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**Construction of a
Learning Society**
Theories, Experiences and Future Trends
in Lifelong Learning

*Edited by Weiguaju Nong, Jian-Hong Ye,
Yuzheng Lu and Xiantong Yang*



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Education and Human Development is an interdisciplinary research area that aims to shed light on topics related to both learning and development. This Series is intended for researchers, practitioners, and students who are interested in understanding more about these fields and their applications.

Meet the Series Editor



Katherine Meltzoff received her BA in Psychology from Trinity College, in Connecticut, USA and her Ph.D. in Experimental Psychology from the University of California, San Diego. She completed her postdoctoral work at the Yale Child Study Center with Dr. James McPartland. Dr. Meltzoff's doctoral dissertation explored neural correlates of reward anticipation to social versus nonsocial stimuli in children with and without autism spectrum disorders (ASD). She has been a faculty member at the University of California, Riverside in the School of Education since 2016. Her research focuses on translational studies to explore the reward system in ASD, as well as how anxiety contributes to social challenges in ASD. She also investigates how behavioral interventions affect neural activity, behavior, and school performance in children with ASD. She is also involved in the diagnosis of children with ASD and is a licensed clinical psychologist in California. She is the Assistant Director of the SEARCH Center at UCR and is a faculty member in the Graduate Program in Neuroscience.

Meet the Volume Editors



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Dr. Yuzheng Lu is a Postdoctoral fellow at the Ministry of Education's Curriculum and Textbook Research Institute, with a Ph.D. in Education, primarily engaged in research on the fundamentals of vocational education and undergraduate vocational education. Published academic papers in journals such as "Chinese Higher Education Research," "Modern Distance Education Research," "Journal of National Academy of Educational Administration," and "Contemporary Vocational Education." Multiple articles have been fully reprinted by the People's University of China's photocopied periodicals "Vocational and Technical Education" and "Educational Abstracts," and excerpted from "Xinhua Digest." Completed projects include the Ministry of Education's industry-university cooperation collaborative talent cultivation project and the Zhejiang Provincial Department of Education's general scientific research project. Also involved in multiple key and general national social science topics.



Dr. Xiantong Yang's research focuses on exploring the educational psychological mechanisms underlying student learning and teacher teaching in school settings, and how to promote this teaching-learning process using technology-supported tools. His research concentrates on AI-supported teaching, student and teacher competency evaluation, and student mental health monitoring. He has published more than 40 articles as the first or corresponding author in SSCI, CSSCI, and Peking University Core Journals. He has won international best paper awards, national awards (such as the National Scholarship), and provincial awards (such as the Beijing Outstanding Graduate). He serves on the editorial board of BMC Psychology (SSCI Q1) and reviews for over a dozen SSCI journals. With 2 years of teaching experience, his Google Scholar citations exceed 900, and according to ResearchGate, his Research Interest Score is higher than 95% of his peers.

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Preface

Lifelong education is accorded a high priority within the global educational community and is actively promoted by UNESCO. It is an essential part of educational development. Through continuous knowledge renewal, lifelong learning effectively fosters individual development at different stages of life and promotes participation in aging societies. In the context of the accelerating new industrial revolution, digital transformation, and societal change, lifelong learning has become the driving force behind the development of a Learning Society and the promotion of a sustainable educational ecosystem. Against this backdrop, this volume brings together scholars from relevant fields to share their insights and research findings on lifelong learning and the development of the Learning Society. This provides sustainable momentum for lifelong learning.

The volume encompasses diverse article types, including reviews, original research, and opinion pieces, covering a wide range of themes. These include research trends in vocational education and lifelong learning, the challenges of artificial intelligence in future teacher training, adult continuing education within the IT sector, community library applications in service learning, continuous professional development for healthcare practitioners, and the integration of learning experience models in lifelong learning. It presents descriptions and critiques of research experiences and perspectives from scholars in China, Portugal, Spain, Botswana, South Africa, the United Kingdom, Romania, and other countries. Each author thoroughly examines the implementation of lifelong education and the development of learning societies in their own country. This enables government bodies, social organizations, professionals, academics, and the public to better understand the current state of lifelong learning research across nations at different stages of development.

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Chapter 1

Evolution and Hotspots of Vocational Education and Lifelong Learning: A Visualized Analysis Using CiteSpace

Yanxuan Liu, Jian-Hong Ye and Weiguaju Nong

Abstract

The integration of vocational education and training (VET) and lifelong learning (LLL) has garnered increasing scholarly interest over the past two decades. This study conducted a comprehensive bibliometric analysis of research published between 2005 and 2025, employing CiteSpace to examine 212 journal articles from the Web of Science-Core Collection and Scopus databases. This chapter outlines the intellectual structure of this research domain through publication trend analysis, keyword co-occurrence networks, cluster identification, and burst detection. The results indicate that: (1) temporal distribution of published papers reveals a clear three-stage evolution – the initial incubation stage (2005–2014), the rapid growth stage (2015–2017), and the consolidation and maturation stage (2018–2025); (2) research themes identify five core clusters, including qualifications framework, adult VET, labor market, institutional change and policy, and digital integration; (3) research evolution demonstrates three major paradigm shifts: from conceptual separation to systemic integration, from initial vocational training to adult and continuing education emphasis, and from exploring technological enablers to addressing contemporary demands such as digital skills and economic growth; (4) research frontiers highlight the transition from early interests in e-learning and policy to current emphases on digital skills, adult education, and economic growth. By systematically mapping the literature on VET–LLL integration, our study contributes to the existing knowledge base and provides valuable insights for both researchers and policymakers interested in advancing this field.

Keywords: Bibliometrics, CiteSpace, Vocational education, Lifelong learning, Research review, Visualization

1. Introduction

In an era characterized by rapid technological advancements, demographic shifts, and the evolving demands of the global knowledge economy, the paradigm of education is fundamentally transforming. The concept of education as a finite

phase of life is increasingly being supplanted by the imperative for lifelong learning (LLL), a continuous process essential for personal development, active citizenship, and sustained employability. LLL is rooted in the integration of learning and life, encompassing learning activities that address a range of learning needs and aspirations across all age groups, within diverse life contexts, and through varied learning approaches [1]. LLL empowers individuals to improve their lives by developing competencies, changing directions, and overcoming setbacks [2].

This global momentum is strongly reinforced by international commitments. The United Nations 2030 Agenda for Sustainable Development, launched in 2015, established Sustainable Development Goal 4: ensuring inclusive and equitable quality education and promoting LLL opportunities for all. This goal positions LLL as a key indicator of educational progress. Further solidifying this framework, the UNESCO Institute for Lifelong Learning (UIL) released LLL opportunities for all: Medium-Term Strategy 2022–2029 in March 2022, outlining the development direction, framework, and action strategies for the next eight years. This strategy aims to establish an LLL system that spans and integrates every learning context throughout an individual's life, from work to daily living, ensuring benefits for people of all ages and backgrounds [3]. These international frameworks form the overarching global context for the necessary integration of educational sectors.

Concurrently, the very nature of work is evolving. It is estimated that 85% of the jobs today's learners will undertake in 2030 have yet to be invented, creating an employment landscape characterized by uncertainty and unknowns [4]. This reality demands a parallel transformation in how we prepare individuals for their working lives. Vocational Education and Training (VET) is thus undergoing a critical redefinition, evolving from a terminal track preparing youth for specific trades into a dynamic and recurring component of an individual's professional journey across the lifespan.

The theoretical underpinning for this shift is powerfully articulated by New Vocationalism, championed by scholars such as W. N. Grubb. It emphasizes shifting away from traditional vocational education's focus on "technical preparation for specific occupations," arguing instead that vocational education should establish broader and more far-reaching goals: preparing students for employment and continued learning [5]. This philosophical shift from a model of "social efficiency" to one resembling Dewey's vision of democratic education has also been enacted in policy [6]. As Hagedorn observed: "Only through an educated society prepared for work can a nation better achieve higher levels of economic prosperity" [7]. A pivotal example is the evolution of US legislation, notably the transition from the Carl D. Perkins Vocational Education Act of 1984 to the Carl D. Perkins Career and Technical Education Act of 2006. The seminal change in terminology from "Vocational and Technical Education" to "Career and Technical Education" (CTE) legally codified this expanded mission. This places greater emphasis on preparing students for postsecondary education [8], highlights a people-centered philosophy and sustainable development concepts, and focuses on the unity of lifelong development and current employment.

Therefore, the strategic integration of VET within a comprehensive LLL framework is not merely an educational interest but a cornerstone for building resilient, adaptive, and inclusive skill-based societies. Despite this clear policy

and theoretical push for integration, the academic landscape remains fragmented. Research exists in disparate streams, focusing on specific aspects such as policy reform, adult learning, or technological integration, without a synthesized understanding of the field's overall intellectual structure, evolutionary trajectory, and emergent frontiers. Key questions persist: How has the scholarly discourse on VET and LLL coalesced and evolved over the past two decades? What are the enduring research hotspots, and how are they interconnected? What are the dynamic frontiers signaling the future direction of this field? A systematic, macroscopic analysis is urgently needed to map this complex domain, identify the knowledge base, and illuminate the pathways for future inquiry.

To address this gap, this study conducted a robust bibliometric analysis utilizing the CiteSpace visualization software to examine 212 peer-reviewed journal articles indexed in the Web of Science Core Collection and Scopus databases between 2005 and 2025. This methodology enables a quantitative and visual exploration of the international research on VET–LLL integration, moving beyond traditional literature reviews to uncover latent patterns and trends. The remainder of this chapter is structured as follows: Section 2 outlines the research design, detailing the data sources and analytical methods. Section 3 presents the results, including the general publication landscape, research hotspots, and evolutionary paths. Section 4 discusses the theoretical and practical implications of these findings, derives policy inspirations, and acknowledges the study's limitations. Finally, Section 5 offers a concluding summary of the research.

2. Research design

2.1 Method and tools

Bibliometric analysis is a quantitative method for investigating the body of scholarly publications within a specific field [9]. This approach enables a systematic and objective review of large volumes of literature, allowing researchers to trace the evolution of a domain, identify its intellectual structure, and anticipate future research trajectories [10]. Due to its capacity to map the landscape of scientific knowledge through various metrics and indicators, bibliometric analysis has become increasingly popular and is frequently carried out using CiteSpace [11]. This study employed CiteSpace (version 6.4.R1), a Java-based information visualization software package, as its primary analytical tool. CiteSpace was fundamentally designed to visualize and analyze trends and patterns within scientific literature. It operates on co-citation analysis and pathfinding network algorithms to identify pivotal points in a field's development, such as research frontiers, emerging trends, and critical transitions, and maps the dynamic networks of scientific knowledge [12].

Using CiteSpace, we conducted a visual analysis of the collected literature data across four key dimensions: the temporal distribution of published papers to understand the field's growth trajectory, the research themes through keyword cluster analysis, the research evolution using timezone views of keyword clusters, and the research hotspots through burst detection analysis. The software parameter settings are shown in **Table 1**.

Analysis type	Timespan	Slice length	Node types	Selection criteria
Research themes	2005–2025	1	Keyword	g-index (k = 25)
Research evolution	2005–2025	1	Keyword	g-index (k = 15)
Research hotspots	2005–2025	1	Keyword	g-index (k = 25)

Table 1.
Input parameters and default settings for CiteSpace analysis in this research.

2.2 Data source and process

The data for this bibliometric analysis were retrieved from the Web of Science Core Collection (SCI and SSCI) and Scopus databases, targeting journal articles published between 2005 and 2025. A comprehensive search strategy was employed using a query that combined key terms related to vocational education (e.g., “vocational education and training,” “CVET,” “undergraduate vocational education”) with variants of “lifelong learning,” applied to titles, abstracts, and keywords. We were able to acquire 752 articles in total based on these terms. To ensure the dataset’s relevance and academic rigor, a multi-step screening process was applied to the publications from 2005 to 2025: the results were first restricted to English-language, peer-reviewed journal articles published within this timeframe, excluding other document types and non-English publications; the titles and abstracts were then manually screened for thematic consistency with the study’s focus on vocational education and LLL integration; finally, duplicate articles found in the two databases were removed. This process yielded a final corpus of 212 high-quality journal articles published between 2005 and 2025, with the complete literature selection process detailed in **Figure 1**.

2.3 Characterization of the consulted literature

In alignment with the research objectives outlined in the methodology, the 212 publications comprising the final corpus were characterized to establish their relevance for addressing the study’s aims. The consulted literature predominantly consisted of three complementary types of scholarly work: (1) theory-building and framework articles, which provide the conceptual foundation necessary for identifying broad research themes and understanding the field’s evolution; (2) empirical research studies, which offer concrete evidence on specific programs and technologies, forming the basis for pinpointing research hotspots and frontiers, the collective output of which defines the temporal distribution of publications; and (3) policy analysis and comparative studies, which are instrumental for analyzing the drivers of institutional change and international benchmarking trends that shape the research frontiers. This typology ensures that the dataset is not only robust but also aptly suited to comprehensively address the four core analytical objectives of this study, namely mapping publication trends, identifying research themes, tracing evolutionary paths, and detecting emerging frontiers.

