, there was a challenge for the teacher (researcher) because the children were used to having finished studying at 10.00 but had to increase their study time by about 15 minutes for prayer practice. so that today one of the children asked “Mrs. Dilla, can Adam ask a question?” “Yes Adam, what do you want to ask Adam?” Mrs. Dilla asked back “What time do we finish studying?” Adam asked “fifteen more minutes, kid” replied Mrs. Dilla.

They feel a little burdened when one of the students asks this because they are worried that they do not like or are already bored with the material or that it is a form of protest for their dislike/discomfort with this new additional material. But the teacher immediately changed the atmosphere to a learning atmosphere.

On this day the teacher offers two prayer practice videos, namely prayer practice videos taken from YouTube, and the second is a prayer practice video worked on by SD Ar-Rahman Motik Collection. And based on deliberation and consensus, all agreed to use the video that was worked on by researchers belonging to the school collection because the reading was quieter and not too fast so it was easy to follow.

The teacher plays a prayer learning video after the children feel ready, there is only one child named Habibie who is a boy while the others find it difficult to follow him. But the teacher continues to motivate students until they finally try to do it. The activity lasted until 10.15 am.

Day 3, Tuesday, March 9, 2021

The third day went on as before, this time the children no longer asked when learning was over, but there was one child who was seen eating snacks while reciting prayer readings. At that time the teacher did not reprimand the child, some children were just silent because they felt they could not pronounce it and felt less interested because they were still adapting from the previous time when learning activities only lasted until 10.00. The teacher realizes that this activity is not interrupted by breaks. It turned out that the activities were even less interesting when there was signal interference when the teacher played the video. The video does not play right away, it just rotates, until finally the teacher cancels the video playback and is replaced by opening the school's handbook, all goes on until the end of the reading.

Day 4, Wednesday, March 10, 2021

On the fourth day, the activities were getting better under control, the children were able to follow the prayer readings in an orderly manner, they already looked more compact and had started to follow the reading flow quite well, moreover, the teacher always motivated students with the lure of Achievement Stars and attractive prizes for those who can carry out prayer activities five times a day using video tutorial guidance that has been made and shared by the previous teacher through the Google Class Room.

2. Week 2

Day 5, Thursday, March 11, 2021.

The second week on Thursday, March 11, 2021, the teacher started the lesson, as usual, greeting, asking how they were doing, and taking students' attendance. Alhamdulillah all present. And all look happy when entering the lesson. Some students did enter the zoom room from 07.00. they are children who are diligent and enthusiastic in learning even though virtually, behind them there are parents who really care about education even though learning is done virtually parents are very supportive and enthusiastic every day in accompanying children in the process of teaching and learning as well as submitting assignments independently to Google Class Room.

The second meeting on Islamic Religious Education material this time still discussed prayer, this time the material focused more on prayer movements. The teacher explains and practices directly with students through zoom meetings, the teacher gives an example and the students follow it, the teacher also explains the names of each prayer movement, and everything is done from Takbir to greetings. After finishing everything the teacher evaluates by conducting questions and answers through visual media, namely in the form of pictures of the prayer movement, the children are very enthusiastic, as well as when evaluating individually, around 95% of students master the name of the prayer movement.

The lesson was continued by singing a song entitled "5 Prayer Times". Some of the children have already mastered the song because some of them are from Ar-Rahman Motik Kindergarten and they have been taught it so they can follow it.

The children wrote down the lyrics of the song and then continued by watching the video "Nusa and Rara" entitled "Prayer is Obligatory" and continued by playing quizziz. Quizziz is a game application that can be created and managed by the teacher and adapted to the subject matter, in this case, the material is about Movement and Prayer readings, which can be done directly or used as Homework. Usually, children like this game, because they will compete to be the champion.

Day 6, Monday, March 15, 2021

On the sixth day, the students seemed to be used to the prayer practice routine after learning, it was seen that no one was asking when the lesson was over. And on the sixth day, students began to practice prayer using movement and reading, so that students were immediately directed to position themselves so that the whole body could be seen. In this case, the children are still assisted by adults or parents who accompany them. And again, parents are very supportive of this activity. They started putting up prayer rugs and the girls put on a prayer tool in the form of a mukena. Prayer practice can run smoothly and there are no signal problems until the activity is complete.

Day 7, Tuesday, March 16, 2021.

The seventh day of prayer practice this time is not as usual because today's learning takes a long time because there are two materials, namely Civics, and SBDP to make crafts to draw grandparents which requires a little more time than usual.

So today the children just read it without doing the movement and without playing the prayer reading video.

Day 8, Wednesday, March 17, 2021.

On the eighth day of prayer practice, the children's abilities were increasingly visible, the teacher felt very happy, the feeling of happiness was expressed to the students and the students became more enthusiastic when they were given appreciation by the teacher. The ability of students, especially in reciting the prayers of bowing and prostrating, all seemed to have mastered it, even the *iftitah* prayer, which was originally only Habibie who mastered this time, has very many children who have mastered the recitation of the prayer. as well as other readings. Like a sitting prayer between two prostrations and a *tasyahud* prayer.

3. Week 3

Day 9, Thursday, March 18, 2021.

Day 9 is the last week of the target to be achieved. This time, before the prayer practice begins, there is prayer material in the third week, namely discussing the Islamic Religion package on pages 111–11990 and practicing answering the questions in the book.

The activity continued with singing the song "Uphold the Prayer". Almost all of the children mastered the song because almost every day the song is sung before learning begins. In addition to the short rhymes and easy-to-follow tunes, this song is easy and fun for children.

The activity ended by playing Quizziz Live. The kids like this quizziz, especially when it is done live, they like to compete to see who has the most correct answers and in the shortest amount of time, because the top three who succeed will get an Achievement Star.

When the lesson was over, as usual, the children rushed to prepare their prayer equipment and adjusted their positions as well as their laptops to carry out the prayer practice. This time the children seemed to have almost mastered the prayer readings starting from the *iftitah* prayer, bowing, *I'tidal* prostration, sitting between the two prostrations, the initial and final *tasyahud*, and greetings.

Day 10 Monday, March 22, 2021

The tenth day of prayer practice can be carried out smoothly, there are no obstacles whatsoever, and the children continue to get motivation from the teacher because they are doing well, especially since their ability to read their prayers is getting smoother. In the prayer movement, there are still some children who are still playing around while doing it, the teacher continues to watch throughout the prayer practice while occasionally reminding students who are still playing around and not concentrating while doing it.

Day 11 Tuesday, March 23, 2021.

The exercise this time was still the same as the previous day, students could carry out the exercise, as usual, it was seen that there were still some children who were less focused and still having fun while doing it. And the teacher did not hesitate to remind them.

Day 12 Wednesday, March 24, 2021.

The last day of the research target has arrived. Before this exercise, the teacher reminds students to be more focused and concentrated when doing it, because the teacher will assess all students while doing it.

The students were very enthusiastic, especially when the teacher promised them that they would get two stars if they could do it well. They can do prayer exercises

well and solemnly they can do prayer movements and recitations as well as possible. Teachers feel proud and happy with the results achieved by students.

Teachers keep motivating them to continue praying until the end of their lives wherever and whenever they are. And this prayer practice will continue to be carried out at the end of the second semester except during the month of Ramadan.

In the last opportunity for this exercise, the children were invited to play the Wordwall Game. This is one of the games that are also in great demand by students, the game not only hones academic skills but can stimulate students' adrenaline because they have to answer and also have to avoid monsters. Ready to devour them if they are not careful. In this game, the teacher gives two games related to this prayer material, namely the prayer movement games and the five prayer times games.

4. Discussion

4.1 The use of audiovisual media in improving students' understanding of prayer during the COVID-19 pandemic at SD Ar-Rahman Motik Jakarta

Grade 1 elementary school children fall into the Early Childhood category, at this early age which contributes a lot to the development of children when they become adults [28]. Several ways are carried out either by parents, the community environment, or educational institutions, both formal and non-formal, so that the children in their environment become a proud generation [29], especially for the advancement of Islam. It is a challenge in itself for teachers, especially Islamic Religion teachers, how to make Religion subject matter as optimal as possible during an outbreak of the virus that is currently hitting and learning is not being carried out as before, all is done online [30].

One of the efforts to optimize prayer learning is conducting Classroom Action Research using prayer learning media in the form of audio, visual, and audiovisual which is carried out virtually/online [31]. By using Zoom meetings. Prayer learning media is already owned by the school. However, in this case, the researcher tries to create new media as well as modify existing media.

In classroom action research, the initial steps of research that must be carried out by a researcher are planning, implementing, and reflecting on actions in a collaborative and participatory manner to improve his performance as a teacher, so that student learning outcomes can increase [32]. So in conducting this research, the researcher planned before researching so that this research would get good results that would be beneficial for researchers in particular and the world of education in general. The steps taken by the researcher are as described previously.

4.2 Making audio, visual, and audiovisual media

After obtaining permits and conducting outreach to parents and students, the researchers did was to observe or observe the students' abilities in terms of understanding prayers.

As we know that observation is an activity that includes the activity of paying attention to an object by using all the senses. it can be said that observation activities can be carried out through sight, smell, hearing, touch, and taste, also known as direct observation. In the sense that observation can be done with tests, questionnaires,

recorded pictures, and sound recordings. Observation activities can be carried out in two ways, namely:

1. Non-systematic observations made by observers without using observation instruments.
2. Systematic observation, is carried out by observers using guidelines In this study, the researcher made observations in these two categories, during the observation to find out the initial abilities (pre-cycle) the researcher made systematic observations, and during the cycle, the researcher used non-systematic observations

From the data obtained, the researchers concluded that students currently have little ability in terms of prayer both reading and movement, because some of them are alumni of the Ar-Rahman Motik Kindergarten who indeed learn to pray has been taught every Friday. And some of them are alumni of kindergarten outside Ar-Rahman Motik.