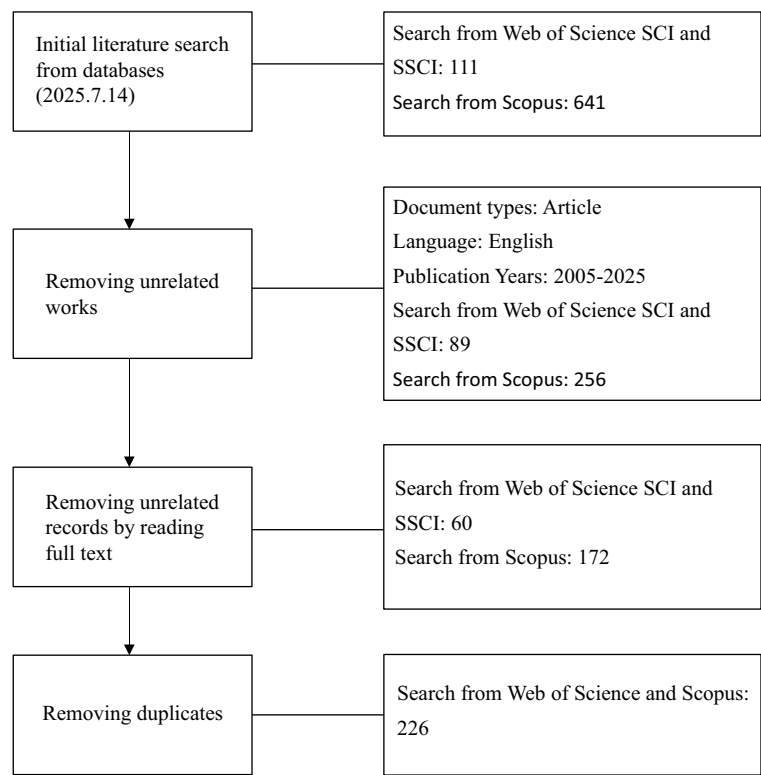


Figure 1.
A schematic illustration of the process of literature inclusion and exclusion.

3. Findings

3.1 Temporal distribution of published papers

To delineate the macroscopic developmental trajectory of international research on the integration of VET and LLL over the past two decades, a quantitative analysis of annual publication output from 2005 to 2025 was conducted. The volume of publications serves as a pivotal indicator of a field’s academic vitality, growth momentum, and the level of scholarly interest it garners. The annual publication data, illustrated in **Figure 2**, reveal that the evolution of this field has not been linear but is characterized by three distinct phases: a period of initial incubation, followed by rapid growth, culminating in a phase of consolidation and maturation.

3.1.1 Initial incubation phase (2005–2014)

During this first decade, the field was in its nascent stage. Annual publication figures remained consistently low, fluctuating marginally with minor peaks in 2009 (eight publications) and 2012 (thirteen publications), but with an average annual output of only seven publications. This pattern indicates that the interdisciplinary nexus between VET and LLL had not yet coalesced into a major, self-sustaining stream of international research. Scholarly efforts during this period were likely

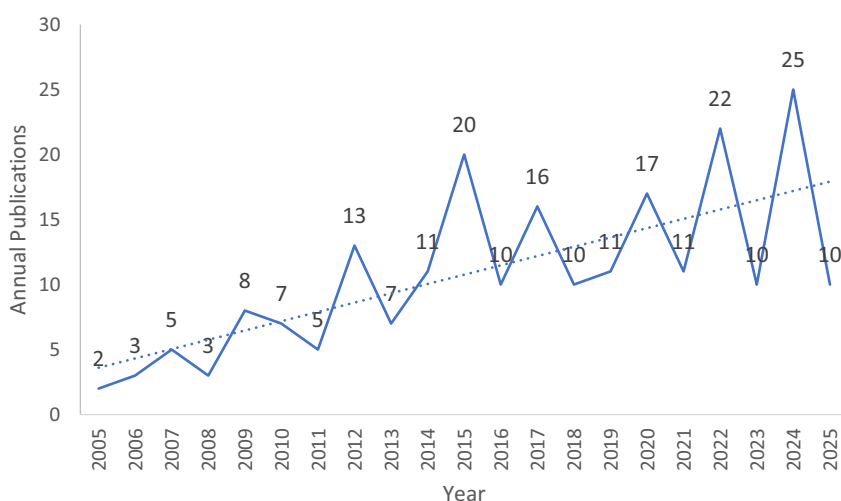


Figure 2.
Annual publication statistics of VET and LLL (2005–2025).

fragmented, focusing on foundational theoretical explorations or isolated case studies, without generating widespread, sustained academic momentum.

3.1.2 Rapid growth phase (2015–2017)

A dramatic inflection point occurred around 2015, when annual publications surged to twenty, effectively doubling the output from the previous year. This surge marked the transition to a period of rapid growth, with outputs remaining notably higher in 2016 (ten publications) and 2017 (sixteen publications) compared to the pre-2015 baseline. This remarkable ascent can be strongly correlated with the global policy landscape. The launch of the United Nations’ 2030 Agenda for Sustainable Development in 2015, which explicitly champions “inclusive and equitable quality education” and promotes “lifelong learning opportunities for all” (sustainable development goal [SDG] 4) [13], provided a powerful, universal mandate. Concurrently, in June 2015, the European Union (EU) released the 2015 Riga Summary, aiming to enhance the overall quality and status of VET within the context of the Copenhagen Process, thereby supporting broader European economic growth and employment initiatives [14]. Ongoing strategic initiatives in key regions, which linked VET to LLL strategies, catalyzed substantial policy-oriented and empirical research. This phase signifies the moment the topic gained significant traction on the international research agenda.

3.1.3 Consolidation and maturation phase (2018–2025)

From 2018 onward, the field entered a phase of consolidation. The data exhibit fluctuations but demonstrate a new, higher plateau of productivity, with an average of fifteen publications per year. This period is punctuated by new, significant peaks in 2022 (twenty-two publications) and 2024 (twenty-five publications), suggesting robust, sustained interest, and the emergence of new research sub-themes. The fluctuations likely reflect the field’s response to evolving global challenges, such as

the imperative for digital skills and just green transitions in the wake of the Fourth Industrial Revolution, the assessment of National Qualifications Frameworks (NQFs), and the post-pandemic re-evaluation of online and blended learning models in professional training. It is noteworthy that the data for 2025 are provisional, given the current year is incomplete, yet the preceding high-volume years confirm the field's continued relevance and dynamic evolution.

In summary, the analysis of publication output over the past twenty years reveals a compelling narrative of academic emergence and consolidation. The research domain concerning the integration of VET and LLL has unequivocally evolved from a niche interest into a mature and dynamically evolving field of international scholarly inquiry, firmly positioned at the intersection of global education policy, economic development, and social equity.

3.2 Research themes

Keywords represent the refinement and concentration of literature research. Analyzing high-frequency keywords can effectively reflect the research hotspots in a given field. This study conducted a co-occurrence analysis of keywords from the collected literature and performed a cluster analysis, building upon the keyword co-occurrence network. This clustering generated fifteen distinct clusters, comprising 433 keyword nodes and 1,284 connecting links. The first nine clusters were selected for in-depth examination. The keyword cluster analysis revealed a sophisticated and multi-layered intellectual structure within the field. The identified clusters are not isolated islands of inquiry but are dynamically interconnected, converging into five primary thematic hotspots. **Table 2** displays the research clusters and keywords.

3.2.1 Institutional linchpin: Building bridges with qualifications frameworks

This theme represents the most critical structural foundation for the integration of VET and LLL. At its core, research in this area (Cluster 1: qualifications framework and Cluster 7: educational transition) investigates the systemic mechanisms that enable the recognition and portability of learning across time and contexts. The NQF is studied not merely as a classificatory tool but as a transformative “linchpin” that aims to break down the traditional barriers between academic and vocational pathways, as well as between formal, non-formal, and informal learning [15]. Scholars explore the design, implementation challenges, and governance of NQFs, examining how they can effectively standardize learning outcomes, ensure quality, and foster trust among employers and educational institutions.

This institutional architecture is intrinsically linked to the practicalities of learner mobility, as captured in Cluster 7. The focus on “educational transition” and the specific mention of a “credit-based lifelong learning system” highlight the operational tools that translate the theoretical promise of NQFs into reality. Research here delves into the development of credit accumulation and transfer systems, which allow individuals to build qualifications incrementally over their lifetimes. This facilitates vertical progression (e.g., from a vocational certificate to a university degree) and horizontal movement (e.g., between different trades or into new fields), thereby making the ideal of a seamless LLL journey a tangible possibility. The connection between these two clusters underscores

Cluster ID	Name	Size	Silhouette	Top terms (LLR)
0	Testing competence	40	0.933	Blended learning space; learning activities; community healthcare; medical education.
1	Qualifications framework	39	0.872	Adult learning; national qualifications framework; broad-based voucher; life-long learning.
2	Institutional change	37	0.86	Reform fit; new EU member state; social dialog; mobile policies.
3	Vocational training adult education	36	0.795	Historical construction; lifelong learning policy space; European Union; entrepreneurship pedagogies.
4	Research hotspot	35	0.834	Evolutionary pathway; Chinese undergraduate vocational education; biological science; Gujarat, India.
5	Labor market	27	0.981	Industrial Revolution; method-based analysis; other EU member state; unemployed adult
6	Integration	25	0.966	E-learning; web; technologies; training.
7	Educational transition	22	0.93	Education; Australia; credit-based lifelong learning system; sociology.
8	Education level	19	0.972	Human capital depreciation; educational system; changing societies; task.
9	International education policy	16	0.91	Attitude; VET system; AQUA-TNET lifelong learning strategy change; lifelong learning.

Table 2.
Main clusters and keywords of VET and LLL (2005–2025).

a fundamental research consensus: without robust structural frameworks, the integration of VET and LLL remains fragmented and ineffective.

3.2.2 Core practice: Adult VET for labor market adaptation

This hotspot constitutes the practical heartland where the integration of VET and LLL directly impacts individuals and economies. It signifies a paradigm shift in VET, from a primary focus on initial preparation for youth to a continuous, lifelong process of skill development for adults (explicitly linking vocational training and adult education in Cluster 3). The research is rigorously anchored in the realities of the labor market (Cluster 5), analyzing how VET systems must adapt to macro-level challenges such as the skills demands of the Fourth Industrial Revolution [16], economic restructuring, and the need to reintegrate unemployed adults.

The economic underpinning of this practice is elaborated in Cluster 8 (education level). The keyword “human capital depreciation” is pivotal here, providing a powerful theoretical rationale for lifelong VET. Technological progress has a depreciation effect on human capital, rendering certain knowledge obsolete, even for highly skilled workers. This phenomenon is known as high-skill automation technological progress [17]. Schultz [18] and Becker [19] were the first to propose human capital theory, decomposing human capital into five components: healthcare facilities and services, on-the-job training, formal education, adult education programs, and labor migration. They emphasized that human capital serves as a vital

source of technological innovation and economic growth, effectively driving sustainable economic and social development [18, 19]. Continuous investment in VET for adults is not a luxury but a necessity to counteract this depreciation, thereby maintaining individual employability and enhancing national economic competitiveness and resilience [20]. This body of work often involves empirical studies on the returns on investment in adult training and analyses of how VET policies can be designed to target specific skill gaps in the economy.

3.2.3 Drivers of change: Policy transfer and systemic reform

This thematic area moves beyond the “what” and “how” to investigate the “why” and “who” behind systemic integration; that is, the political and discursive forces that drive change. Research captured in Cluster 2 (institutional change) and Cluster 9 (international education policy) examines the complex processes of VET system modernization and adaptation. It explores the concept of “reform fit,” that is, how global LLL models are adapted, resisted, or transformed within specific national institutional contexts.

A significant focus is the role of supranational bodies, with the EU featuring prominently. Studies have analyzed the EU’s “mobile policies” and its strategic use of tools such as the “AQUA-TNET lifelong learning strategy” (Cluster 9) to foster policy convergence among member states [21–23]. The mention of “new EU member states” and “social dialogue” in Cluster 2 indicates a specific research interest in the dynamics of policy transfer to transitioning economies and the critical role of involving social partners (employers, trade unions) in the reform process [24, 25]. This research hotspot essentially investigates the governance of VET–LLL integration, viewing it as a politically negotiated and discursively constructed process.

3.2.4 Technological enabler: Digital integration of learning and training

This theme identifies digital technology not as a peripheral tool but as a fundamental enabler that reshapes the delivery and experience of integrated VET and LLL. The integration cluster (Cluster 6) is central here, with keywords such as e-learning, web, and technologies pointing to a robust research stream. Scholars have investigated how digital platforms, online learning modules, virtual simulations, and mobile technologies facilitate just-in-time, personalized, and accessible vocational training. This research moves beyond mere technical implementation to explore pedagogical models for blended learning (also in Cluster 0) [26], the development of digital competencies for both learners and trainers, and the potential of technology to create a ubiquitous “lifelong learning policy space” (Cluster 3), where learning opportunities are no longer constrained by geography or time [23]. It positions technology as the vehicle that can democratize access and make lifelong vocational learning a practical reality for diverse populations, including working adults.

3.2.5 Evolving frontiers: Competency assessment and contextual expansion

This final theme captures two critical and evolving frontiers of the field. First, the testing competence cluster (Cluster 0) addresses a fundamental challenge that arises from diversified learning pathways: how to validly and reliably assess and certify skills

acquired outside traditional classrooms. Research in this area focuses on developing innovative assessment methodologies for complex competencies in environments such as blended learning spaces, community healthcare, and medical education [27]. It questions what constitutes valid evidence of learning and how to ensure that credentials issued through these new modes hold value in the labor market.

Second, the research hotspot cluster (Cluster 4) indicates significant expansion in both geographical scope and contextual dimensions within this field. The focus on China's undergraduate vocational education and the case of Gujarat, India, demonstrates that discussions on integrating vocational education with LLL are becoming increasingly globalized [28]. This marks a shift in research perspectives away from a Eurocentric paradigm, with academia increasingly examining the interpretation, implementation, and localization of these concepts within major Asian economies and other distinct sociocultural contexts. This diversification enriches the field by introducing new paradigms, challenges, and empirical foundations.

3.3 Research evolution

The time-zone map presents the evolution of knowledge in the field from a temporal perspective, which helps in understanding the themes and changing trends in vocational education and LLL research across different time periods. All nodes are positioned on a coordinate axis, with time on the horizontal axis, and keywords are marked at the time of their first appearance. The larger the node, the higher the frequency of the keyword's appearance across all years, and the more keywords in a certain time zone, the more research outcomes there are at that time, indicating a period of prosperity. The lines between time segments indicate a connection between the keywords of the two time periods. **Figure 3** displays the time-zone map of keywords in vocational education and LLL research. This analysis reveals a remarkable evolution from conceptual separation to functional integration, characterized by three distinct yet interconnected phases that reflect the deepening understanding of how vocational education serves as a crucial component within LLL frameworks.