So some do not seem to master at all, especially in terms of reading their prayers. Furthermore, the researcher chose the right media to optimize the ability of students to understand prayer towards the implementation of prayer. And audiovisual media is media that is considered capable of increasing students' prayer understanding in this research.

According to Syaiful Bahri Djamarah and Aswan Zain, media are all tools that can be used as teaching aids. Media as an intermediary tool conveys [33], which indeed if seen the word media comes from Latin, besides that the word media functions as a source of learning that can overcome space and time, also have a communicative function, motivation, meaning, perception, and individual equality [34], that caters to the needs of individuals who have different talents and interests. Learning media is an important part of this research, as we know media comes from the Latin *medius* which means "middle," "intermediate," or "introductory." In Arabic, media is an intermediary or message delivery from the sender to the recipient of the message [35].

Hamalik (2009) suggests that the use of learning media in the teaching and learning process can generate new desires and interests, generate motivation and stimulate learning activities, and even bring psychological influences on students. In addition to arousing student motivation and interest, instructional media can also help students improve understanding, present data interestingly and reliably, facilitate interpretation of data, and condense information [36].

Audiovisual learning media are widely used as learning media, especially during a pandemic through online learning, such as educational videos, video recording activities, use of commercial films or TV programs. Even social network podcasts, the diversity of use and allocation of audiovisual resources in the classroom are generally supported by the understanding that films and videos can:

1. Enables critical perception of students
2. Arouse, and strengthen the demand, and motivation of students
3. Presenting everyday facts to class and open channels of privileged access to cognitive and affective levels.

Grade 1 elementary school children who are in the age range of 6–7 years according to Jean Piaget's theory are children who are in a transitional period between concrete pre-operational and concrete operational [37]. At this time his ability to remember and think logically is also increasing and all his developmental processes always make maximum use of all five senses in the learning process. Thus the researchers are trying their best to make prayer learning media in the form of audio, visual, and audiovisual with the hope that students are capable and interested so they can maximize their potential and learning objectives can be achieved to the fullest, especially during the COVID-19 pandemic.

Being interesting and worthy of research, teacher researchers feel compelled to answer a big challenge so that prayer learning can be maximally carried out in grade 1 SD Ar-Rahman Motik. So one of the tasks that must be done is to make learning media that are not only interesting but can actualize learning to the fullest, in this case, the researcher makes learning media in the form of:

1. audio (recording the reading of the four rak'ah prayers).
2. visual (image of complete prayer movement).
3. audiovisual (learning videos and complete prayer movements and readings) the prayer learning media in the form of audio is already owned by the school, but researchers will complement it again according to research needs.

4.3 Making audio, visual, and audiovisual media assessment instruments and validating them

After the learning media and the Achievement Star Book was made, it was time for the researcher to evaluate the media that had been made for an assessment of the learning media by making several assessment instruments. Research instruments are tools or facilities used by researchers in collecting data so that their work is easier and the results are better. In the sense that it is more thorough, complete, and systematic so that it is easier to process.

To get convenience in the research process, such as its function the instrument is made to make it easier for researchers to carry out their research and get satisfactory results. Then all the instruments needed in the research were made and completed by the researcher.

The learning media assessment instrument was validated by three people who were considered capable of giving suggestions on the feasibility of the media to be presented. They are supervisors, principals, and colleagues. And when the media has received approval, the media is suitable for use.

4.4 Steps for using audio, visual, and audiovisual media

4.4.1 Steps to use audio media

There are several steps (in general) that need to be known in utilizing audio media for learning activities. These steps include preparatory steps, implementation steps, and follow-up steps [34]. Below is an explanation of the three steps.

- a. Preparation: The activities carried out by the teacher during preparation are (1) making a lesson plan, (2) studying the instruction manual for using the media, and (3) preparing and managing the media equipment to be used.
- b. Implementation/Presentation: The use of this media is to send it to the parents of students to play it when the children perform the obligatory prayers when they are not with the teacher.
- c. Follow-up: This activity is carried out to strengthen students' understanding of the material that has been delivered using audio media. In addition, this activity aims to measure the effectiveness of learning that has been implemented. Activities that can be carried out include discussions, observations, experiments, exercises, and adaptation tests.

4.4.2 Steps to use visual media

- a. Preparation: The activities carried out by the teacher during preparation are (1) making a lesson plan, (2) studying the instruction manual for using the media, and (3) preparing and managing the media equipment to be used.
- b. Implementation/Presentation: When carrying out learning using visual media, teachers need to consider things such as (1) ensuring that the media and all equipment are complete and ready to use, (2) explaining the objectives to be achieved, (3) explaining the subject matter to students during the learning process, (4) avoid events that can disturb the concentration of students. This media is used during question-and-answer activities about prayer movements. When the explanation of the material takes place.
- c. Follow-up: This activity is carried out to strengthen students' understanding of the material that has been delivered using visual media in the form of pictures/photos of prayer movements. In addition, this activity aims to measure the effectiveness of the learning that has been carried out. Activities that can be carried out include discussions, observations, experiments, exercises, and adaptation tests.

4.4.3 Steps to use audiovisual media

Audiovisual learning media has stepped in its use like other learning media. Learning steps using audiovisual media are as follows:

- a. Preparation: The activities carried out by the teacher during preparation are (1) making a lesson plan, (2) studying the instruction manual for using the media, and (3) preparing and managing the media equipment to be used.
- b. Implementation/Presentation: When carrying out learning using audiovisual media, teachers need to consider things such as (1) making sure the media and all equipment are complete and ready to use, (2) explaining the objectives to be achieved, (3) explaining the subject matter to students during the learning process, (4) avoid events that can disturb the concentration of students. This media is used during prayer and explanation of prayer material. Conducted at the time of learning/subject matter ends. Played and the children followed the readings and movements shown.

- c. Follow up: This activity is carried out to strengthen students' understanding of the material that has been delivered using audiovisual media. In addition, this activity aims to measure the effectiveness of learning that has been implemented. Activities that can be carried out include discussions, observations, experiments, exercises, and adaptation tests.

4.4.4 Implementation techniques for using audio, visual, and audiovisual media

The use of audiovisual media is used during learning every day. This research process lasted until the time limit is not limited. Even this audiovisual media is used by students every day at prayer times. In addition to learning media, researchers are trying their best to make something so that learning is still interesting and keeps children motivated in doing learning during this virtual. This is by making a reward (Prize). In this case, the researcher made a Prayer Achievement Card. Every day the child who performs the prayer must be written down and signed by the parents on a card that has been prepared. Every child who prays five times a day, the child is entitled to get six stars. And the star is written in the Book of Stars. For every multiple of 20 Achievement Stars, students are entitled to exchange it for a prize that has been prepared at school.

They can get prizes by exchanging achievement stars by coming directly to the school and making an agreement with the teacher beforehand and of course following the health protocol, namely: wearing a mask, washing hands, and Keeping Your Distance, or known as 3 M [38]. Prizes are a form of motivation for students. What is the real motivation? The word "motive" is defined as the effort that encourages someone to do something [39]. According to Mc. Donald, motivation is a change in energy within a person which is marked by the appearance of "feeling" and is preceded by a response to the existence of a goal [40].

In a learning theory put forward by Edward L Thorndike in a Connectionist theory, he found three laws of learning including Thorndike's The Law of Effect making motivation the basis of the law of effect. He sees in this law of learning the need for additions or assistance to the law of forming habits through repetition. According to Thorndike, repetition in the law of effect learning theory is very important because it will have an impact on the behavior of the learner. The law which is also closely related to motivation is the law of Exercise. It is a continuation of the process of the relationship between Stimulus and Response, Thorndike refers to the relationship between learning and practice and training, and learning activities will weaken when learning activities are not supported by training. With repeated practice, learning can be maximized [41]. Also, the theory of Behaviorism presents the "Reward and Punishment" technique, one of the learning techniques that are quite well known in education and psychology circles and is considered quite effective in children's learning, namely techniques or punishments, and rewards. a teacher will give a prize/reward to the student if he succeeds in carrying out the task or is given punishment if he does otherwise [42].

Motivation can also be said to be a series of attempts to provide certain conditions, so that a person is willing and wants to do something, and if he does not like it, he will try to negate or avoid that feeling of dislike. Motivation to learn is a psychological factor that is non-intellectual. Its distinctive role is in terms of growing passion, feeling happy, and being eager to learn. According to behavioristic theory, learning is a change in behavior as a result of the interaction between stimulus and response. In other words, learning is a form of change experienced by students in terms of their ability to behave in new ways as a result of the interaction between stimulus and response. A book

entitled Talent Is Never Enough (talent alone is never enough) states that many things a person can succeed by developing all the potential that exists within us that sometimes we never imagined before, with confidence, passion, initiative, persistence, and practice., courage, and focus will answer all the despair that we all have talent. Making prizes is expected to be able to make prizes as motivation for students to do good things that can change them for the better and learning objectives can be achieved optimally.

4.4.5 Assessment of students' prayer understanding ability by using audio, visual, and audiovisual media

This activity is carried out after all the subject matter has been delivered. Students are assigned to video their prayers and send them to the Google Class Room. Furthermore, the teacher will assess the results of their prayer videos.

4.5 Results of students' prayer

4.5.1 Understanding mastery of student prayer reading

From the results of the research conducted in Cycle 1 (for 3 weeks), the following is data on students' ability to recite prayers before and after Cycle 1. After conducting class research actions using audiovisual media, the following is the ability to read the students' prayers after the cycle.