The initial phase (2005–2009) was characterized by the emergence and solidification of the field's core concepts. The prominence of broad, foundational keywords such as “lifelong learning,” “education,” “vocational training,” and “vocational education and training (VET)” from 2005 to 2008 established the two primary domains of inquiry. The significant appearance of “employment” in 2009 explicitly anchored this research to labor market outcomes, providing a critical rationale for the subsequent linkage between vocational education and LLL. During this period, the research primarily operated at a conceptual level, defining the scope and importance of its constituent parts.

Then, 2010–2014 marked a significant shift toward operationalizing the connection between vocational education and LLL. The emergence of “e-learning” in 2010 signaled the beginning of a focus on the technological enablers of accessible, flexible learning. Concurrently, keywords such as “continuing vocational training” (2011) and “curriculum” (2013) reflected efforts to structurally embed LLL within vocational pathways. A pivotal moment was the strong presence of “Germany” and “continuing education” in 2014, highlighting the role of international policy transfer and the benchmarking of established VET systems as models for structuring LLL.

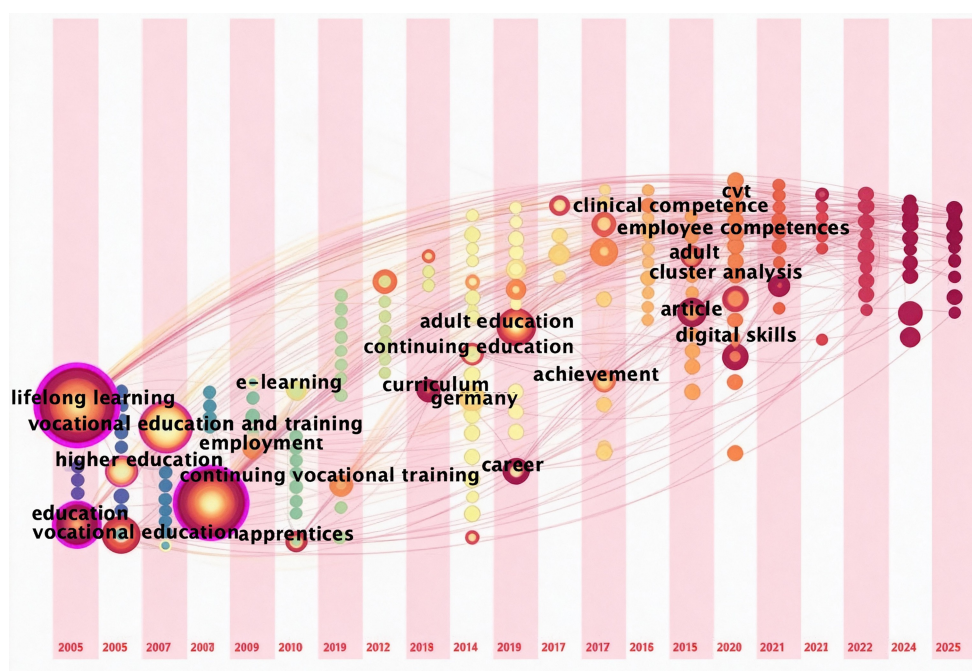


Figure 3.
 VET and LLL research evolution (2005–2025).

This phase was defined by a focus on the systems, policies, and curricula that could formally couple vocational education with LLL.

The most recent phase (2015–2025) revealed a maturation and diversification of the field. Research began to focus more sharply on outcomes and specific competencies, as seen with keywords such as “achievement” (2017) and “clinical competence” (2018) [29]. The focus on the “adult” learner (2019) solidified the target demographic for lifelong vocational learning. From 2020 onward, the frontier became intensely focused on contemporary demands, with the rise of “digital skills” [30], “employee competences,” and “cluster analysis.” This indicates a direct response to the skills demanded by digitalization and the modern workplace, and the adoption of more sophisticated methodological approaches, such as “cluster analysis,” to map the intellectual structure of the field itself. The continuation of these trends through 2025 confirms that the research agenda is now firmly centered on skills development, competency assessment, and the empirical analysis of the integrated VET–LLL ecosystem.

3.4 Research hotspots

Research frontiers represent the emergent, rapidly evolving themes and shifting paradigms within a field over specific periods. According to Chen, the referenced literature or burst keywords reveal the areas of interest for researchers [10]. Burst detection analysis, which identifies keywords with a sharp increase in citation frequency, serves as a robust indicator of these dynamic frontiers. The burst strength and duration of the top fifteen keywords (see **Table 3**) reveal a clear and compelling

Keywords	Strength	Time
E-learning	1.68	2010–2012
Teacher training	1.88	2011–2012
Policy	1.73	2012–2013
Germany	2.17	2014–2017
Vocational education and training	2.52	2015–2016
Advanced vocational training	1.73	2015–2016
Lifelong education	1.65	2016–2017
Skills	2.46	2017–2020
Adult education	2.2	2017–2023
Achievement	1.6	2017–2018
Article	1.55	2019–2025
European Union	2.06	2020–2023
Economic growth	1.7	2021–2025
Vocational training	2.81	2022–2023
Education	1.88	2022–2025

Table 3.
Burst detection of VET and LLL: 2005–2025 (Top fifteen).

evolutionary path in the study of VET and LLL integration over the past two decades. This evolution highlights how scholarly attention has shifted from foundational enablers, through systemic and international benchmarking, toward a focus on broad economic value and systemic integration.

The earliest bursts, from 2010 to 2013, centered on the essential prerequisites for integrating VET and LLL. The frontier was defined by e-learning (2010–2012), signaling the initial exploration of digital technologies as a transformative tool for delivering flexible and accessible LLL opportunities. This was immediately followed by a focus on teacher training (2011–2012), underscoring the recognition that educators themselves required new competencies to facilitate this technologically enhanced, learner-centered paradigm. Concurrently, the burst of policy (2012–2013) marked the beginning of serious scholarly discourse on the governmental and institutional frameworks necessary to promote this integration, moving the discussion from theoretical potential to practical implementation.

The research frontier expanded significantly from 2014 onward, characterized by a turn toward international comparison and the core components of an integrated system. The strong burst of Germany (2014–2017) is particularly telling, establishing the country’s dual VET system as a leading international reference point and a model for structuring work-based learning within a lifelong context. This period of benchmarking saw the core concept of VET (2015–2016) itself, along with advanced vocational training (2015–2016), surge to the forefront, reflecting efforts to define, systematize, and elevate the status of VET within LLL architectures. The subsequent bursts of skills (2017–2020) and adult education (2017–2023) signify a critical narrowing of the frontier onto the primary target group and the central objective: equipping adults with the relevant skills for a changing world.

The most recent phase of frontier research demonstrates a maturation of the field, connecting VET and LLL to broader economic agendas and adopting a more holistic, systemic view. The bursts of EU (2020–2023) [23] and economic growth (2021–2025) [31] powerfully illustrate this shift. Research has moved beyond national case studies to analyze the role of supranational policy entrepreneurship in driving integration and to explicitly link lifelong skills development to macroeconomic outcomes. The strongest burst keyword, vocational training (2022–2023, Strength: 2.81), reaffirms the practical core of the field. Finally, the ongoing burst of the most general term, education (2022–2025), suggests a powerful concluding frontier: the conceptual absorption of VET and LLL into a singular, integrated, and overarching discourse on the purpose and future of education itself. The frontier is no longer just about connecting two domains but about rethinking the entire educational paradigm around the principles of LLL and employability.

4. Discussion

4.1 Implications

4.1.1 Theoretical implications

First, this study has empirically validated and refined the conceptual model of VET–LLL integration. The three distinct phases identified in both the publication trends and evolutionary path, namely conceptual foundation, systemic integration, and value realization, demonstrate that the fusion of vocational education and LLL is not a spontaneous process but a deliberate, staged evolution. This progression, from establishing separate conceptual pillars to building institutional bridges and finally focusing on synergistic outcomes, provides a robust dynamic integration framework that can guide future theoretical development. It moves beyond abstract advocacy for integration to describing its concrete, measurable trajectory.

Second, the keyword clusters reveal that the integration is fundamentally multi-layered and systemic. The co-existence of distinct but interconnected clusters – qualifications framework (institutional layer), adult VET and labor market (practice layer), and digital integration (technological layer) – demonstrates that the field is structured as a complex ecosystem rather than a linear relationship. This finding challenges simplistic, one-dimensional models of VET–LLL interaction and calls for a more sophisticated, multi-level systems theory to fully comprehend the interplay between policy, practice, and technology in building effective LLL systems.

4.1.2 Practical implications

From a practical perspective, the findings offer clear guidance for policymakers and institutional leaders. The strong, sustained research focus on NQFs and Credit Systems underscores their non-negotiable role as the foundational infrastructure for integration. The implication for practice is unequivocal: strategic investments must prioritize developing and refining these transparent, skill-based recognition systems to dismantle barriers between education and work, and to make LLL a tangible reality for individuals.

Furthermore, the shift in research frontiers toward “skills,” “economic growth,” and “digital skills” provides a powerful narrative for advocacy and funding. It equips practitioners with evidence to frame lifelong vocational training not as a cost but as a critical investment in national competitiveness and individual employability. The demonstrated link between VET–LLL integration and macroeconomic outcomes, as seen in the latest burst keywords, is a crucial tool for securing political and financial support, urging a reallocation of resources toward upskilling and reskilling initiatives for the adult workforce.

Finally, the consistent emphasis on Germany and the EU as key nodes in the research network highlights the immense value of international benchmarking and policy learning. Rather than reinventing the wheel, educational leaders and policymakers are implored to systematically study, adapt, and implement proven models and policies from frontrunner countries and regions, thereby accelerating their own systemic integration processes.

4.2 Inspiration

4.2.1 The imperative of a unified NQF

The persistent prominence of the “qualifications framework” and its strong linkage to “educational transition” in the keyword analysis underscore its role as the foundational infrastructure for integration. Such a framework is crucial for recognizing and accrediting learning outcomes acquired through diverse formal, non-formal, and informal pathways. By establishing clear equivalence and transferability between vocational and academic credentials, an NQF can effectively dismantle institutional barriers, thereby creating a truly flexible and permeable LLL system that empowers individuals to navigate their learning and career trajectories seamlessly.

4.2.2 Strategic prioritization of adult and continuing vocational training

The convergence of clusters on “vocational training adult education” and “labor market,” coupled with the sustained burst of “adult education,” highlights that the core of the integrated system lies in serving the adult population. This provides a clear strategic direction: national policy and resource allocation must pivot toward strengthening and expanding continuing VET (CVET). This involves developing targeted programs for upskilling and reskilling the existing workforce, with a special focus on vulnerable groups, to proactively address skill obsolescence (human capital depreciation) and meet the demands of the evolving labor market, particularly those driven by the Fourth Industrial Revolution.

4.2.3 Leveraging digitalization as a core integrative enabler

The early emergence and sustained relevance of “e-learning” and the recent frontier of “digital skills” demonstrate that technology is not merely a delivery tool but is rather a transformative force for integration. This inspires a need to deeply integrate advanced digital pedagogy and infrastructure, particularly artificial intelligence (AI) and metaverse technologies, into the core of vocational education and LLL strategies. We should invest in large-scale, AI-powered digital learning

platforms that can personalize learning pathways, provide real-time feedback, and automate assessment, thereby making LLL more efficient and accessible. Furthermore, the development of metaverse-based virtual campuses and simulation environments can create immersive, hands-on training experiences for vocational skills, from complex machinery operations to soft skills training, that are otherwise risky, costly, or impractical in the physical world. By systematically embedding not only foundational digital skills but also AI literacy and metaverse-enabled collaborative projects into all VET curricula, we can ensure equitable access to high-quality, future-oriented LLL opportunities.

4.2.4 Policy formulation through strategic international benchmarking

The strong research focus on “Germany” and the “European Union” indicates the significant value of cross-national policy learning. Rather than developing systems in isolation, we can gain immensely from a structured analysis of policy successes and challenges in established VET–LLL systems. This involves studying the mechanisms of their dual training models, governance structures involving social dialog, and the implementation of their qualification frameworks. Adapting these internationally validated practices to the specific socio-economic context of our country can accelerate the development of a robust and effective integrated system.

4.2.5 Aligning system outcomes with macro-economic goals

The powerful burst of “economic growth” as a recent research frontier provides a compelling narrative for justifying investment in VET–LLL integration. This insight should be leveraged to reposition lifelong vocational training in the national discourse, shifting it from social welfare expenditure to strategic investment in human capital and national economic competitiveness. Policymakers and educators should explicitly articulate and measure the contribution of VET–LLL initiatives to key macroeconomic indicators, thereby securing sustained political and financial commitment for building a highly skilled, adaptable workforce that drives sustainable development.

4.3 Limitations

While this study provides a comprehensive overview of the research landscape on the integration of vocational education and LLL through systematic bibliometric analysis, several limitations should be acknowledged to properly contextualize the findings and guide future research.

First, the scope of data sources, while robust, inherently shapes the analytical perspective. The exclusive reliance on the Web of Science Core Collection and Scopus databases, although ensuring the inclusion of high-impact, peer-reviewed international literature, may introduce linguistic and geographical bias. This approach likely underrepresents significant research published in other languages or in regional and national journals, particularly from developing contexts. Consequently, the identified trends, clusters, and frontiers may disproportionately reflect the priorities and perspectives of the English-speaking academic world and established research ecosystems, potentially overlooking unique models and challenges emerging in other regions.

Second, the methodological constraints of CiteSpace and bibliometrics must be considered. The analysis is fundamentally based on keyword frequency, co-occurrence, and citation bursts. While these are powerful indicators of intellectual structure and trends, they are primarily quantitative. This approach may not capture the nuanced arguments, theoretical depth, or contradictory findings within the primary literature. Therefore, the findings represent the “what” and “when” of the research field more effectively than the “why” or “how,” necessitating complementary qualitative analysis for a deeper understanding. By acknowledging these limitations related to data sources and methodology, this study not only underscores the need for cautious interpretation of its results but also paves the way for more inclusive and methodologically diversified future investigations.

5. Conclusion

This chapter presents the outcome of a bibliometric analysis of research papers on the integration of vocational education and LLL from the Web of Science Core Collection and Scopus databases. We systematically reviewed 212 relevant publications and explored the evolution of research themes, hotspots, and emerging frontiers in this field. The analysis was supplemented with a more comprehensive literature review. This study found that:

- (1) Research on the integration of vocational education and LLL has experienced three distinct development stages: the initial incubation stage (2005–2014), characterized by conceptual foundations and parallel development; the rapid growth stage (2015–2017), marked by policy-driven integration and systemic coupling; and the consolidation and maturation stage (2018–2025), defined by diversification, skill focus, and value realization. The overall growth trend indicates a dynamically evolving field that is far from saturated, with new research directions continuously emerging.
- (2) Research themes from 2005 to 2025 can be categorized into several core clusters, including qualifications framework, adult VET, labor market, institutional change and policy, and digital integration, which collectively illustrate the multi-faceted nature of the VET–LLL integration.
- (3) The research evolution from 2005 to 2025 is reflected in three major shifts: from conceptual separation to systemic integration; from a focus on initial vocational training to an emphasis on adult and continuing education; and from exploring technological enablers, such as e-learning, to addressing contemporary demands, such as digital skills and economic growth.
- (4) The burst detection analysis explored the dynamically developing aspects of this field. The research frontiers have evolved from early focuses on e-learning and teacher training, through policy and system benchmarking (e.g., Germany, EU), to recent bursts in skills, adult education, and economic growth, indicating the field’s ongoing response to global socioeconomic and technological developments.

Aligned with the primary objective of systematically delineating the international developmental trajectory of research on the integration of VET and LLL over the past two decades, the overarching conclusion of this study, derived from the analysis of 212 peer-reviewed journal articles, is as follows: the international scholarly inquiry into this field demonstrates a clear evolutionary pattern, moving from conceptual advocacy to systemic institutionalization, and further to value. This pattern reveals that the integration of VET and LLL is no longer a theoretical proposition but has become a multi-faceted and dynamically evolving reality. Its core mechanism involves the synergistic construction of a flexible educational ecosystem through institutional designs such as qualifications frameworks, adult-centered vocational training practices, and digital technology enablement, all serving both individual lifelong career development and national economic competitiveness. The knowledge map generated by this research provides a reliable benchmark for future theoretical refinement and policy optimization.

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Challenges of Artificial Intelligence in Teacher Training: Perceptions of Future Teachers

Bruno F. Gonçalves, Maria Raquel Patrício and Elza Mesquita

Abstract

The growing presence of AI-based tools in teaching practices presents new challenges for training institutions, requiring future teachers to be prepared not only to use these technologies but also to critically understand their implications. This study aims to investigate future teachers' perceptions of the main challenges of AI in teacher training, focusing on three central dimensions: technological, pedagogical, and ethical challenges. The research employed a quantitative–descriptive approach, utilizing a questionnaire-based method with a sample of 72 participants. The respondents were students enrolled in the Bachelor's degree in Basic Education and the professional Master's degree in Teaching at a higher education institution located in northern Portugal. The results not only reveal a widespread perception of the relevance of AI for pedagogical practice but also point to significant limitations. On the technological level, difficulties related to the available infrastructure and the digital training of teachers in training stand out. Pedagogical challenges are associated with the effective integration of AI tools into teaching strategies, as well as the redefinition of the teacher's role in a technology-mediated setting. Finally, ethical challenges include concerns about data privacy, algorithm transparency, and the risks of dehumanization of the educational process. It is concluded that teacher training should incorporate a critical and interdisciplinary approach to AI, promoting technical, pedagogical, and ethical skills that enable future educators to act responsibly and conscientiously in an increasingly digital and automated educational setting.

Keywords: artificial intelligence, challenges, future teachers, perceptions, teacher training

1. Introduction

In recent decades, artificial intelligence (AI) has evolved from a field restricted to technological research to a central element in social, economic, and cultural transformations. In the education sector, the progressive integration of intelligent systems – such as virtual assistants, adaptive platforms, data analysis systems, and

applications based on machine learning algorithms – has opened new possibilities for teaching and learning. At the same time, these innovations raise critical questions about the role of the teacher, the nature of pedagogical interaction, and the ethics of using data and algorithms.

In the context of teacher training, the growing presence of AI requires rethinking not only training content but also the essential competencies for professional practice. Initial teacher training, traditionally focused on pedagogical foundations and subject matter, is challenged to include technological and ethical dimensions that enable future educators to act critically and innovatively in digital environments. Therefore, it is not enough to simply understand how the tools work; it is also necessary to understand their limitations, potential biases, risks of dehumanizing teaching, and implications for privacy and data security.

Recent literature highlights the significant benefits of AI in supporting teaching, including personalizing learning, continuously monitoring student progress, and automating administrative tasks, thereby freeing up time for more meaningful pedagogical activities. However, studies also point to persistent obstacles, including insufficient technological infrastructure, a gap in teachers' digital literacy, the difficulty of effectively integrating AI tools into pedagogical practices, and the lack of clear ethical guidelines for their use in educational contexts.

In Portugal, as in other countries, the discussion about AI in education has been gaining relevance, but it still lacks research focused on the perspective of future teachers, key actors in the process of pedagogical innovation. Understanding the perceptions of this group is essential to guide training policies that respond to emerging challenges and ensure a critical, conscious, and humanized approach to the integration of AI in teaching.

Based on this premise, this study seeks to analyze the perceptions of students in the Bachelor's degree in Basic Education and the professional Master's degree in Teaching regarding the technological, pedagogical, and ethical challenges of AI in teacher training. The objective is to identify the areas of greatest concern and recognized potential, contributing to the design of training strategies better suited to the demands of contemporary education.

The article is organized as follows: the "Introduction" presents the theoretical framework and relevance of the study; the "Literature Review" discusses concepts, models, and previous studies related to the integration of AI in teacher training; the "Methodology" describes the research design, the construction and validation of the data collection instrument, the sample characterization, and the ethical procedures; the "Results" section presents and analyzes the data obtained; and finally, in the "Conclusions," the main findings are summarized, the practical implications are discussed, and recommendations for future research are presented.

2. Literature review

The incorporation of generative artificial intelligence (AI) in the field of education has been rapidly intensifying, encompassing a wide range of actors: students, teachers, technical support teams, and institutional managers. The relevance of this technology in the educational context, highlighted by national and

international studies [1–4], underscores the need to prepare everyone involved to address the demands of contemporary digital society (Web 4.0).

In addition to its direct impact on teaching and learning practices, the integration of AI has been gaining prominence in teacher training, considered strategic for the development of technical, pedagogical, and ethical skills [4, 5]. Recent literature, supported by national and international systematic reviews, indicates that we are facing a complex and multifaceted scenario in which significant opportunities coexist with substantial challenges that require critical reflection and coordinated action.

In recent years, particularly between 2020 and 2025, scientific production on AI in education has grown exponentially, especially after the popularization of generative tools such as ChatGPT and Gemini [3, 4]. These platforms have not only increased academic interest in the topic but also catalyzed discussions on issues such as reliability, ethics, pedagogical adequacy, and teacher training. Although European and North American countries concentrate most of the structured initiatives, there is a consistent movement of adaptation and innovation in Latin America [3, 4], which, despite facing restrictions, has sought to align new technologies with its sociocultural and economic realities.

In the specific case of initial teacher training, the literature reveals concrete experiences of integrating AI into teaching internships and curricula. Some studies report the use of virtual assistants to support lesson planning, while others analyze how adaptive systems can personalize the monitoring of future teachers during supervised practice. These contributions reinforce the need to align the discussion not only with ethical and technical dilemmas but also with real-world training contexts, where AI can directly influence the development of professional teaching skills.

2.1 Infrastructure, digital competence, and pedagogical reconfiguration

The effective adoption of AI in education depends heavily on the existence of adequate technical and human resources. From a structural perspective, many institutions – especially in the public sector – still lack access to compatible equipment, specialized software, and quality connectivity [3, 5]. This lack is not limited to the acquisition of resources but also involves system maintenance and updates, as well as the availability of technical support capable of quickly troubleshooting and guiding teachers and students on the correct use of the tools.

At the same time, the digital competency of teachers and future teachers presents significant gaps. Research indicates that many educators feel insecure about operating and interpreting AI-based resources [3]. This insecurity is not limited to the basic use of technology but also includes a critical understanding of its functioning, limitations, biases, and ethical implications. The lack of continuing education programs focused on both instrumental mastery and critical analysis of technology exacerbates this situation.

At the pedagogical level, AI integration requires profound changes in teaching strategies. The literature [3, 4] points to the need for curricular reconfiguration that goes beyond the simple inclusion of technical modules, seeking to train teachers capable of acting as mediators and critics of the pedagogical use of AI. This implies redefining the teaching role from a mere transmitter of content to a learning facilitator, research advisor, and information curator.

Tools like ChatGPT can help personalize teaching, automate assessments, and provide immediate feedback [5], expanding the possibilities for adaptive learning. However, excessive or uncritical use can generate technological dependence, affecting teachers' intellectual autonomy and reducing interpersonal interaction, a central element in the development of socio-emotional skills. The literature warns that, without a conscious pedagogical approach, AI adoption risks being more cosmetic than transformative, reproducing traditional practices with a new technological veneer.

2.2 Ethics, academic integrity, and reliability

The integration of generative AI into higher education and teacher training brings with it a set of ethical implications that cannot be overlooked. Academic integrity emerges as a central concern. Tools like ChatGPT enable the production of high-quality texts in a short time, which can facilitate plagiarism, question the limits of authorship, and encourage academic fraud [6, 7]. There are reports of the increasing use of AI to prepare assessment papers and scientific articles, often without due transparency [8]. To address this reality, experts advocate the adoption of clear academic conduct policies, the use of advanced software capable of identifying AI-generated texts [9], and the promotion of an institutional culture focused on intellectual honesty.

Data protection is another critical issue. AI-based tools frequently access, process, and store sensitive student and teacher information [9–12]. Without adequate safeguards, there is a risk of privacy breaches and misuse of this information. Compliance with specific regulations, such as the LGPD, is essential, as is the implementation of technical and administrative protocols that ensure security and exclusive use for educational purposes.

Algorithmic bias also deserves attention. Models trained with large datasets can replicate preexisting biases and inequalities, influencing decisions and assessments in a discriminatory manner. The case of GCSE (General Certificate of Secondary Education) and A-Level in the United Kingdom, where algorithms assigned grades favoring private schools [9, 13], is a concrete example of the risks involved.

The reliability of AI-generated information is equally problematic. The phenomenon of “hallucinations” [14, 15] in which AI produces incorrect or fictitious information, can seriously compromise the quality of teaching materials and academic research. Furthermore, the technology can be used maliciously to create and disseminate fake news, biased propaganda, and manipulative content [16].

Finally, there are concerns related to human–computer interaction. Excessive use of AI-generated content can reduce human interaction, compromise the development of practical skills, and generate technological dependence [8, 9, 17]. This scenario raises questions about students' ability to develop critical thinking and autonomy when excessively mediated by automated systems.

2.3 Recommendations and pathways for ethical and sustainable integration of AI in education

Given the technical, pedagogical, and ethical challenges posed by generative artificial intelligence, the specialized literature suggests a series of integrated strategies to ensure its adoption is simultaneously innovative, responsible, and inclusive [3–5].

First, the reformulation of teacher training curricula is highlighted, ensuring that AI is not treated solely as a technological resource but as a cross-cutting content that permeates the development of future teachers' digital, pedagogical, and ethical competencies. This approach should include teaching how technologies work, their potential, limitations, and social implications, preparing teachers to act critically and consciously in AI-mediated environments [3, 4].

Furthermore, ongoing training for in-service teachers is essential. Training programs should combine instrumental mastery of tools with critical reflection on their pedagogical and ethical use, strengthening professional autonomy and stimulating the development of critical thinking and creativity. The combination of these elements helps ensure that teachers do not become mere technology operators, but rather active mediators capable of leveraging the benefits of AI in learning [3, 5].

Another crucial aspect is investment in adequate infrastructure and ongoing technical support, especially in public education systems, which often face limited access to equipment, software, and a stable connection. Public policies committed to democratizing access to educational technologies are essential to prevent the widening of digital inequalities and ensure that innovation reaches all educational contexts equitably [3, 5].

Furthermore, the literature emphasizes the importance of interdisciplinary collaboration and the building of support networks involving teachers, researchers, technology developers, and policymakers. This cooperation is essential for the development of contextualized teaching resources, protocols for the ethical use of AI, and the sharing of good practices that promote sustainable educational innovation [5].

Finally, the creation and dissemination of frameworks, models, and guidelines for digital literacy and AI are identified as priorities for future research and educational policymaking. Such tools should facilitate the integration of AI into all stages of teacher training, ensuring that the use of technologies is guided by sound ethical and pedagogical principles, in addition to contributing to the reduction of gaps in knowledge and practice [18, 19].

In short, the successful integration of AI into education depends on a multidimensional and collaborative approach that combines technological innovation with ethical reflection and pedagogical adaptation, aiming not only for efficiency but also for humanization and equity in educational processes.

3. Methodology

This study adopted a quantitative–descriptive approach, aiming to investigate prospective teachers' perceptions of the main challenges posed by AI in teacher education. This approach was chosen due to the need to obtain objective and measurable data that allow for the systematic identification of trends and opinion patterns.