4.5.2 Mastery of student prayer movements

From the results of the research conducted in Cycle 1 (for 3 weeks), the following is data on students' ability to pray before and after Cycle 1. After carrying out class research actions using audiovisual media, the following are the post-cycle students' prayer reading abilities: The students' prayer ability that was measured was the ability to memorize prayer readings and the accuracy in carrying out prayer movements. Implementation is done by conducting a pre-cycle assessment where learning does not use audiovisual media. The pre-cycle results on the ability to memorize prayer readings were 61% insufficient, 28% sufficient, 11% good, and 0% very good. While the results of the pre-cycle prayer movement were in the less category, namely 6%, sufficient at 89%, good at 6%, and very good at 0%. Then after the activities in Cycle 1, the results shown in the ability to memorize prayer readings were 0% insufficient, 5% sufficient, 39% good, and 56% very good. While the results of cycle 1 of the ability to perform prayer movements are 0% in the less category, 0% sufficient, 40% good, and 60% very good. Improving students' abilities in reading and prayer movements carried out in class 1B cannot be separated from the media presented to students.

Arsyad said in his book "as in general, audiovisual media has a fairly high level of effectiveness, according to research, the average is above 60–80%" [43]. Given the improvement in cycle 1, there was an increase in students' prayer skills both in memorizing prayer readings and accuracy in prayer movements. In the ability to memorize prayer readings students who get good grades, very good, or have reached 95% KKM (Minimum Completeness Criteria), while for the ability to perform prayer movements correctly, all students achieve. Minimum completeness criteria score of 100%. Then cycle 2 is not necessary. This is in line with Suharsimi Arikunto's opinion that the success of classroom action research is marked by the presence of conformity percentage criteria, as described in **Table 2** below:

Criteria Conformance (%)	Explanation
0–20	So not enough
21–40	Not enough
41–60	Enough
61–80	Good

Table 2.
Success of classroom action research.

The success of learning to pray after improvements have been made, namely the use of audio media in the form of recorded prayer readings, visuals with pictures of prayers, and audiovisual in the form of films. It turns out that the media used is not only more effective in improving students' abilities but also can motivate students in learning. Children prefer to learn by using more interactive media. Also, a variety of audio, visual, and audiovisual can facilitate students' diverse learning styles. Bobbi De Porter said that students' learning styles consist of three types, namely, visual, auditory, and kinesthetic [44].

The way children learn with a visual learning style paying more attention to explanations made using pictures or there is eye contact with what is being learned. Students who have a visual learning type will quickly learn the subject matter presented in the form of pictures. On the other hand, material that is only conveyed verbally or through gestures is still poorly understood. Visual learning media can facilitate understanding and strengthen memory [45]. Students with the auditory type find it easy to learn subject matter that is presented in sound form so that the information conveyed by the teacher will be easily absorbed by the child [46], such as radio or cassette sound and friends (discussion).

In addition, audio media is very helpful for students in understanding objects that require sound clarity, such as in the case of memorizing the Qur'an according to the rules. Children with a kinesthetic learning style like to move and need elements of physical movement. Media that contains elements of motion and sound such as films can facilitate children with the kinesthetic type.

The use of media that facilitates all types of children's learning will be able to provide learning motivation for all children [36]. Teachers can also keep children's focus on the material being taught, and on learning situations that are carried out online, the role of parents and other family members. Especially concerning the habit of praying, a behavior that becomes a daily routine at home considering that prayer is carried out five times a day as a form of obligation that must be carried out by Muslims wherever they are. Parents are the closest environment for children and the right example in instilling good values in social skills [47].

Based on the data, there are still some children who are still not optimal both in memorizing readings and in prayer movements, this happens because there are several factors including:

1. The seriousness of students in following the prayer practice process.
2. Some children seem to have difficulty pronouncing Arabic.
3. The role of parents in accompanying students during the learning process takes place.

4. Collaboration of parents in carrying out prayer exercises using audio media when the time for obligatory prayers arrives. And outside of study hours. This is proven by the number of children who did not fill out the Prayer Achievement Cards.
5. Busyness and weak supervision from parents.

Based on the results of the analysis and discussion of the research data described above, it can be concluded that the audio, visual, and audiovisual visual learning in learning to pray in memorizing prayer readings and performing movements increases from the results of the pre-cycle to the first cycle. The increase in value is also seen as significant at 95% for the ability to memorize prayer readings while for the ability to perform prayer movements correctly, all achievements are 100%. Prayer learning media is also easy for teachers to make at school. Teachers can record prayer readings which can be accessed on a computer or mobile phone, pictures of a series of prayer movements, and also prayer learning films which contain moving pictures, oral explanations, and writing. This media can facilitate three types of children's learning and can motivate children in learning. Given that all of these media can be played and viewed repeatedly children can study them at home under the guidance of their parents.

5. Conclusions

Prayer apart from being an obligation as a Muslim is also a mandatory program that is carried out by all students from grade 1 to grade 6 at Ar-Rahman Motik Jakarta Elementary School. The implementation process is carried out jointly in schools. However, this activity stopped since the government implemented online learning. Especially for grade 1 students who should learn to pray by practicing prayer from the start. Grade 1 students are students between the ages of 6–7 years.

At this time, children are in a transitional period between concrete pre-operational and concrete operational 115 according to the theory of Jean Piaget, one of the child development psychologists. This time is the golden age or the Golden Age. Because at this time all the processes of growing and developing children are very rapid both in their development and growth. So the researchers are trying to create a learning media that is able to make students at this time to be able to optimally use their potential so that the learning process can be as maximal as possible, especially during the COVID-19 Pandemic which requires learning to be carried out not face to face but through virtual/online. Line. This research is carried out continuously every day through the zoom meeting application which is carried out after learning ends, namely at 10.00–10.20 WIB. And also at other prayer times monitored the parents of students by writing them in a prayer achievement book.

In addition to video tutorials for implementing prayers, several other supporting applications are presented to students so that students do not get bored, namely by doing games that are interesting and fun. Classroom Action Research conducted in class 1B SD Ar-Rahman Motik can run smoothly and get full support from parents, to optimize students' prayer understanding in class 1 during the COVID-19 Pandemic by using learning media in the form of audio, visual, and audiovisual.

From the results of the pre-cycle study, it was found that the average ability to read prayers for students was 69 while the KKM (Minimum Completeness Criteria) for Islamic Studies had to reach 76. Then Cycle I was carried out. Cycle I was carried out

for 3 weeks starting on March 4 to March 24, 2021. Learning activities were carried out continuously, namely carried out on every effective school day at the end of learning around 10.00–10.20 minutes. The activity lasts about 15–20 minutes. Obligatory prayer monitoring every day is carried out through a prayer achievement card.

Apart from using learning media in the form of audio, visual, and audiovisual, many other supports are also used to optimize learning, including (1) IT-based learning applications (Google Class Room, Quizziz, wordwall. Life Worksheet), (2) Achievement Sheets Prayer, (3) Star Book, (4) Reward (Prize), and (5) Book of Islamic Religion Assessment (Salat guide book and daily prayer). At the end of the lesson, the researcher evaluates students' ability to read and pray movement by giving assignments to students to make a two-rakaat prayer video and send it to the Google Class Room.

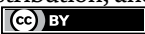
The results of the study showed an increase from before the use of audiovisual media to after use. That is, 11% good and 89% of the ability to read prayer readings is sufficient and lacking. About 5% is good and 95% of the child's ability to carry out prayer movements is sufficient and lacking, this number is still below the KKM (Minimum Completeness Criteria) after the Action is carried out the result is an increase Namely, 94% is good (39% is good and 55% is very good). As for the prayer movement, it was 100% good (39% good, 61% very good) although there were 6% or one child who was judged to be lacking in prayer reading. But overall 80% have met the criteria so cycle II is not needed. Based on the research conducted, the following suggestions are made regarding prayer learning activities using prayer learning media in the form of audio, video, and audiovisual.

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Encouraging Interaction to Promote Learner Engagement in an Online Blended Learning Course Based on ZOOM, CNMOOC, and CANVAS

Li Zhang and Yangyang Yu

Abstract

This study investigates how to engage students in a blended academic writing course. We did classroom observation and analyzed the chatroom and video recordings of the class on ZOOM, the learning materials and procedure on CNMOOC, and the collaborative writing tasks submitted on CANVAS. We also analyzed data from WeChat and the interview. The results show that teacher-student, student-content, and student-student interactions can all influence students' engagement. Teacher-student interaction in the form of questions and answers, presentations and comments, knowledge exploration using note-pen, and teacher's written and oral feedback has effect on students' engagement in ZOOM. Student content interaction *via* well-designed videos, exercises, and in-class activities influences their engagement on CNMOOC. Student-student interaction for completing project-based writing tasks and peer review in collaborative writing has an impact on students' engagement after class. The study will have pedagogical implications for how to promote student engagement in an online blended learning context

Keywords: learner engagement, interaction, blended learning, ZOOM, CNMOOC

1. Introduction

Student engagement has always been a topic receiving much attention in language teaching and learning. Because of the COVID-19 pandemic, students cannot travel to campus or study in the classroom, making it more difficult for the teacher to engage students, especially to have students involved in the interactions with the teacher, the peers, and the learning contents. Blended learning, as a means of educational innovation and an approach to solving the problem, was encouraged and adopted in many Chinese universities in the post-pandemic era, but problems arise as to whether and how students can be engaged in this new online learning context.

Blended learning is normally defined as the combination of face-to-face instruction with computer-mediated instruction [1], and it has been extended to the online situation, which means “the integration of different online platforms to facilitate learning that can be achieved by blending online learning and offline face-to-face classroom instruction” ([2], p. 180). In blended learning, students are given video lectures online for learning autonomously before class, thereby creating opportunities of discussion for the internalization of knowledge in class. This process involves a lot of interactions with the knowledge contents and with teachers and peers. Researchers have included the idea of interaction in models of engagement [3], and the basic element for facilitating interaction is to encourage students to engage themselves and be responsible for their own learning [4]. While interaction can be more easily achieved in the off-line or face-to-face learning context, how can interaction in the online blended learning environment achieve the same or even better effect is worth exploring. This chapter examines how learners’ interaction can promote their engagement in a blended academic writing and presentation course. Our purpose is 1) to analyze the patterns of interactions undertaken in the blended learning context; 2) to understand the practice of collaborative interactions in teaching and learning; and 3) to gain insights to enhance course design and delivery where interactions are included for better learner engagement.

2. Literature review

2.1 Theoretical background

Learner engagement is commonly defined as a multifaceted construct that entails a learner’s intense attention and involvement in not only psychological but also social, academic, and other aspects [5, 6]. It is largely a reflection of personal experience interacting with external contexts, closely related to a learner’s inner qualities such as cognitive ability and motivation level, and social environments where he or she lives and learns [7]. Sociocultural theory, which accentuates knowledge being socially constructed rather than confined to an individual’s mental process in isolation [8], naturally forms a sensible framework to investigate interaction, which may correspondingly facilitate engagement in learning and promote learners’ second language development [9].

Originally proposed by Vygotsky [10] to summarize general features of human learning, sociocultural theory has been continually developed and widely applied in second language research [11]. Acquiring a second language, according to Lantolf and Thorne [12], mainly concerns meaning creation through intrapersonal and interpersonal interaction where humans may appropriate physical and symbolic tools to mediate their command of a target language and their relations to the outer world. With numerous digital devices invented in this technological era as physical tools, technology-assisted language learning can be approached from a sociocultural lens to see how a changed setting brought by web-based systems and mobile applications may induce mediation to the learning process. Ai and Lu [13] pointed out that the synergy between computer-mediated language learning and sociocultural theory was promising, in that the former may engender innovative learning contexts that require guidance and explanation from the latter and even invoke further theoretical upgrades.

Blended learning, a combination of online learning *via* digital platforms and traditional in-person classroom instructions, offers such a technology-mediated context worth in-depth sociocultural investigation [14]. After reviewing 20 studies on the design of blended learning, Boelens et al. [15] identified social interaction as one of the four key issues in devising blended courses, given that maintaining interaction can be much more challenging in online activities compared with face-to-face meetings. It is argued by Stein and Graham [16] that establishing personal connections early in offline classes and sustaining the connection with interactive tasks online can be crucial to blended learning. The practical needs for interaction in blended learning can find their rationale from sociocultural theory, which posits that it is social, usually communicative, interaction that contributes fundamentally to a learner's mental development [8]. Vygotsky [10]'s zone of proximal development (ZPD) in sociocultural theory refers exactly to a learner's performance that cannot be achieved independently but may be accomplished after the learner interacts with others, often teachers and peers, in a certain environment. Specifically, in a blended learning context, technological elements are added and learning modes are enriched, making the interaction not confined to humans and humans but extended to humans and digital tools. Sociocultural theory may help to reveal dynamic interrelations among teachers, students, learning tasks, and tools, and thus rejuvenate its theoretical implications in response to technological advancements.

2.2 Learner engagement in blended learning

Despite no consensus regarding the number and scope of engagement dimensions, the continuous effort has been made to capture and clarify the key dimensions [17–19]. Kahu [19] critically reviewed four mainstream research approaches to this multidimensional construct and proposed a conceptual framework for engagement in higher education, which centered on students' affect, behavior, and cognition while acknowledging the influence of wider sociocultural and political backgrounds. Halverson and Graham [18], on the other hand, built an engagement framework particularly for blended learning where they considered cognitive and emotional engagement most relevant and inclusive. Since neither of the two frameworks has been well validated, this study does not directly take either one as the construct of engagement, but with reference to them, it adopts four dimensions: behavioral, cognitive, affective, and social. The first three dimensions are clearly defined in Fredricks et al. [17] and prevalent in engagement studies [20]. Behavioral engagement is described as observable conducts including learners' attention, effort, persistence, and participation. Cognitive engagement involves the mental effort to understand, awareness, self-regulation, and use of strategies. Affective engagement encompasses feelings toward teachers, peers, and course contents, such as interests, anxiety, and boredom. The additional social engagement pertains to communicating with others in learning-related activities, which becomes noteworthy especially in the online environment as digital spaces lead to new social features for teachers to consider in course design [21].

Much research has been done in face-to-face and remote settings to show the effect of engagement on learning outcomes and factors that may moderate the impact [22, 23]. It turned out that distinct engagement dimensions may be interrelated and vary in their influence, and that both individual factors (e.g., language proficiency and self-efficacy) and contextual factors (e.g., task complexity and use of technology) may account for the variance [24, 25]. These findings may somehow be relevant to blended learning contexts but not completely applicable, because while a blended

course typically concerns respective features of online and offline modes, specificity and complexity may emerge when two modes are combined to form a new one [26]. A comparison study on the effect of different learning modalities suggested that the overall student engagement with online Icelandic courses was higher in the blended mode than in the distance learning mode and the self-directed mode [27]. But the overall engagement in this study was largely behavioral, as the measure depended on course progress recorded by the online system, which was plain descriptive statistics mostly related to learners' behaviors. Cornelius et al. [28] examined a group of undergraduates' experience in a blended course with an MOOC component for tutorials and independent study, finding that these students were more engaged in social aspects but less engaged in cognitive aspects than the wider undergraduate cohort at the same university. These results point to blended learning as a context distinct from others with regard to learner engagement and call for inquiry into specified engagement dimensions in blended learning.

It is true that blended learning allows for greater flexibility and autonomy, but higher chances of distraction and interruption usually come together with a flexible and autonomous learning environment [29]. Learners, especially those with less confidence or lower proficiency level, may not devote their attention and mental effort in a blended course as much as they do in a traditional classroom [30]. Hence, only when thoughtful and cohesive designs are applied to blended learning to effectively merge synchronous and asynchronous contact can learners be fully engaged in a blended context, embracing better learning experiences, and even academic success [31]. Starting from the students' perspective, Tuiloma et al. [32] conducted a large-scale survey to investigate the support that students perceived in their blended courses and existing barriers in the way to more engagement. Through acknowledging support from their teachers and universities, more than 30 percent of surveyed students reported at least three barriers preventing them from being engaged behaviorally, cognitively, or affectively. With a belief that learner engagement is malleable through pedagogy, Heilporn and his colleagues synthesized from extensive teacher interviews engagement strategies to foster students' behavioral, cognitive, and affective engagement in blended courses of various disciplines [31, 33]. These strategies, many of which focusing on enhanced interaction, properly used technological tools, and well-designed guidance and assessments, were categorized into different types corresponding to engagement dimensions and course design aspects.

However, how those engagement strategies actually work in a certain authentic institutional context remains under-explored, since seldom have researchers detailed a particular blended learning design for engagement improvement. The latest exception is by Korkealehto et al. [30], who analyzed 22 business students' engagement in a blended language course design with data from learning diaries and open-ended questionnaire responses. It was revealed that interactive assignments and authentic learning materials contributed greatly to students' behavioral, affective, and cognitive engagement, whereas collaboration and self-regulated practices boosted social engagement. As this course mainly focused on the oral development of business English, it may be interesting to examine the blended learning design of a language course with other objectives.

2.3 Connecting interaction with engagement

Among the aforementioned engagement strategies and support, increased interaction is frequently mentioned by teachers, students, and researchers in

online learning [32–34]. This is probably due to the issue of “transactional distance,” a psychological distance that may lead to students’ misunderstanding of their teachers and that may extend with a lengthened physical distance in online contexts [35], p. 23. Without effective interactive designs that inspire communication across the “transactional distance,” misunderstanding may accumulate in distance learning, blended learning, and flipped classrooms to the extent where learners no longer believe in their teachers, lose interest in course contents, and experience negative feelings of anxiety, helplessness, and isolation [36]. Hence, interaction can be closely associated with engagement in online learning. Stein and Graham [16] adopted the classification of learning interaction into three subcategories by Moore [37]: student-content, teacher-student, student-student, and revealed their respective strengths and limitations to give guidance for maximizing engagement in blended learning. The following part reviews the literature on the connections between the three interactions with specific engagement dimensions.

2.3.1 Teacher-student interaction

Teacher-student interaction typically occurs when a teacher interacts with a group of students in real or virtual classrooms and when a teacher communicates with a student outside classrooms by email or social media [16]. Regarded as the most important interaction type among the three, teacher-student interaction can greatly influence students’ engagement in learning as well as final performance [38]. Teachers may provide direct support after immediate contact with students who encounter content or technical problems, so that they could avoid too much anxiety that possibly results in low engagement [36]. Under emergent circumstances such as the lockdown during COVID-19, social presence of teachers and students can be critical to keeping students socially and affectively engaged in online courses, and teachers should stay connected and take the initiative to sustain a stable online learning community especially during the crisis [39]. Teachers can also render scaffolding conducive to learner engagement out of class by communicating with students *via* social media. For example, Tong et al. [40] examined how 110 university students from a class of Chinese as a foreign language engaged in authentic and semi-formal conversations in the class WeChat group. The online communication was initially led by the teacher but then gradually by students themselves as they grow more interested and confident. It is mindful rather than merely frequent teacher-student interaction that may facilitate learner engagement.