Data collection was conducted using a structured questionnaire designed with closed-ended questions and items assessed on a five-point Likert scale, ranging from “strongly disagree” to “strongly agree.” The instrument addressed three core dimensions: technological challenges (infrastructure, digital literacy, and access to resources), pedagogical challenges (integration of AI tools into teaching strategies

and redefinition of the teaching role), and ethical challenges (data privacy, algorithmic transparency, and risks of dehumanizing educational practices).

The questionnaire underwent content validation by a panel of three experts in education and technology, who assessed the clarity, relevance, and suitability of the items for the study's objectives. The suggestions received were incorporated into the final version of the instrument, ensuring its relevance and consistency.

To ensure the instrument's reliability, Cronbach's alpha was calculated for the three dimensions of the questionnaire. Values ranged from 0.78 to 0.84, indicating acceptable to high internal consistency. While expert validation was essential to ensure the clarity and relevance of the items, the presentation of objective metrics reinforces the study's methodological robustness.

The sample consisted of 72 students from a higher education institution located in northern Portugal, enrolled in the Bachelor's degree in Basic Education and the professional Master's degree in Teaching. Participants were selected non-probabilistically for convenience, considering accessibility during the data collection period.

It is important to recognize that the sample has representative limitations, given that it comprises students from only one institution in northern Portugal, with a strong female predominance (88.9%) and a concentration of 17–23-year-olds. This profile does not fully reflect the diversity of future teachers' educational paths, such as different subject areas or internship experiences. Therefore, generalizations of the results should be made with caution.

All ethical procedures inherent to the research were strictly adhered to. Participants were informed in advance of the objectives and nature of the study, and informed consent was obtained freely and voluntarily. The anonymity and confidentiality of responses were guaranteed, as well as the use of data exclusively for scientific purposes. The right to withdraw at any time was also respected, without any detriment to the participants.

Data analysis was conducted using descriptive statistics, including the calculation of absolute and relative frequencies, measures of central tendency, and measures of dispersion, to identify patterns and highlight prevailing perceptions. This analysis allowed us to comprehensively understand how prospective teachers perceive the impacts of AI on pedagogical practice and which challenges they consider most relevant in their training.

4. Results

4.1 Sociodemographic data

Table 1 presents the sociodemographic data of the students participating in the study.

The sociodemographic analysis of the sample shows a significant predominance of females (88.9%), in contrast to a minority of males (9.7%), complemented by a residual percentage of participants who did not specify their gender (1.4%). This asymmetrical distribution, in fact, reflects the phenomenon of feminization that characterizes teacher training courses in Portugal.

Concerning the age variable, there was a significant concentration in the 17–23 age group (81.9%), followed by a significantly smaller representation in the 24–28

Variable	Category	Frequency	Percentage (%)
Sex	Female	64	88.9%
	Male	7	9.7%
	I'd rather not say	1	1.4%
Age group (years)	17–23	59	81.9%
	24–28	7	9.7%
	29–34	1	1.4%
	Over 35	5	6.9%
International/ Erasmus student	No	61	84.7%
	Yes	11	15.3%
Cycle of studies	Degree	61	84.7%
	Master's degree	11	15.3%
Year/ Graduation course	First year of Basic Education	46	75.4%
	Second year of Basic Education	4	6.6%
	Third year of Basic Education	11	18%
Year/Master's degree	First year Master's degree in Teaching the first cycle of Basic Education and Portuguese, and History and Geography of Portugal in the second cycle of Basic Education	1	9.1%
	Second year Master's degree in Teaching the first cycle of Basic Education and Portuguese and History and Geography of Portugal in the second cycle of Basic Education	4	36.4%
	First year of the Master's degree in Pre-School Education and Teaching of the first cycle of Basic Education	2	18.2%
	Second year of the Master's degree in Pre-School Education and Teaching of the first cycle of Basic Education	2	18.2%
	First year Master's degree in Teaching the first cycle of Basic Education and Mathematics and Natural Sciences in the second cycle of Basic Education	2	18.2%

Table 1.
Sociodemographic distribution of participants (N = 72).

age group (9.7%), the over-35 age group (6.9%), and the 29–34 age group (1.4%). This distribution shows a predominantly young profile, corresponding to the usual pattern of entry and academic progression in study cycles leading to teaching qualifications.

As far as nationality is concerned, there is a significant majority of students of Portuguese nationality (84.7%), complemented by a significant number of students in international mobility programs/Erasmus (15.3%). These figures indicate a significant degree of internationalization of the institution's training offer.

In terms of the level of education, students enrolled in Bachelor's degree courses predominate (84.7%), with a minority of Master's degree students (15.3%).

Analysis of the distribution by curricular year in Basic Education shows a marked concentration in the first year (75.4%), followed by the third year (18%), and a significantly smaller representation in the second year (6.6%). As far as Master's degrees are concerned, there are three areas of specialization: Teaching in

the first cycle of Basic Education and Portuguese, and History and Geography of Portugal in the second cycle of Basic Education (five students, distributed between the first and second years), Pre-school Education and the second cycle of Basic Education (four students, equally distributed between the two curricular years), and Teaching in the first cycle of Basic Education and Mathematics and Natural Sciences in the second cycle of Basic Education (two students, both in the first year).

4.2 Pedagogical challenges in the use of AI in the context of initial teacher training

The statement, “The incorporation of AI-based technologies can transform and optimize initial teacher training,” obtained an average of 4.43, revealing a high degree of agreement among participants about the transformative potential of AI in the educational context. However, there is concern about over-dependence on these tools, with the statement, “The use of AI can contribute to future teachers becoming over-dependent on these tools,” having an average of 3.86, showing some division in students’ perceptions.

The need for balance between pedagogical knowledge and the use of AI, with an average of 4.78, indicates a consensus on the importance of integrating AI without compromising pedagogical foundations. In addition, the preparation of future teachers for the critical and effective use of AI also received a high level of agreement ($M = 4.57$).

As for the updating of initial teacher training concerning the use of AI, the responses show a moderate degree of satisfaction, with the statement “Initial teacher training is up to date concerning the use of AI in education” obtaining an average of 3.39. Similarly, the statement “Initial teacher training prepares teachers to use AI tools in the classroom” had an average of 3.46, indicating that students recognize some initiatives but still identify gaps in preparation for the practical use of AI.

The statement, “There is a lack of opportunities in initial training to learn how to use AI effectively in teaching and learning”, with an average of 3.79, reveals a pertinent concern regarding the lack of training opportunities in the area. In addition, students find it challenging to keep up with the evolution of AI tools and their applications in education ($M = 4.04$).

Respondents recognize the importance of empowering teachers to use AI in an inclusive and responsible way ($M = 4.58$), as well as the potential of AI to make assessments less subjective and more data-driven ($M = 3.73$).

Finally, the participants expressed their opinions on the biggest pedagogical challenges of using AI in initial teacher training, which are shown in **Table 2**.

4.3 Technological challenges in the use of AI in the context of initial teacher training

The statement, “The quality of the internet available at school is a factor that limits the use of AI in the classroom,” with an average of 4.21, indicates that the internet infrastructure is seen as a significant challenge. The availability of enough technological devices for everyone to use AI in teaching activities is not satisfactory for everyone ($M = 3.40$).

Categories	Pedagogical challenges
Ethics and critical thinking	Excessive dependence on AI. Lack of critical thinking about the content generated. Loss of pedagogical autonomy. Risk of teaching standardization.
Teacher training	Lack of specific training in AI. Difficulty in curriculum integration. Resistance to change on the part of teachers. Lack of familiarity with the tools.
Equity and access	Inequality in access to technology. Differences in the level of digital literacy. Limited technological infrastructure in schools.
Human role in education	Loss of human contact in learning. Balance between automation and personalized teaching. Valuing empathy and creativity in teaching.
Security and privacy	Ethical issues in the use of data. Risk of exposure and manipulation of personal information. Lack of knowledge about how algorithms work.
Technological evolution and updating	Need for constant updates on AI. Rapid technological evolution makes it difficult to keep up. Integration of new tools into teaching practice.

Table 2.
Main pedagogical challenges.

Regarding the perception of technical support (“The school offers the technical support needed to solve problems related to the use of AI”), the average of 3.29 indicates an area that may need improvement.

The statement, “Students in initial training have the digital skills to use AI in educational practices,” obtained a low average (2.99), suggesting a tendency toward disagreement or uncertainty about the digital skills of future teachers to use AI.

The high average (4.32) obtained for the statement, “The lack of technical knowledge about AI among future teachers is a barrier to its effective use,” shows that most participants recognize that the lack of technical knowledge is an obstacle.

About finding AI tools and content adapted to the educational reality, the average of 4.10 indicates that this is a challenge for initial training. Another relevant challenge is the compatibility of AI tools with the technological systems already implemented in educational institutions ($M = 3.90$).

The idea that AI updates and maintenance are a challenge for institutions is a consensus among respondents ($M = 4.06$), and, even more so, the lack of ongoing technical support is a factor that hinders the use of AI ($M = 4.43$).

Finally, in the answers given to the question about the biggest technological challenges of using AI in initial teacher training, we identified some themes and concerns which, although directed at technology, touch on pedagogical aspects or have direct consequences for teaching practice, as can be seen in **Table 3**.

4.4 Ethical challenges in the use of AI in the context of initial teacher training

The results reveal an informed and critically constructive perception on the part of the students regarding ethical challenges.

Categories	Technological challenges
Technological infrastructure and access	Inadequate internet quality. Lack of adequate technology and internet in schools. Insufficient technological devices. Updating systems. Inequality in access to technology.
Technical training and lack of knowledge	Gaps in the technical and pedagogical training of future teachers to use AI. Difficulties for trainee teachers when using AI for the first time. The need to develop specific digital skills for integrating AI into educational practice.
Integration of AI into the curriculum and teaching practices	Difficulty in integrating AI effectively into the existing curriculum without compromising the pedagogical foundations. The need to adapt technologies in a way that is coherent with teaching and learning objectives. Risk of overcomplicating educational processes with poorly implemented technological tools.
Ethics, privacy and data security	Concerns about the collection, use, and protection of personal data in the educational context. Lack of clarity about the ethical limits of using AI tools with students. Need to guarantee the safety and privacy of users (teachers and students).
Quality and suitability of AI tools	Difficulty in identifying AI tools that are reliable, appropriate, and pedagogically relevant. Concerns about the quality of AI-generated content (inaccuracy, bias, superficiality). The need for critical and continuous evaluation of the technological solutions used in the teaching–learning process.

Table 3.
Main technological challenges.

The statement “Initial teacher training should include topics on ethics and social responsibility in the use of AI” obtained an average of 4.69, indicating high agreement with the need to integrate an ethical approach into training curricula. Similarly, the relevance of topics such as privacy, transparency, prejudice, and human responsibility ($M = 4.47$) was widely recognized.

There were also significant concerns about the potential for AI to compromise the privacy of students and teachers ($M = 3.61$), generate injustices in assessment processes ($M = 3.46$), and widen social inequalities ($M = 3.46$). Teacher autonomy also emerges as a sensitive dimension ($M = 3.82$), reflecting a perception that AI can, in some contexts, devalue the human pedagogical role. In this regard, there is a tendency to disagree with the statement that educational decisions should be attributed exclusively to AI systems without human supervision ($M = 2.68$).

Statements such as the need to comply with the General Data Protection Regulation (GDPR) ($M = 4.42$) and the view of AI as a complementary tool, rather than a substitute for the teacher ($M = 4.57$), obtained high consensus. The statement “AI can be beneficial if it is used in a transparent, inclusive way that respects data privacy and security” had one of the highest averages ($M = 4.62$). Uncertainty about the lack of normative guidance also proved to be a concern among students ($M = 4.12$).

Table 4 shows the greatest ethical challenges perceived by the participants.

Categories	Ethical challenges
Privacy and data protection	Ethical use of data. Informed consent. Identity protection. Risks of surveillance and exposure of students' and teachers' personal data.
Inequality and access (digital equity)	Barriers to accessing technology. Digital exclusion. Lack of equity in learning opportunities. Risk of deepening social and educational inequalities.
Transparency and explainability	Difficulty understanding how AI systems work. Lack of clarity in automated evaluation criteria. Right to an explanation of AI processes and decisions.
Autonomy and the role of the teacher	Reduced teacher autonomy. Devaluation of the teacher's role. Replacement of human interaction with automated systems. Loss of pedagogical control.
Bias and algorithmic discrimination	Reinforcement of social prejudices through AI. Biased decisions are based on algorithms. Negative impact on justice and educational inclusion.
Dependence and responsible use	Uncritical use of tools. Excessive trust in AI. Weakness in digital literacy. Loss of critical thinking and intellectual autonomy on the part of future teachers.
Responsibility and accountability	Unclear who is responsible for AI decisions. Ethical risks in the misuse of tools. Need for accountability and effective regulation.
Lack of knowledge/Uncertainty	Indication of a lack of knowledge on the subject. Perception of uncertainty or fear regarding the use of AI in teaching practices.

Table 4.
Main ethical challenges.

5. Conclusions

This study is part of higher education research exploring the pedagogical, technological, and ethical challenges associated with integrating AI into initial teacher training. It aimed to identify the perceptions of students enrolled in a Bachelor's degree in Basic Education and a Master's degree in Professional Teaching at a higher education institution in Portugal. The results reflect a diverse range of opinions on the pedagogical, technological, and ethical challenges of adopting AI in education.

The pedagogical challenges of AI in initial teacher training go beyond the mere use of technology. They include the need for adequate training, curriculum updates, practical preparation, keeping pace with technological developments, balancing automation and humanization, addressing ethical issues, and ensuring equitable access. Therefore, the integration of AI must be accompanied by critical and ethical thinking, ensuring that future teachers know how to use it consciously, creatively, and pedagogically.