2.3.2 Student-content interaction

Student-content interaction involves reading, understanding, or responding to learning materials from textbooks, videos, software, and any other available sources [41]. Goh et al. [42] unveiled the relationships among student-content interaction, behavioral engagement, and learning outcomes with an intervention study of 45 Malaysian students participating in online peer review activities for a research writing project. The result that students who spent more effort on peer review, and constantly reviewed course materials tended to submit better final writing indicates that interaction with contents can mediate the effect of behavioral engagement on final learning outcomes. Whereas traditional content is static and limited in adapting to learners’ levels, digital content is dynamic and encourages active learning through suitable tasks based on learners’ needs [16].

Bikowski and Casal [43] found that the introduction of digital interactive textbooks inspired effective strategy use of 13 non-native English-speaking university students during the learning process in an ESP course, demonstrating how content interaction may improve behavioral and cognitive engagement. Technology affords “hypertextual, multimodal, and communicative platforms” for presenting knowledge and opens the possibility for student-content interaction in blended learning [43].

2.3.3 Student: Student interaction

Students may interact with peers formally in class discussions, collaborative writing and other group work for a course, or informally in study groups out of class [16]. This interaction type has been repeatedly highlighted in educational research, because good learning is, in many situations, not isolated or competitive but collaborative and social [34]. Even though social interaction among peers may be impeded in online learning contexts because of psychological or physical distances between students, technology offers numerous solutions realized through digital tools which, if integrated well into learning activities, may trigger effective communication between students. Kim and Kim [44] designed a wiki-enhanced blended writing course where 56 high-school participants utilized a wiki platform to complete writing assignments and conducted peer review activities. Results showed that wiki-based peer discussion helped create a sharing community where those students felt motivated to exchange ideas and revise their own drafts. Lyu and Lai [45] looked into the interaction initiated by 11 L2 learners with native speakers of their target languages on *Lang-8*, a language learning social media. When these learners posted their blog-like L2 writing on the platform and received feedback from native speakers who were *Lang-8* users learning other languages, they felt supported in social and emotional aspects in addition to language and acquired a sense of community belonging that encouraged persistent involvement in language learning on this platform.

The three subcategories of interaction, albeit with different emphases, are connected, as they all revolve around “students” in a learning environment. Existing evidence has somehow proved a certain association between interaction and engagement, but failed to reveal a complete and dynamic picture since most previous research just focused on one or two subcategories of interaction. The assistance of digital tools has brought ever-increasing opportunities of interaction, which may further bring along the improvement of learner engagement in blended learning settings. Nevertheless, mere increased interaction may not be sufficient. Only when meaningful interaction in the learning context is increased can learners become actively engaged in the learning events and create knowledge through “transformation of experience” ([46], p. 205). To our best knowledge, no research has touched upon a thorough examination of interaction and engagement in blended learning.

Therefore, in order to address the gaps identified from the literature, this study is proposed to make an in-depth exploration of interaction patterns in light of engagement in a blended learning course based on ZOOM and CNMOOC. The research questions are raised as follows: 1) What are the patterns of interactions undertaken in the blended academic writing and presentation course? 2) How can different patterns of interactions promote learner engagement in the course?

3. Method

3.1 Participants

Participants in the research were 21 undergraduates enrolled in Academic Writing and Presentation course in Shanghai Jiao Tong University in China. Among them, 9 were international students while 12 were Chinese students. They attended the 90-minute class *via* ZOOM once every week for 16 weeks. Since it was a blended course, students were supposed to do autonomous learning *via* CNMOOC before class, participate in activities *via* ZOOM, and complete project-based writing prompted by assignments on Canvas, a platform designed by the university for the management of learning modules, the arrangement of course materials, and the assignment of learning tasks. They also employed WeChat, an APP frequently used in China for synchronous and asynchronous communications after class.

3.2 Instruments

We did classroom observation by video-recoding the ZOOM class and downloaded the data from the ZOOM chatroom. We also followed the learning procedure records on CNMOOC, including watching videos, doing exercises, and posting ideas. Besides, assignments were saved from CANVAS all along the process of writing, such as reading research papers, planning and revising the outline, and writing and revising the research paper. At the end of the course, we interviewed an international and a local student from two different groups to investigate more details about how students engaged themselves in learning. Some of the students' interactions in WeChat were also used as further evidence to show group members' engagement through interaction in cooperative learning.

3.3 Procedure of data collection and analysis

We transcribed the ZOOM video recordings into texts, together with the texts in the chatroom to analyze teacher-student interaction. We also analyzed data from the teacher's written feedback, followed by the oral feedback in the form of discussions with each group *via* ZOOM microphone. The records of student learning, such as textbook study, note-taking for research paper reading, and autonomous learning on CNMOOC, were analyzed for investigating engagement in student-content interaction. Peer-review comments and students' communication in WeChat for jointly completing the project were analyzed for student-student interaction. Interview data were used to further support ideas about students' interactions and engagement in the course.

4. Results

4.1 Teacher-student interaction

Teacher-student interaction in ZOOM is mainly demonstrated in the form of questions and answers, exploration using ZOOM note-pen, student presentations and teacher comments, and teacher's written and oral feedback about students' writings.

4.1.1 Questions and answers by using ZOOM chatroom and microphone

Example 1

Some astonishing questions about the nature of the universe have been raised by scientists studying black holes in space. _____. So much matter compressed into so little volume changes the fabric of space around it in puzzling ways.

1. The collapse of a dead star into a point perhaps no larger than a marble creates a black hole.
2. A black hole is created by the collapse of a dead star into a point perhaps no larger than a marble.

Excerpt.

T: Which sentence do you think is better to be filled in the blank?

S1: 2.

S2: 2.

S3: 2.

S4: 2.

S5: 2.

S6: 2.

T: OK, most of you think it's No. 2. Why do you feel No 2 is better? What's the difference between these two?

S7: Passive voice.

S8 (Microphone): The first one is formal and the second one is informal.

T: Do you mean the second sentence is less formal. But usually, a passive voice is more formal than an active voice.

S5: The term comes first, followed by the definition, easy to understand what the sentence is intended for.

S7: Important thing is placed first in the sentence.

T: You are closer. Very good! Can you recall what you have watched in CNMOOC?

S7: Oh, old and new information principle.

T: Good, can you give some explanation?

S7: (Microphone) The second sentence start from "black holes," which has been mentioned at the end of the 1st sentence. Old information first and new information second is easier to understand.

T: Excellent! In summary, begin sentences with information that are familiar to your readers. End sentences with information that readers cannot anticipate.

Example 1 is to show how students and the teacher interact in the form of questions and answers to perform class activities by using chatroom, microphone, or both in ZOOM. In Example 1, students tried to find the connection between the sentences in a paragraph for enhancing logic and flow. We can see from the example that students actively contributed their ideas in the ZOOM chatroom, or used the microphone to make their voices heard. The teacher did not give the answers quickly, instead, she waited patiently and encouraged students to give more opinions. As a result, they not only made a correct judgment but also struggled to figure out the reason why the second sentence was better. Through interactions in ZOOM, students were able to have a thorough and deep exploration of the knowledge about academic

writing. Finally, one student recalled the knowledge learnt from CNMOOC and gave the correct answer. This process of teacher-student interaction demonstrates deep engagement of learning by means of questioning and answering in ZOOM.

4.1.2 Knowledge exploration by using ZOOM note-pen

Figures 1–4 demonstrate how students used the note-pen to interact with the teacher. In Figure 1, students were asked to underline the key information for the summary of a given text. In Figure 2, students were required to find out the informal expressions and turn them into more academic ones. Figure 3 shows how students revised an outline that had problems concerning parallelism, ordination, subordination, and division. In Figure 4, students explored the five essentials of an abstract and tried to improve the abstract. To be more specific, they were supposed to learn the basic contents by themselves *via* videos and exercises on CNMOOC. When they participated in class activities in ZOOM, they used the knowledge they had learnt to analyze the essentials involved in the abstract taken from a published research paper. To encourage more engagement from the students, the teacher asked them to use the note-pen in ZOOM to identify the different parts such as background, aim, method, result, and conclusion. They were also required to figure out how to improve the abstract by making some modifications in the form of deletion, addition, or rewriting. Students jointly marked the different parts of the abstract by using the note-pen. They also found that the background was too long and one student deleted it by crossing out those sentences. When the teacher asked whether the background could be simplified,

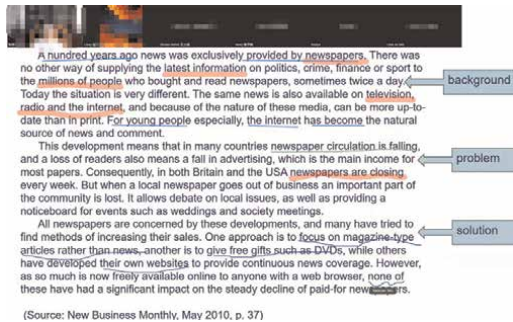


Figure 1.
Summary task using note-pen.

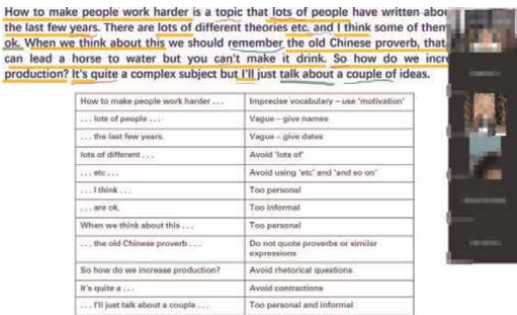


Figure 2.
Academic style task using note-pen.



Figure 3.
Outline task using note-pen.

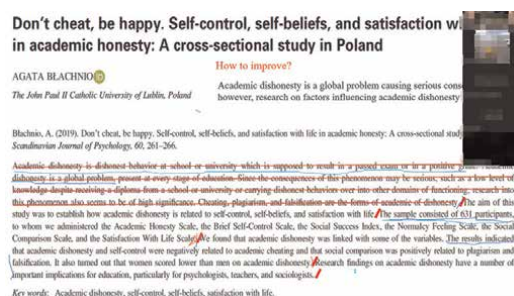


Figure 4.
Abstract task using note-pen.

they started to think hard and finally wrote down their suggestions for improvement in the chatroom.

4.1.3 Student presentation and teacher comment

Students were supposed to give a 3-minute presentation on the topic they chose, the research papers they had read, and the outline they designed for their own research. Students gave the presentation in ZOOM and comments were given immediately after their presentations. In order to save time and improve efficiency, students were asked to record their presentations and sent the videos to Canvas so that the teacher could watch these videos in advance and choose typical examples to give comments in class. They were also required to submit the outline in written form to CANVAS for the teacher to give written comments.

Example 2 demonstrates students' draft outline for collaborative writing and the teachers' comments (Figure 5). The students submitted the outline in PPT format and the teacher gave intensive written feedback to show what need improving by using the "note" function in PPT. She also demonstrated the video to the whole class when they met in ZOOM and gave oral comments while playing the video so that students could learn from others and possibly avoid similar problems in their own outline. The excerpt that follows is part of the interaction between the teacher and students while the teacher gave oral comments in ZOOM.

Example 2

Excerpt.

T: ... Can you find any problems in the literature review part?

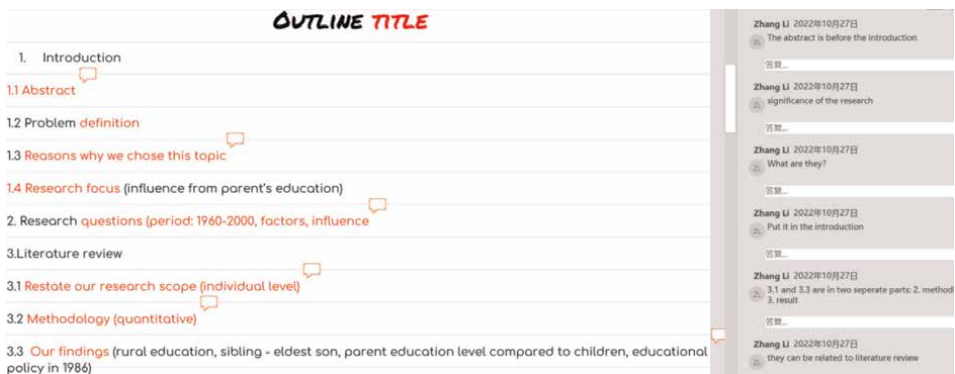


Figure 5.
Students' draft outline (part) with teacher comments.

S1: I do not know quite well about literature review.
T: Literature review is about the review of previous studies in the research area
... .. In this part, you should have some thematic perspective
S1: Maybe I need to read more so that I can try to add something new to this part.
T: And what is “3.2 Methodology,” is this included in the literature review?
S2: This is the method of past research.
T: Oh, you do not put “methodology” to refer to past research, or it will be very
confusing because others will think this is your own research method.
S2: I will delete it and reorganize according to the topics.
T: Mm ... And why do you put “3.3 our findings” in literature review? It should be
a separate part “Results.”
S2: Mm, there are problems with the structure.
... ..

After the written and oral feedback, students had a better understanding of what problems they had in the outline and felt confident in revising the outline. They resubmitted their outline to Canvas, which demonstrated much improvement. On the basis of the outline, students were able to develop ideas in detail and write a logical research paper. In short, the interactions in the form of student presentations and teacher comments facilitate students' engagement, resulting in better performance in learning.

4.1.4 Teacher's written and oral feedback to student writings

After students submitted their drafts, the teacher gave feedback in written form. In order to achieve a better understanding of the feedback, students in their collaborative groups had discussions with the teacher in turn *via* ZOOM microphone. Example 3 is written feedback on the draft abstract (**Figure 6**), followed by the oral

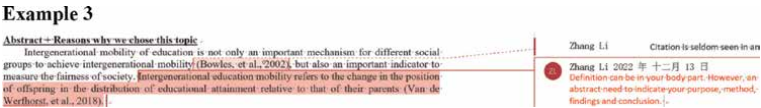


Figure 6.
Original abstract with teacher's written feedback.

discussion between the teacher and the students in ZOOM, and a revised abstract showing the improvement resulting from the written and oral feedback. This example demonstrates how the teacher gave written and oral feedback to the draft, how the teacher and students interact to reach a better understanding of the comments, and how the abstract was revised. The whole process can demonstrate the engagement of students and improvement of performance.

Example 3

Excerpt.

T: Now, look at the abstract. It's very short.

S1: Yes, it's too short. I think we will put some more contents like the conclusion we made and what we will find in our study.

S2: We have used another person's research in our abstract, so I think we might need to cite the resource?

T: Usually in the abstract, you will give a very general and brief introduction of the background, and emphasize on the things you have done, such as the method, result and conclusion. The background is general, you seldom use citations. Have you seen citations in an abstract when you read other research papers?

S2: I see some in the discussion and introduction part. So professor's idea is to put this sentence in the introduction or literature review, is that right?

T: Yes.

Revised abstract

Intergenerational mobility of education can be seen as one dimension of educational fairness. In this chapter, we applied multiple linear regressions to study the relationship between Intergenerational mobility of education and area, policy, and family education background with 11,000+ data collected from China Family Panel Studies (CFPS). We found a possible "ceiling," which is the approximate bachelor and master degree, for the education level of children. Also, policy generally increases the education level while hurting mobility. Children living in urban areas are likely to receive better education and surpass their parents while there is no significant difference in mobility between urban and rural areas. Male offspring are more likely to attain a higher degree and less likely to be influenced by their family's education background.

In the revised abstract, students solved all the problems that occurred in the original paper. The new abstract demonstrates the essential elements required by an abstract. Compared with the draft, the method and results of the research are specified and the conclusion is given.

4.1.5 WeChat interactions

We established a WeChat group for the teachers and students to have frequent interactions both synchronously and asynchronously. There are altogether 172 messages from the teacher and 122 messages from the students. **Figure 7** contains three clips from the WeChat group to show how the teacher and the students interact. The teacher would engage students by setting the steps of learning, informing students of newly assigned tasks, specifying requirements of certain tasks, sending useful learning materials, reminding students of the deadlines, and answering students' questions. The students would be motivated by the teacher and engaged in learning. They would state some management problems whenever they need support, raise questions about

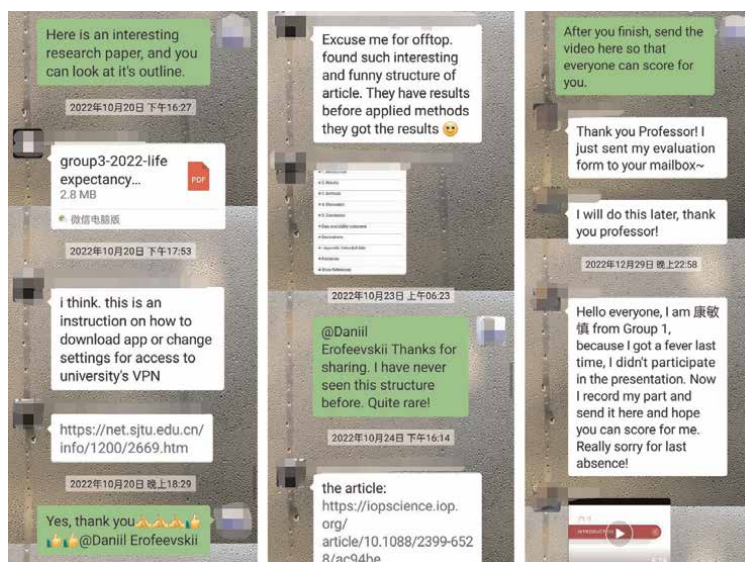


Figure 7.
WeChat group interactions.

learning to ask the teacher for help, and share interesting materials they have found with other students.

4.2 Student-content interaction

Student-content interaction is manifested by students' interaction with the teaching materials such as textbook learning, research paper reading and note-taking, video-watching, and exercise completion on CNMOOC.

4.2.1 Textbook learning, research paper reading, and notetaking

The textbook entitled "Academic Writing and Presentation" is designed by the instructor for the course. This book covers contents about academic ethics, topic choice, literature reading, language improvement, academic writing essentials, and presentation strategies. It features the blended-learning model, with directions for before-class autonomous learning of MOOC, in-class activities with implementation instructions, and after-class tasks for completing the research project. Students frequently referred to the textbook, either for previewing the lessons before class or for reviewing the lessons after class. They also referred to specific contents if they were not sure about certain knowledge in the course, such as how to do a literature review, how to give peer-review comments, and how to provide citations and references. As one student said in the interview: "The textbook is just like a handbook that I can refer to whenever I have questions about learning." In fact, students frequently had interactions with the course textbook, which shows their engagement in learning.