Technological challenges are significant and need to be addressed to facilitate the effective integration of AI. These challenges range from basic infrastructure (internet, devices) to technical knowledge, the availability of adequate resources, compatibility with existing systems, the need for technical support, and the digital skills of future teachers.

Ethical challenges highlight a critical but open stance on the use of AI in initial teacher training. Participants recognize the potential of AI to positively transform education if its implementation respects ethical, legal, and pedagogical principles.

In response to the study findings, the following hierarchically structured recommendations are proposed:

Curriculum and pedagogical development

- Include curricular modules dedicated to the critical and ethical use of AI in classrooms.
- Implement practical workshops where prospective teachers can experiment with AI tools in simulated teaching situations, guided by supervisors who discuss limitations and potential.
- Review pedagogical approaches to integrate AI in a more structured and equitable way into teacher training programs.

Institutional Policies

- Develop internal policies guiding the responsible use of AI.
- Align institutional guidelines with national and international standards on data protection and digital equity.
- Define clear pedagogical and political guidelines to promote the conscious, safe, and ethically grounded integration of AI in education.

Technological Development and Support.

- Ensure adequate infrastructure (internet access, devices, system compatibility).
- Provide technical support and digital skills development for future teachers.
- Promote continuous technological updates and maintain a balance between automation and human-centered teaching practices.

Despite the challenges identified, students demonstrated a constructive and open attitude toward the use of AI, provided it is applied ethically, inclusively, and under proper regulations. This critical ambivalence represents a relevant starting point for designing teacher training pathways that are more aware of and prepared for the pedagogical, technological, and ethical challenges of integrating AI in education.

Finally, while this research offers important insights, it also has some limitations. The convenience sample, primarily first-year undergraduate students, limits the generalizability of the findings. Data were largely based on subjective perceptions

from questionnaires and open-ended questions, reflecting concerns and expectations rather than direct practical effects of AI integration. Additionally, the technological scope was broad, preventing a detailed analysis of specific tools or platforms. Future research could focus on comparative analyses of AI tools or case studies of their implementation in specific teaching contexts.

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Conflict of Interest

The authors declare no conflicts of interest

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Chapter 3

Inclusive Adult Education for Reskilling in the IT Sector

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Abstract

The concepts of upskilling and reskilling are catching on lately in the digital society we live in, as new technologies are rapidly emerging. However, while the former implies building up talent by expanding previous knowledge on a linear path, the latter implies building up talent outside previous knowledge through a lateral movement. Hence, reskilling usually requires a greater effort, which becomes even more challenging when it involves adults with special needs. Such additional difficulties are common among members of the IDEA framework, which stands for inclusion, diversity, equity, and access. The inspiration behind the IDEA framework is to help guide purposeful action to address inequalities across different populations. However, there is limited research on reskilling associated with the IDEA framework. In this chapter, we present an inclusive adult education scheme aimed at reskilling a group of adults with special needs in the IT sector, specifically in the coding field. Hence, this piece of research may serve as a valuable addition to the IDEA framework. The training was delivered to enable participants to acquire basic coding skills in Python and JavaScript at an entry level. The training was attended by 20 candidates, and the final results indicate that 60% of the participants completed the entire training, while 30% were officially certified in at least one programming language, and 20% were officially certified in both programming languages.

Keywords: inclusive education, adult education, reskilling, Python, JavaScript

1. Introduction

Reskilling of adults has been set as an urgent priority in the European Union to help them keep up with the pace of technology in the digital society. The estimated target is supposed to be 128 million adults, thus accounting for 46.1% of the overall adult population [1]. The application of these policies targets four types of low-skilled adults, such as those with low education; those with medium-high education carrying out elementary jobs; those with low digital skills, medium-high education, and not carrying out elementary jobs; and those with low cognitive skills, medium-high education, not carrying out elementary jobs, and having already used

computers [2]. A notable gap has been identified when it comes to demand and supply within the IT sector in the European Union, such that there are many job advertisements looking for unemployed people with an IT background that are not being filled [3].

In order to cope with this, the European Union has established some ambitious goals for reskilling, such as 80% of adults having basic skills and 90% of small and medium businesses reaching at least a basic level of digital intensity. This way, the participation of adults in learning is expected to increase to 50%, while the participation of low-qualified adults is expected to rise to 30%, and the participation of unemployed adults is expected to grow to 20%, thus reaching 20 million ICT (information and communication technology) specialists employed [4]. In view of all this, the European Union designated 2023 as the European Year of Skills in order to pursue four main objectives, such as promoting investment related to training, including upskilling and reskilling, ensuring a match between the skills provided by candidates and the needs of employers, matching the aspirations and skillsets of candidates with job opportunities, and attracting potential employees from abroad with the needed skills [5]. Basically, the key strategy addressed was to empower lifelong education and learning in order to close labor mismatches and skills gaps, which lead to a shortage of qualified staff to meet the demands expected in the labor market [6].

According to the need for reskilling, not only in the European Union but all around the world, this chapter presents a particular use case of reskilling in the IT sector, where the participants were adults at risk of social exclusion. This group of adults with special needs comes from different backgrounds, although they all usually face greater challenges when it comes to entering the labor market for various reasons. Hence, this initiative aims to reskill them to be fit for integration into the IT sector as entry-level programmers in Python and JavaScript. The research question in this chapter is whether it is possible for a group of adults with special needs to be reskilled in the coding sector. There is not much information in the literature about the success rate in such cases, even though there is a report from the European Commission quoting a 22% overall success rate out of the initial participants in similar courses [7], whereas another report from the Organization for Economic Co-operation and Development (OECD) states a 25% overall success rate [8]. Hence, the research hypothesis is whether the success rate obtained in the proposed course will be somewhat similar to those figures.

The organization of the rest of the chapter is as follows: first of all, Section 2 describes the motivation; next, Section 3 reviews the methodology; then, Section 4 displays the results; after that, Section 5 presents the discussion; and eventually, the last section draws the final conclusions.

2. Motivation

This section is dedicated to exhibiting some key concepts needed to explain the particularities of this case of inclusive adult education for reskilling in the IT sector. In this context, the subsections included are reskilling in the labor market, reskilling in the IT sector, the IDEA framework, adult learning, and, finally, the significance and application of Python and JavaScript in IT reskilling education.

2.1 Reskilling in the labor market

It has been reported that 50% of employees are going to be reskilled by 2025 due to the adoption of new technologies. Similarly, it is estimated that a third of the essential skills in 2025 are going to be technology competencies not considered crucial just three years ago, whereas it is expected that more than two-thirds of the critical skills deemed essential then in the labor market will change in three years' time [9]. These facts highlight the importance of upskilling and reskilling, where the former refers to enhancing skills in a longitudinal way, whereas the latter refers to acquiring new skills in a transversal way, which is usually more challenging [10].

In this sense, workers will suffer from deskilling if they do not keep up with technology-related skills, meaning the decline in work positions in favor of automated processes carried out by specific machinery or technology. Otherwise, polarization of the labor force will take place, where moderate-skilled jobs will tend to disappear in favor of either more low-skilled jobs or fewer high-skilled jobs [11]. In any case, the digital divide will increase, thus creating vulnerable groups among citizens and even entire countries. Among the former, those most likely to suffer from the digital divide are the elderly, those with lower levels of education, manual workers, unemployed people, those with low income, and those with limited internet use [12].

Hence, automation and digital transformation force the labor market to be in constant change in order to adapt to new situations, so reskilling is key to building a resilient work force, which results in continuous learning and professional growth for workers [13]. Besides, reskilling is considered a strategy to solve the lack of evolving skills needed in the market. The continuous education brought by these strategies leads to benefits for companies and employees, such as talent retention, business growth, and overcoming the digital divide [14]. In this sense, it is important to highlight the significance of not only hard skills, meaning those related to technical competencies, but also soft skills, meaning those related to personal competencies, which in recent years have also included those pertaining to virtual leadership or managing remote teams [15].

Furthermore, it is to be considered the impact of artificial intelligence (AI) on workers' skills, where AI is reshaping professional competencies, while transversal competencies are becoming more essential in this evolving landscape [16]. Additionally, AI assistants can address known problems with tailored solutions, as they can customize the learning needed to adapt workforce development to meet the established requirements [17]. Hence, the adoption of AI in labor environments leads to the reskilling of employees, where some of the critical skills involved are data analysis, digitalization, complex cognition, decision-making, and continuous learning [18].

2.2 Reskilling in the IT sector

One of the sectors where reskilling is most crucial is the IT sector because it is constantly evolving as new technologies and trends emerge increasingly faster. IT organizations may adopt different approaches to cope with these challenges, as some provide formal training programs, whereas others furnish informal opportunities to learn new skills [19]. Delving into it, some of the most popular strategies for reskilling are mentoring and coaching, internal training, courses and certifications,

e-learning, job rotation, and promoting a continuous learning culture through weekly microchallenges [20].

The goals of reskilling in the IT sector are closing the digital divide, promoting internal talent, reinforcing talent retention, promoting a dynamic business culture, enhancing capabilities to adapt to a constantly-evolving environment, improving corporate reputation, and contributing to meeting sustainable development goals (SDG) [21]. Furthermore, the benefits for current and potential employees include acquiring and enhancing skills and competencies, improving professional careers, earning higher salaries, adapting to and assuming new roles, as well as promoting personal development, increasing motivation, and reinforcing the feeling of belonging and commitment. In summary, reskilling could be viewed as providing the right skills to the right people at the right time [22].

2.3 IDEA framework: Inclusion, diversity, equity, access

Diversity, equity, and inclusion, whose acronym is referred to as DEI, represent a concept related to recognizing and valuing differences among people, as well as ensuring fair treatment for all in various environments, such as organizations, corporate businesses, or academia [23]. In this sense, diversity refers to representing people from a variety of backgrounds, such as different races, religions, or genders, while equity refers to fairness and justice, and inclusion refers to the feeling of belonging. Hence, taking care of these three values reflects how an organization tries to correct inequities and provides opportunities for all members to thrive [24].

There is a current school of thought stating that diversity is the core factor in the DEI framework, which seems to be the prevalent one at this stage. However, there is an alternative school of thought stating that inclusion should come first, and, in this case, diversity naturally follows as long as inclusion is followed by equitable treatment. This way, the correct acronym in this alternate approach is IED, as it assumes that an inclusive climate must first be set up within an organization, along with equitable practices, in order to attract and retain diverse candidates [25].

Nonetheless, another aspect is missing within the three values described above, which is access. Specifically, unequal access greatly affects those from different backgrounds when it comes to evaluating access in a variety of contexts, such as healthcare, housing, education, or job opportunities. That is why there is another school of thought proposing to expand the three concepts mentioned above to four, which leads to the acronym IDEA, namely inclusion, diversity, equity, and access. That way, IDEA represents a set of values and practices designed to facilitate the active presence of people from different physical, economic, and socio-cultural backgrounds with fair access to both opportunities and outcomes [26].

Focusing on the education field, the IDEA framework could be detailed as follows: inclusion refers to the creation of an environment where different identities feel welcomed and valued; diversity refers to the presence of people from diverse identities; equity refers to work done to correct and address identity-based disadvantages and barriers; while access refers to the presence of people from different backgrounds, such as social, economic, or cultural [27].

There is no single way to properly address the challenges posed within an IDEA framework, although some recommendations for instructors could be to put more focus on skills like beat-building or follow-up, cultivating soft skills in order to enhance curiosity, empathy, or compassion, and reconsidering course content in

order to fit the attendees [28]. Furthermore, considering metacognition as a set of self-regulatory functions and skills which facilitate responding successfully in different aspects of life, a metacognitive approach to soft skills may be used as a training paradigm to accelerate not only inclusion but also the success of all kinds of attendees [29].

One of the most important aspirations of the members within the IDEA framework is the adaptation of language to make it more accessible and inclusive, as well as to avoid implicit bias, discrimination, or harassment [30]. This could serve as a first step toward a holistic approach to promoting a more equitable and inclusive society, including government policies and education systems [31]. Moreover, the IDEA framework aims to benefit people who have been systematically excluded, helping them get back on track by identifying priorities, barriers, challenges, and opportunities [32]. In fact, the primary objective of the IDEA framework is to ensure everyone feels included and empowered to thrive in any field [33].

The IDEA framework is extending throughout many fields in society. For instance, Mackaway et al. studied the effects of the IDEA framework within work-integrated learning (WIL), where specific issues were identified, such as language, common barriers, or inclusive workplaces [34]. Besides, Li et al. presented a study on commitments related to the IDEA framework regarding manufacturing firms, concluding that positive stock returns were experienced in many cases [35]. Wang et al. carried out a systematic review of actions taken by organizations regarding the IDEA framework in the workplace, where the most common actions were shifting curriculum to support organizational change, providing longitudinal training, or implementing rigorous evaluation methods [36].

Park et al. identified six common research themes within the IDEA framework in a company, such as management and practice, perspectives, group diversity, conceptualization, leadership, and climate [37]. Thakur and Dhar carried out a review in which they concluded that training on the IDEA framework results in a positive impact on employee-related factors [38]. McCarter et al. stated that the results of IDEA-related training help reduce systemic disparities and biases [39].

Focusing on adult education, Hovdhauen and Opheim examined adult education and training in five European countries, stating that its demand is higher depending on an individual's education and socioeconomic levels [40]. Similarly, Kosyakova and Bills extended this review to countries worldwide, and they reached the same conclusion [41]. Likewise, Vaculiková et al. undertook a study on non-formal adult education related to four European countries, where the same conclusions were drawn as well [42].

2.4 Microcredentials for adult learning

Digitalization has brought profound changes to all aspects of society, which obviously affect adult education, favoring the emergence of new opportunities and challenges. Basically, the changes driven by digitalization in adult education could be classified in three ways. The first is related to the change in environmental conditions, as traditional on-site synchronous learning has been extended with online and asynchronous features, which provide a wider set of educational setups. The second is related to the change in content and topics, as traditional book-based or teacher-delivered content has been extended with multimedia content, while

novel topics related to new technologies are included in the curricula. The third is related to the rise of new learning tools, such as learning management systems (LMS) or video streaming platforms, which facilitate the setup of content within courses and how it is delivered to students [43].