Since students had the freedom of choosing their own topic of interest for research, the papers they read were different except for some sample papers the teacher used in the instruction. The members of a group searched and shared the papers for the group research, they had interactions with the contents in the published papers while reading and making notes (**Figure 8**). They were also required to give presentations about

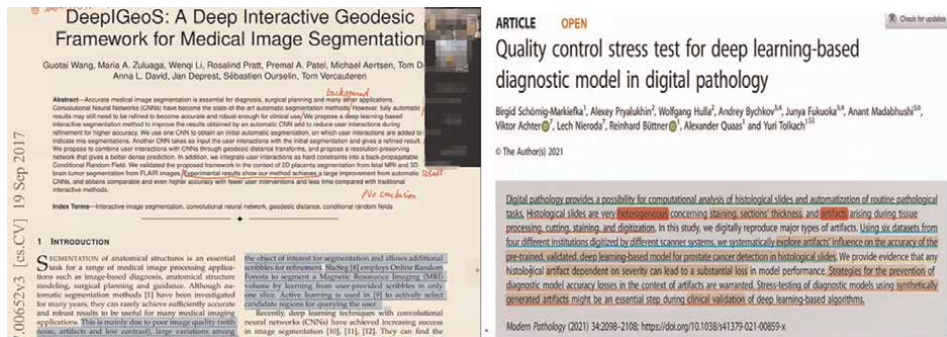


Figure 8.
Research paper reading with notes.

their reading and write the research background on the basis of reading. As a result, students were highly engaged in the reading process.

4.2.2 Video-watching and exercise completion on CNMOOC

Table 1 shows the online learning materials and students' learning records on CNMOOC. It is shown that there were many contents for students to do autonomous learning on CNMOOC and that students had asynchronous interactions by posting on the discussion board. **Figure 9** shows students' learning track on CNMOOC, such as the length of time they spent on learning, the progress of task completion, and the percentage of video watching and exercise completion. The online records help the teacher know how students were engaged in learning all through the semester, enabling her to give formative assessments of learning and adjustment of teaching whenever necessary.

One thing to be notified of is that the exercises must be well-designed. That means the exercise should have some degree of difficulty so that students are most likely to have more interactions with the contents and be more engaged in CNMOOC. They also have to be more attractive when they come to the class so that they are able to know how to do the exercises correctly. For example, there was a paraphrase exercise, in which students were asked to read the following sentence and identify the best paraphrase.

Items	Number or time length
Number of videos	33
Total length of videos (minutes)	227
Number of files	18
Announcements	1
Number of tests	12
Number of exercises	70
Student posting	62
Teacher posting	16

Table 1.
Learning materials and learning process records on CNMOOC.

Name	Starting-time	Time-length	Progress	Video	Exercise
姓名	首次学习时间	学习时长	学习进度(%)	课件浏览	客观练习
	2022-09-21 18:56:39	14:16:51	91%	100%	100%
	2022-10-10 16:10:57	5:23:38	15%	16.9...	16.6...
	2022-09-29 10:47:18	21:57:05	91%	100%	100%
	2022-09-22 16:11:58	14:59:28	84%	100%	16.6...
	2022-09-24 16:18:04	12:22:21	97%	100%	100%
	2022-09-22 15:08:07	9:35:45	74%	83.0...	25%
	2022-09-22 15:04:29	12:28:31	70%	71.7%	91.6...
	2022-09-29 09:33:55	18:47:42	87%	100%	75%

Figure 9.
Student learning track on CNMOOC.

Example 4

The amphibia, which is the animal class to which our frogs and toads belong, were the first animals to crawl from the sea and inhabit the earth.

- A. The first animals to leave the sea and live on dry land were the amphibia, such as frogs and toads.
- B. Frogs and toads belong to the animal class amphibia.
- C. The amphibia, the animal class to which frogs and toads belong, were the first animals that move from the sea to the earth.
- D. Frogs and toads are the amphibia that come from sea to earth.

Excerpt.

T: Which one do you think is the appropriate paraphrase of the original sentence?

S1 (Microphone): It's C?

S2: A.

S3: C.

S4: C.

S5: C.

S6: A.

S7: A.

S8: (Microphone) I think it's A.

T: You think it's A. there are two different ideas now.

S8: (Microphone) I think A is better.

T: According to the meaning, both are correct. But a paraphrase should not be too similar to the original sentence structure or the use of words, so A is better.

The result shows that students had disagreements about whether to choose A or C because both seem to be the possible answers. The conflict of ideas might arouse more attention from the learners to the teacher's explanation that a paraphrase was not only

close in meaning but also different in form from the original sentence. We can see from the example that well-designed in-class activities can promote pre-class learning and generate numerous ideas from the students in ZOOM activities. In other words, the well-designed videos and exercises on CNMOOC and the corresponding activities in ZOOM can promote learner engagement in that students have to be devoted to learning before class in order to be equipped with the knowledge to participate in the discussions in class.

4.3 Student-student interaction

Student-student interaction includes three forms: WeChat interaction for finishing collaborative project-based tasks, peer review in writing, and the question and answer session in the final presentation of their research papers.

4.3.1 Collaborative work in project-based tasks

For completing their collaborative research project, students had a lot of interactions after class *via* WeChat. The interaction occurred throughout the process, starting from choosing a research topic, allocation of tasks and responsibilities, and to jointly finishing and improving their writing. The following is an excerpt from two students when they tried to choose their research topic. Example 5 is an excerpt from the WeChat discussion between two students.

Example 5.

S1: hahaha ~ maybe I'm talking too much, but I'm also thinking that for analyzing why Chinese and Russian students think differently in your part, maybe I could give you some ideas about how Chinese students think?

S2: I think too. I love your enthusiasm, it will be cool! Also our university is starting the vegan meals in Cafe on campus, maybe it will be useful info for our work?

S1: Actually I do not know much about vegan meals, but I think yes it may have an influence on people's attitude of eco-friendly food.

The two students from China and Russia collaboratively worked on the project. They were both enthusiastic about the project and were discussing what topic to choose. The Russian student proposed vegan meals and the Chinese student responded with eco-friendly food. Then, the Chinese student suggested doing a comparative study to see how Russian and Chinese students' opinions differed concerning eco-friendly food. They found the comparison would be interesting and immediately reached an agreement. Later, as one of the students in the interview mentioned: "We frequently interact with each other *via* WeChat when we need to, such as sharing information about our sources, allocation our tasks and assignments, collecting data from both sides." Since they were quite motivated at the very beginning of the project, they were more willing to interact with each other and continued with a lot of engagement, as a result, they completed the task quite well.

4.3.2 Peer review in collaborative writing

Example

Students were trained on how to do peer review before giving peer review to each other, they were also provided with a peer review checklist to ensure that they had

paid attention to all the important issues in writing. If they disagreed with their peers' comments, they were supposed to discuss them together until they reached an agreement for revision. Example 6 is part of a peer review work taken from the Chinese student who jointly worked with the Russian student on the topic of how ecological advertisement influences the purchase of green food (**Figure 10**). The student gave very intensive comments, either by direct addition or deletion, which is shown by the revision track on the left column or by noting, as is shown in the right column. The student who received the comments would read, think, and make judgment about how to revise. They would also talk to each other if they had disagreements. As the student mentioned in the interview: "We may not totally agree with each other's suggestions. On this occasion, we will discuss via WeChat." In fact, peer review is a task that can engage students well because this is not only an assignment to be scored, but also a process involving a lot of reading, thinking, and writing. Students read their peers' writings so that the whole paper can be more systematic in structure, richer in content, and more fluent in language.

4.3.3 Q & A session in research presentation

Example 7

S1: I'm Kathy from Group 7. I'd like to ask questions about the solution part. You have mentioned that there are a lot of problems about the economic and political aspects, like low labor participation rate and little property right for female. I just ask why in your solution part, only education is mentioned? Why there are not solutions regarding economy and politics? Are there any other solutions?

S2: Thank you Kathy for your question. In terms of whether there are possible solutions other than education, the answer is definitely "yes" As for why we choose education as the solution, we saw that education could possibly

The effect of ecological advertising on people's purchase intention of green food: (eco-friendly food)

1. Introduction

1.1 Ecological products and its current situation

In the modern world, more and more attention is being paid to the environmental aspects of life. One of the important aspects of a person's daily life is nutrition. The emotional and physical state of health depends on it. On store shelves, we can see more and more products labeled "eco" on the packaging. However, most consumers have a lot of questions about the quality and ethics of making such food. Is it really true that eco-products are much healthier and more environmentally friendly than conventional ones?

1.2 Ecological advertisement and its current situation

Another aspect of this problem is whether consumers' feelings are being played on? and does the product really meet all aspects of environmental friendliness? or is it just a publicity stunt. Advertising is now the main tool in the struggle for the attention of buyers. Marketers and PR people are looking for more and more new and sophisticated ways to influence the human mind in order to increase sales. In this article we tried to find out how the younger generation treats food advertising. Do they pay attention to the eco-labeling of goods when buying and does this affect the subsequent choice?

3. Method

(1)-quantitative-investigation-questionnaires-on-participants'-evaluation-and-purchase-intention-of-products-with/without-ecological-advertisement

(2)-qualitative-investigation-interview-on-participants'-attitude-toward-products-with/without-ecological-advertisement

In this article, two methods were used -- a survey and an interview. This is how we planned to get both quantitative and qualitative information. With the help of a survey on the Internet, you can interview quite a lot of people and find out their opinion on the problem we are investigating. With the help of interviews, we find out the emotional attitude of the participants to the problem, their personal attitude. We can ask more about certain aspects. It was decided to conduct a survey among students from China and Russia to find out about their attitude to ecological food. Why students? We chose university students as subjects for our research because they are a young developing generation, for whom advertising is primarily designed, since young people always follow trends and changing trends in the world.