Additionally, in the context of reskilling the adult population, the European Union has released a scheme related to the implementation of microcredentials for facilitating learning for employment, aimed at providing labor market education and training. Microcredentials are adult education courses with a maximum of 15 ECTS (European Credit Transfer and Accumulation System) credits for individuals between 25 and 64 years old. It is to be noted that one ECTS credit corresponds to 25 working hours for students, although it usually accounts for 10 working hours for teachers, as the remaining hours are considered as self-study time for students. The courses involved could be delivered through any combination of spatial features, such as on-site or on-line, and temporal features, such as synchronous or asynchronous. Additionally, the courses involved must seek specific skills and competencies specifically required [44].

The value of microcredentials varies for different end users. In this sense, learners and employees can acquire the necessary skills to better adapt to labor market mobility, either vertically or horizontally, where the former is achieved through upskilling and the latter by means of reskilling. Moreover, employers can offer more personalized reskilling plans according to the specific needs of each employee or candidate. Besides, traditional providers of vocational education and training can expand their existing reskilling services to new target groups, whereas, at the same time, new services can be provided for both individuals and institutions of all types [45].

2.5 The significance and application of Python and Javascript in IT reskilling education

Python and JavaScript are programming languages, which are considered among the most commonly used for coding purposes. Both share some important features, such as being high-level and interpreted. On one hand, Python implies a strong abstraction of how computers actually work; hence, it allows the use of natural language elements to write the source code, such as words and symbols close to human languages, thus simplifying the way to read and write code. On the other hand, JavaScript implies a slightly lower level of abstraction compared to Python due to the use of curly brackets and semicolons, where its syntax is fairly similar to other common programming languages like C, C++, or Java. However, in both languages, a specific program called an interpreter is needed, whose role is to read and execute the source code at every execution, thus taking human-readable source code and converting it into computer-readable binary code.

Focusing on Python, it can be defined as a general-purpose language, and it is currently labeled as the most commonly used coding language nowadays, although this is not the case in all fields, such as low-level programming or web clients. Python was first designed by Guido van Rossum back in 1991, and it was originally built in the C language, although other implementations have been developed since then. At present, Python 3.x is the current version in use, and some of its main characteristics are code simplicity, platform independence, community support, visualization ability, flexibility, and a large set of libraries available.

Focusing on JavaScript, it was originally designed as a scripting language to be used within specific environments where a compatible scripting engine was embedded. The most common use case was a web browser, that is, the client side of a web transaction. In fact, the creation of many user-friendly websites often involves the inclusion of three layers, where the first layer uses HTML to create static webpages, the second layer uses CSS (cascading style sheets) to establish a customized layout, and, in turn, the third layer uses JavaScript to provide dynamic content at execution time. However, its use on the server side has increased significantly since the release of the Node.js version, which helped popularize the use of JavaScript for general-purpose environments.

JavaScript was first designed by Brendan Eich back in 1995 with the original purpose of extending web development capabilities beyond HTTP. However, despite its name, it is to be noted that JavaScript has nothing to do with the Java language, although they share many basic coding concepts and a similar syntax. Regarding JavaScript Object Notation, whose acronym is JSON, it is a serialization language aimed at storing and transmitting data structures in text format, which is highly used between software applications. Nonetheless, JSON is independent from JavaScript and other programming languages, although the strings generated in JSON format are syntactically identical to the coding needed to create JavaScript objects.

3. Methodology

We are collaborating with an association whose goal is to take care of adults at risk of exclusion, such as those fitting into any component of the IDEA framework, namely inclusion, diversity, equity, and accessibility. In this context, the association recruited 20 people considered to be under any of those conditions in order to take part in a reskilling scheme for the IT sector, specifically in the coding field. The goal was to teach basic coding skills at an entry level in two of the most demanded programming languages in the labor market at this point, namely Python and JavaScript.

Regarding the former, the course selected is “Python Essentials 1,” which is available on different free e-learning platforms, such as Python Institute, Open EDG, or Cisco Netacad, although it was set up on the latter due to its user-friendly layout. The course is aimed at absolute beginners starting from scratch, with the goal of acquiring entry-level skills in a general-purpose track. Its recommended duration is 42 hours, which accounts for 7 weeks with 6 hours per week, and it is available in English and Spanish, even though the course was run in the latter as we are based in Spain.

Regarding the latter, the course chosen is “JavaScript Essentials 1,” which is also available on the same free e-learning platforms as the Python course, except for the JavaScript Institute one instead of the Python Institute one. However, it was set up on Cisco NetAcad as well, which allowed for centralizing the management of both courses. Likewise, the level, the schedule, and the language are the same as in the other course, so that both courses could be run concurrently.

Once each course was completed, there was a final exam, which led to the obtention of a certificate of completion in each case. At that point, a student was ready to take the corresponding certification exam powered by Open EDG and either

the Python Institute or the JavaScript Institute, which could also be accessed on Cisco NetAcad. With respect to Python, the current entry-level certification exam is called PCEP-30-02, and its official name is Python Certified Entry-Level Programmer, which has no expiration date. With regards to JavaScript, the current entry-level certification exam is called JSE-40-01, and its official name is Certified Entry-Level JavaScript Programmer, which has no expiration date either.

It is to be noted that both courses are focused on a general-purpose track in both languages, despite both having other well-known tracks, such as machine learning for Python or web development for JavaScript. The fact of running the same track in both languages facilitates the learning process because the syllabi of both courses were run in parallel, as the same commands and data structures could be explained to the students in both languages at the same time in the same session.

Therefore, the target in this reskilling scheme was, first, to run both courses at an entry level; second, to complete both final exams; and third, to take both certification exams. That was the first edition of this training, so no comparisons can be made with courses taught in previous editions. However, in the next edition, it will be possible to compare the results obtained at that point in the entry-level courses with those achieved in this edition with respect to the final exams and the certification exams.

Furthermore, in the next edition, it will also be possible to set up the corresponding associate-level courses in both languages, namely “Python Essentials 2” and “JavaScript Essentials 2,” which will allow comparisons of those results with the corresponding results in the entry-level courses. In that case, the certification exams for the Associate level would be PCAP-31-03 for Python, namely Python Certified Associate Programmer, and JSE-41-01 for JavaScript, namely Certified Associate JavaScript Programmer. According to that, no comparisons can be made at this point, as this edition is still the first one.

4. Results

This training scheme for reskilling adult learners belonging to the IDEA framework in the coding industry was conducted over 14 weeks, with 6 hours per week, as stated in the recommendations made above. The training was run on the Cisco NetAcad platform, which is an e-learning platform with a user-friendly design, where two courses are available, namely “Python Essentials 1” and “JavaScript Essentials 1”. Both courses are entry level, aimed at absolute beginners in the coding field to provide them with foundational skills. Furthermore, both courses were run in parallel, as the syllabi of both courses overlap in most cases due to the data structures and commands used in both programming languages behaving in a similar way, although there are differences in the syntax used in each case.

In this context, the training started with 20 students, each with a different status related to the IDEA framework. Both courses consisted of a number of modules, where students incrementally acquired skills through the teacher’s explanations, along with the multimedia content provided within the courses, the practical exercises proposed within the courses and by the teacher, and the checkpoint exams set up at the end of each module. Eventually, each course offered a final exam as the last task, along with an end-of-course survey. Hence, students had to take two final

exams: one devoted to Python skills at an entry level and the other devoted to JavaScript skills at an entry level.

Out of the 20 students who started the training, 8 of them quit at different points before reaching the end of the training for various reasons. Hence, 12 students managed to get to the final exams. It is to be noted that both final exams consisted of 30 test questions with no time limit, where four answers were presented per question, and just one of those was correct. Also, both final exams were available in English and Spanish, so students could choose how to take them. Besides, in both final exams, there were two types of questions, such as those related to the theory about code structures and commands, and those requiring students to indicate the output of a certain code snippet. Moreover, both final exams were assessed as a percentage; namely, the top mark was 100, whereas the passing grade was 70, and each incorrectly answered question did not subtract anything from the correctly answered questions. Furthermore, students had an extra attempt in case they did not pass any final exam on the first try, although the second try was not needed by any of the students in either of the final exams.

Regarding the academic results in the final exams, **Table 1** displays the scores obtained in both cases, grouped into intervals of 10.

With respect to the success rate in the training, **Table 2** exhibits the percentage of participants who successfully finished both courses, including the final exams.

Once the training was completed, students had two weeks to review the materials they had learned in order to prepare for the certification exams. Afterwards, they took the official certification exams for Python and JavaScript at the entry level, namely PCEP-30-02 and JSE-40-01, respectively. The layout of those exams was the same as that of the final exams of the courses, so 30 test questions had to be answered, even though there was a time constraint of 40 minutes. The passing score in both cases was 70 out of 100, meaning at least 21 correct answers were required to pass. Regarding the languages, the Python exam was available in English and Spanish, whereas the JavaScript exam was available only in English, which could pose an extra challenge for students as they all lived in Spain and many of them were not fluent in English.

With respect to the outcome in the official entry-level certification exams, **Table 3** presents the scores obtained in both exams, grouped into intervals of 10.

Courses	Score range 70–80	Score range 80–90	Score range 90–100
Python Essentials 1	4	5	3
Javascript Essentials 1	6	4	2

Table 1.
Scores obtained in the final exams, classified into intervals of 10.

Initial students	Students who completed Python course	Students who completed Javascript course	Students who completed both courses	Success rate
20	12	12	12	60%

Table 2.
Success rate referred to students who completed the whole training.

Courses	Score range < 70	Score range 70–80	Score range 80–90	Score range 90–100
Python Essentials 1	6	1	3	2
Javascript Essentials 1	8	1	1	2

Table 3.
Scores obtained in the certification exams, classified into intervals of 10.

Regarding the success rate in the official certification exams, **Table 4** exhibits the percentage of participants who managed to pass them after completing the training.

Furthermore, it is to be noted that all four students who passed the JavaScript certification exam also obtained the Python certification. Hence, **Table 5** shows the overall success rate referring to both official certifications, which was the highest goal expected at the beginning of this training.

Regarding the distribution of scores obtained in the final exams, the values related to skewness and kurtosis are presented in **Table 6**.

Besides, with respect to the distribution of scores achieved in the certification exams, the values related to skewness and kurtosis are displayed in **Table 7**.

Initial students	Students who received an official entry-level Python certification	Success rate for the Python certification	Students who got an official entry-level Javascript certification	Success rate for the Javascript certification
20	6	30%	4	20%

Table 4.
Success rate referred to achieve each official certification.

Initial students	Students who obtained both official entry-level certifications (Python and JavaScript)	Success rate for both certifications
20	4	20%

Table 5.
Success rate referred to achieving both official certifications.

	Skewness	Kurtosis
Python	-0.07	-1.33
Javascript	0.35	-1.40

Table 6.
Skewness and kurtosis for the distribution of scores in the final exams.

	Skewness	Kurtosis
Python	0.31	-1.49
Javascript	0.67	-0.69

Table 7.
Skewness and kurtosis for the distribution of scores in the certification exams.

Furthermore, a regression analysis of the results in the final exams is exhibited in **Figure 1**, where a bar chart is shown for each exam, along with its corresponding tendency line and its coefficient of determination.

Likewise, a regression analysis of the results in the certification exams is displayed in **Figure 2**, where a bar chart is shown for each exam, along with its corresponding tendency line and its coefficient of determination.

Moreover, a boxplot is also shown in **Figure 3** for each final exam, whereas another boxplot is shown in **Figure 4** for each certification exam.

Additionally, with respect to the end-of-course survey, eight items were proposed to the students who completed the training. Each of those eight items had

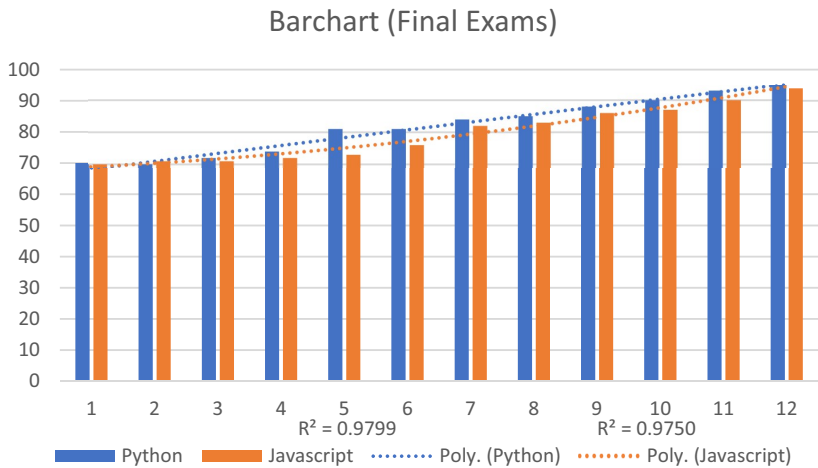


Figure 1.
Bar chart with the results of the final exams.

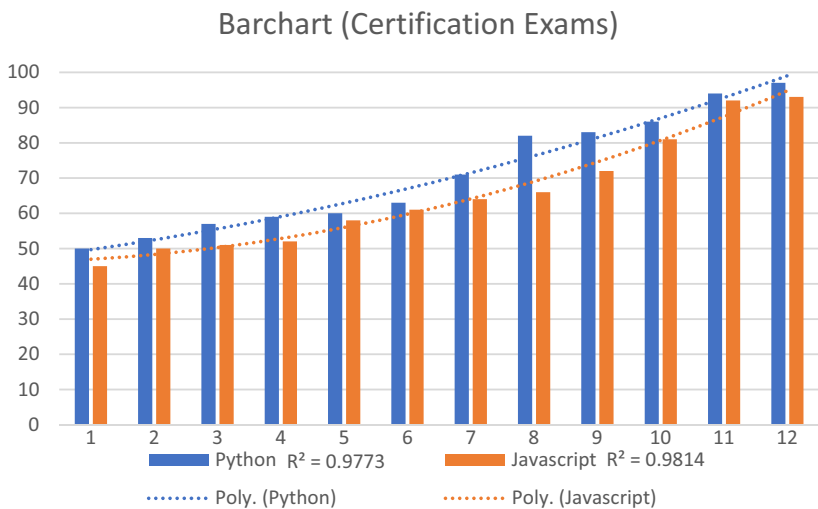


Figure 2.
Bar chart with the results of the certification exams.