Comments:

1. The title may be more concise without the "()" -
2. The language style seems not academic enough. I think we'd better avoid too many short question sentences and use formal and complete statements in a research paper.
3. What is PR short for? When it appears for the first time, there should be a whole name for readers to rightly understand.
4. 1. The language style seems not academic enough. 2. In the method part, I think we need to include the following things as well: ① the contents of our questionnaire (the pictures and questions), ② what questions we asked in the interview, ③ how many students are included in our questionnaire survey and interview.
5. If there's only one paragraph in this part, I think these subtitles are not quite necessary, and the two methods can be clearly described in the paragraph.

Figure 10.
Peer review sample.

solve a number of problems. In terms of the cultural practices, in the long run, teachers and educators being the most important role players, they will be able to help solve and change the mind of our youth In terms of why we chose educations specifically, it was the most practical to implement, we could see the benefits both in the short and long term. I hope that can answer your questions.

Example 7 is the question from the audience and the answer by one of the speakers who jointly gave a presentation on the topic of gender discrimination. Students were supposed to present the parts of their responsibility in the research paper. The presentation was followed by the Q&A section, in which each speaker was required to answer at least one question from the audience. In order to attract the audience's attention to the presentation and encourage them to raise questions, anyone who asked a question would be given 1 additional point to their final score for the presentation. We also invited students to be evaluators of other students' performance so that they could be more engaged by listening attentively to give reasonable scores.

5. Discussion

5.1 Teacher-student interaction

Our study shows that students engaged themselves in learning through teacher-student interaction in ZOOM. The Excerpts about questions and answers for the exploration of certain knowledge and the marking for specific information using a note-pen demonstrate that students were actively engaged in the interaction. It is also found that the WeChat group is a useful platform to ensure teacher-student interaction after class for encouraging students' engagement in learning. The finding is in line with Tong et al. [40] who found that the use of the WeChat group can facilitate learner engagement, especially when the interaction is mindful rather than merely frequent. In both cases, the teacher played the important role of a mediator and involved the students by regulating the interaction. Vygotsky [10] assumes the importance of the presence of mediating agents (e.g., teachers) who guide learners through the process of understanding. From Vygotsky's perspective, emotionality is a detrimental factor in achieving teacher-learner alignment in interaction [9]. Teachers as a mediator of learning should care for students' emotions so that they can be more engaged, as Poehner and Swain [47] observed, mediation concerns the teacher's responsibility of maintaining the learner's interest and engagement in the interaction so that feelings of frustration can be minimized. Lee [48] emphasized that learners' perceptions of how powerful teachers are able to organize the class and care for students might influence engagement. She reported that feelings of comfort or the teacher's ability to create a comfortable context for learning influenced learners' willingness to communicate and the quality of interaction. Therefore, the role of the teacher is not only to instruct about a specific concept but also to mediate learners' behavior and engagement in the collaborative work and to understand the relationship between behavioral, emotional, and cognitive aspects of engagement [49].

As a matter of fact, whether students can be actively motivated and sufficiently engaged in a class is determined, to much extent, by how a teacher is engaged in teaching. In other words, a teacher has to be devoted to teaching and engaged in the course design and course implementation first, because teacher engagement is sometimes a determinant factor in students' engagement. As Davin [9] put it: to engage

learners, teachers should be engaged first by providing excellent classroom design and giving immediate, intensive, and useful feedback. Lidz [49] echoes the point by stating that for a teacher who strives to function as an optimal teacher, engaging in behaviors him/herself is definitive of excellence in teaching (p. 13).

5.2 Student-content interaction

Our study also shows that students engaged themselves by interacting frequently with the learning contents, such as their textbook, the self-selected resources for reading, and CNMOOC videos and exercises. The textbook and CNMOOC developed by the teacher, and the reading materials students have searched for their research topic provide abundant resources for learning and result in student-content interaction. Goh et al. [42] find that students who constantly review course materials tend to have better performance because their interaction with contents can mediate the effect of behavioral engagement on final learning outcomes. Kahn [50] maintains that the investment in learning resources contributes to the behavioral, cognitive, and emotional dimensions of engagement which are reflected by students' active participation, full performance, and satisfactory learning products.

The materials designed for blended learning and the record of students' learning process on CNMOOC demonstrate how computers can be applied to aid teaching and how students can be engaged in a blended learning context. Ziegler et al. [51] find that the online system can influence the learning outcome because it can provide feedback automatically, track learners' actions and engagement with the system, and record the learning processes and progress as they complete certain tasks. Students also exerted much effort in autonomous learning and challenged the difficulties in the process. The finding is shared by Burch et al. [46] who find that students pay attention to the learning materials and maintain their engagement even if challenged by difficult learning activities. As some students mentioned in the interview: "I usually make use of CNMOC to do some preview and review of knowledge if I have difficulty in learning"; "Some CNMOOC exercises are difficult for me, but I'd like to try my best to solve these problems so that I can complete my project well." From the interview, we can see that when encountering difficulties, students will try hard and regulate themselves to meet the challenges. As a matter of fact, students' self-regulation, cognitive strategy use, effort, and persistence can all show their cognitive engagement [52].

Our findings also suggest that both exercises in CNMOOC and activities in ZOOM should be well-designed to encourage higher engagement from the learners. Johnson and Golombek [53] claim that teachers must understand the nature of the instructional activities in classrooms, trace the activity as it is unfolding, and know the extent to which engagement in such activities influences what students learn and how they learn. Teachers as facilitators of engagement with good learning experience design can increase the possibility of learner engagement [18]. When activities are designed well, the teacher becomes a guide rather than an authority, and students may be given more space and freedom, thus students participate in these activities by taking up new modes of engagement [54].

5.3 Students-student interaction

Our study also shows that students are engaged in their learning tasks through student-student interaction. They work collaboratively in project-based tasks, give peer review in collaborative writing, and ask and answer questions in research

presentations. Students' engagement can be enhanced through collaborative project-based writing, during which they interact frequently with each other and are highly engaged for completing these tasks and activities. Li and Zhu [55] claim that whether collaboration is fruitful or not depends on the way of collaboration such as the degree of control over the task, and the level of engagement among learners. If learners in a group are regarded as an intrinsically connected unity rather than independent entities [56], their engagement can be reinforced by the joint construction of meaning [57], joint attention [58], joint mediation [59], and metalinguistic processing of active participation [60]. They can be highly engaged because a collaborative activity is a synergetic process that can promote the emergence of zones of proximal development among learners [58].

We can also find students' engagement in learning by observing the peer review on writing assignments. Students working in the same group gave comments on their two group members' writings so that the whole piece can be systematic with better quality. As one student reflected in the interview: "I find that peer review is helpful because I had to think hard for giving appropriate feedback to my partners and I also received feedback from them as to how to improve the language, content and structure." Yu and Lee [61] use activity theory to understand peer review and maintain that students are motivated to use complex ways and draw on multiple resources to support each other through the writing process. Besides behavioral engagement in peer review, students also engaged themselves emotionally and cognitively, as De Guerrero and Villamil [62] assert that revision involving peer-to-peer scaffolding entails encouragement and emotional support. Goh et al. [42] even maintain that learners may be engaged in metacognitive reflection during peer review, and active engagement in peer review improves learning outcomes. On the whole, understanding peer review as an activity system allows teachers to appreciate the social nature of group writing assignments and enables students to increase their opportunities to use English beyond individual capability [63].

It can be reflected by teacher-student, student-content, and student-student interactions that social environment plays an important role in learning and development, especially in our writing class where students collaboratively work to finish a writing project. Sociocultural theory emphasizes the importance of social context in writing development [64]. The teacher, learners, and content are coordinated so that students can learn successfully and collaboratively in a goal-directed activity [65]. Interaction is considered an important mechanism for promoting L2 development from both cognitive and sociocultural perspectives [58]. It is regarded as an environmental affordance for L2 learners to engage in communication by receiving input, producing output, and gaining feedback from teachers [66].

6. Conclusion

The study examines how the three forms of interaction facilitate learner engagement in an online blended course of academic writing and presentation. The results show that teacher-student, student-student, and student-content interactions can all influence students' engagement in a blended learning environment. Teacher-student interaction in the form of questions and answers, student presentations and teacher comments, knowledge exploration using note-pen, and teacher's written and oral feedback influences engagement in ZOOM. Teacher-content interaction *via* well-designed videos, exercises and in-class activities affects students' engagement in

CNMOOC. Student-student interaction for completing project-based writing tasks in WeChat, and peer review in collaborative writing has an impact on students' engagement after class. The findings are discussed from the behavioral, emotional, cognitive, and social perspectives. The study enables a deeper understanding of the practice of collaborative learning in the online blended learning context. It may enrich the socio-cultural theory by revealing the dynamic interrelations among teachers, learners, learning tasks, and tools, thus contributing to a wider understanding of the theory relating to the advancement of technology. It has pedagogical implications for course design and delivery where interactions are involved for better student engagement.

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The Massive Open Online Courses (MOOCs) educational model has opened access to education by being affordable, removing geographical barriers, and enabling ubiquitous learning. Now, a potential student can study courses from anywhere in the world, is not required to travel to campus, and can study whenever they want. Because of less overheads on offering MOOCs and economies of scale, the courses do not cost much. Due to the COVID-19 pandemic, rapid advances were made in technology, platforms, and networks so that learners could continue studying online. This is the “new normal” of learning and there is no going back. This book looks at the technology, networks, and platforms that enable MOOCs. Is online learning a good substitute for face-to-face learning? We address the concerns, concepts, context, and implications in this book. Learning on your own has many challenges. This book looks at the pedagogical practices that we can apply to overcome these challenges and obtain a successful and satisfying teaching and learning experience.

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