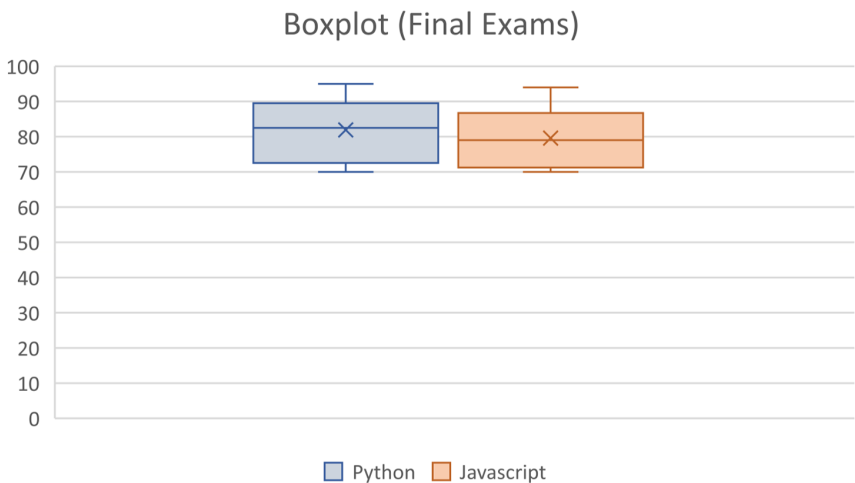


Figure 3.
Boxplot showing the results of the final exams.

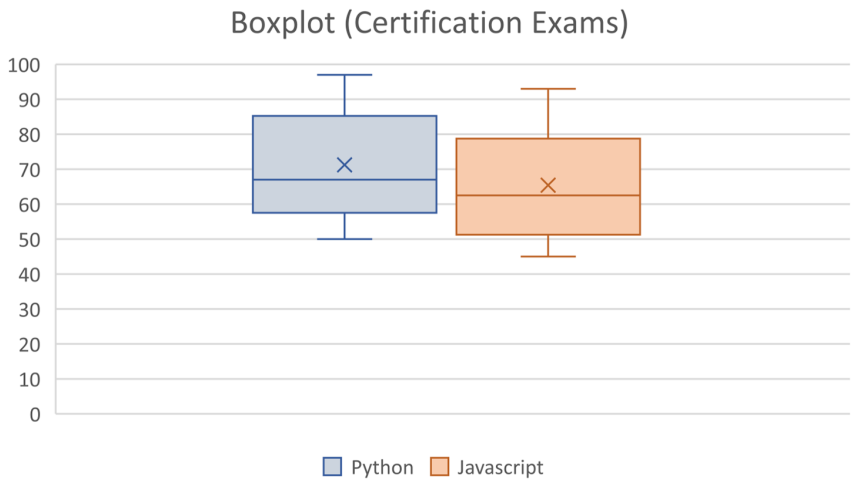


Figure 4.
Boxplot showing the results of the certification exams.

to be rated on a 5-point Likert-type scale, where the value 1 corresponds to "totally disagree," the value 2 corresponds to "disagree," the value 3 corresponds to "neither agree nor disagree," the value 4 corresponds to "agree," and the value 5 corresponds to "totally agree." **Table 8** displays the eight items included in the survey.

With regard to the results obtained in the survey, **Table 9** exhibits the most common descriptive statistics about it, related to either centralization or dispersion.

With respect to the interpretation of the data exposed, it is to be considered that the training was started by 20 students, although, due to different circumstances, 8 of them left the course before getting to the end, such that only 12 students took the final exams related to each programming language at an entry level.

Item identifier	Item text	Rating of the question
I1	Course organization	○1 ○2 ○3 ○4 ○5
I2	Learning platform	○1 ○2 ○3 ○4 ○5
I3	Teacher performance	○1 ○2 ○3 ○4 ○5
I4	Python skills acquired	○1 ○2 ○3 ○4 ○5
I5	Javascript skills acquired	○1 ○2 ○3 ○4 ○5
I6	Learning both languages at a time.	○1 ○2 ○3 ○4 ○5
I7	Preparation for the certification	○1 ○2 ○3 ○4 ○5
I8	Overall satisfaction	○1 ○2 ○3 ○4 ○5

Table 8.
Questions included in the end-of-course survey.

Type	Measure	Value
Centralization	Mean	4.4
	Mode	5
	Median	4
Dispersion	Variance	0.41
	Standard deviation	0.65
	Coefficient of variation	0.146

Table 9.
Descriptive statistics regarding the end-of-course survey.

Table 1 displays the academic results for the final exam in both coding languages. On one hand, focusing on Python, four students scored between 70 and 80 out of 100, meaning $4/12 = 33\%$. Besides, five students scored between 80 and 90 out of 100, meaning $5/12 = 42\%$. Additionally, three students scored between 90 and 100 out of 100, meaning $3/12 = 25\%$. On the other hand, focusing on JavaScript, six students scored between 70 and 80 out of 100, meaning $6/12 = 50\%$. Moreover, four students scored between 80 and 90 out of 100, meaning $4/12 = 33\%$. Furthermore, two students scored between 90 and 100 out of 100, meaning $2/12 = 17\%$.

Those percentages show that students performed a bit better in the Python final exam than in the JavaScript final exam. This could be explained by the fact that the syntax of Python is a bit looser, which makes it easier to learn and use for novice programmers. However, it is to be noted that all students surpassed the passing grade in both languages, namely 70, which was the primary goal of this training, so the differences in the grading of each language are not that important.

Table 2 exhibits the success rate in the training regarding the overall students who started the course, which is $12/20 = 60\%$. However, if the focus is set only on the students who reached the final exam, then the success rate becomes $12/12 = 100\%$, which could be considered an absolute success. Furthermore, none of the students needed an extra second attempt to pass the final exam, which reinforces the idea of the great performance achieved by the remaining students at the end of the course.

Table 3 shows the outcome of the official certification exam at an entry level in each coding language. On one hand, focusing on Python, six students got scores lower than 70 out of 100, meaning $6/12 = 50\%$. Also, one student got a score between 70 and 80 out of 100, meaning $1/12 = 8\%$. Besides, three students got scores between 80 and 90 out of 100, meaning $3/12 = 25\%$. Additionally, two students got scores between 90 and 100 out of 100, meaning $2/12 = 17\%$. On the other hand, focusing on JavaScript, eight students got scores lower than 70 out of 100, meaning $8/12 = 67\%$. Also, one student got a score between 70 and 80 out of 100, meaning $1/12 = 8\%$. Moreover, one student got a score between 80 and 90 out of 100, meaning $1/12 = 8\%$. Furthermore, two students got scores between 90 and 100 out of 100, meaning $2/12 = 17\%$.

In order to appropriately interpret these results, two considerations must be made. First of all, the certification exams put more pressure on students than the other activities within the courses, including the final exams, due to the tight time constraints, which often worsen students' performance because of anxiety. Additionally, regarding JavaScript, the Certification exam could only be taken in English, so students needed more time to fully understand each question as non-fluent English speakers, thus adding extra anxiety for them. These considerations explain the reasons why half of the students sitting for the Python exam did not pass it, while three-quarters of the students sitting for the JavaScript exam did not pass it either. Nonetheless, it is worth noting that two students achieved marks in the higher interval in both certification exams, namely in the top decile of scores.

Table 4 reveals the success rate in the certification exam concerning the overall number of students who started the course, which is $6/20 = 30\%$ for Python and $4/20 = 20\%$ for JavaScript. However, if the focus is set only on the students who reached the certification exam, then the success rate becomes $6/12 = 50\%$ for Python and $4/12 = 33\%$ for JavaScript, which could be considered a relative success in light of the challenges inherent to those certification exams.

Table 5 exhibits the success rate related to the achievement of both official certifications, which is considered the highest possible goal; thus, it could be seen as a secondary goal. Only four students were able to achieve it, with two of them scoring within the top decile in both certification exams, while another one scored within the second top decile in both exams, and one more achieved a score in Python within the second top decile and a score in JavaScript within the third top decile. In summary, if the overall number of students who started this training is considered, the success rate for achieving both official certifications is $4/20 = 20\%$. However, if only the students who took the certification exams are considered, then this success rate becomes $4/12 = 33\%$. This could be seen as a relative success, as the four students with both certifications now have strong credentials to pursue a job in the coding sector, given that Python and JavaScript are probably the most in-demand languages, whilst the two students with just the Python certification now have good credentials to be hired as Python programmers.

Table 6 represents the values of skewness and kurtosis of the distribution of scores obtained in both final exams, namely, the Python one and the JavaScript one. It can be seen that all of those values are within the range between -2 and $+2$; hence, the normality assumption applies, which means that the scores attained follow a normal distribution.

Table 7 exhibits the values of skewness and kurtosis referring to the distribution of scores obtained in both certification exams. All those values are clearly within the

range going from -2 to $+2$; thus, the normality assumption also applies, so it can be said that the scores achieved follow a normal distribution as well.

Figure 1 presents a bar chart with the scores obtained in both final exams, which happen to be pretty similar. A tendency line has been drawn for each case, where a linear shape fits quite well, although a second-degree polynomial one fits even better in both cases. In fact, the coefficient of determination for the Python final exam yields $R^2=0.9799$, while its counterpart for the JavaScript final exam yields $R^2=0.9750$. Hence, both coefficients are really high, which indicates a very strong correlation between the independent variable and the dependent variable in a regression model.

Figure 2 displays a bar chart with the scores attained in both certification exams, showing that the outcome of the Python exam was slightly higher than its JavaScript counterpart. As in the previous picture, a tendency line has also been inserted in both cases, where a second-degree polynomial shape provided the best fit in each case. Actually, the coefficient of determination for the Python certification exam is $R^2=0.9773$, whereas its counterpart for the JavaScript certification exam is $R^2=0.9814$. Therefore, both coefficients are very high, indicating a strong correlation between both variables in a regression model.

Figure 3 depicts the boxplot related to the distribution of scores in both final exams. The height of the Python box seems a bit higher than its counterpart for the JavaScript box, which means that the results in the latter are a bit more concentrated around the median value. Also, the median values are pretty close, even though the one corresponding to the Python final exam is a bit higher, which means that those results were slightly higher.

Figure 4 exhibits the boxplot regarding the distribution of scores in both certification exams. The height of both boxes is higher than those obtained in the final exams, which means that there is more variability in the results attained. Besides, both boxes have a similar height, even though the Python one is located higher than the JavaScript one, which means that the scores obtained were greater in the first case. This fact is also reflected in the higher position of the mean and the median in the first case. Eventually, **Table 9** displays the centralization statistics related to the end-of-course survey. Focusing on the centralization values, the average is 4.4, which is located around the midpoint between 4 and 5, where the former stands for “agree” and the latter stands for “totally agree.” Hence, we can conclude that students rated all items with high marks on average. Likewise, the mode is 5, which means that the most repeated value is the top mark, whereas the median is 4, which represents the midpoint of the distribution obtained after sequentially organizing all ratings achieved in the survey. Therefore, the outcome of the survey reveals that most students either agreed or totally agreed with all items proposed related to the courses taken. Centering on the dispersion values, the coefficient of variation is 0.146, which is just under the boundary of low variability, namely 0.15. Hence, it can be concluded that the results obtained are mostly close to the central value. As such, since the central value is located between “agree” and “totally agree,” most of the results obtained in the survey are comprised between those high ratings. In summary, the overall results obtained in this study account for a 40% dropout rate in the course, as 20 learners started it and just 12 of them managed to finish it. Despite this, all those learners who completed the course managed to pass both final exams.

Hence, it means that 100% of those learners who reached the end of the course eventually passed it, even though this percentage is reduced to 60% if all initial learners are considered. According to a report from United Nations Educational, Scientific and Cultural Organization (UNESCO), the percentage of participants in adult education completing a training course suffers from high variability depending on the type of learners and their particular circumstances, although it usually falls between 40% and 80% [46]. In this case, and considering all 20 initial learners, the completion rate was 60%. Hence, the percentage achieved falls into the central part of the interval stated in the report.

Regarding the percentage of learners who passed the certification exams, only six learners achieved the Python certification, and only four of them attained the JavaScript certification. If just the 12 learners taking those certification exams are considered, then it means that 50% of those learners got the Python certification and 33% got the JavaScript certification. However, if all initial learners are considered, then just 30% of them achieved the Python certification and just 20% achieved the JavaScript certification. Additionally, as all those who got the JavaScript certification also got the Python one, it could be said that the overall success was achieved only by those learners, who stand for 4 out of 20 participants who started the training.

5. Discussion

The research hypothesis established at the end of the introduction was whether it was possible for a group of adults with special needs to be reskilled in the coding sector. As indicated above, the literature does not contain much information about the success rate of reskilling schemes aimed at adult learners with special needs. In this sense, four reports published by well-known national and international organizations have been found, which focus on adult education.

In the first place, there is a report called “An in-depth analysis of adult learning policies and their effectiveness in Europe,” published by the European Commission (European Union), specifically by the Directorate-General for Employment, Social Affairs and Inclusion. It was published in 2015, where it was stated that an average of 22% in overall success was obtained in adult learning schemes [7].

In the second place, there is another report named “Mapping Quality Assurance Indicators for Non-formal Adult Learning,” published by the OECD. It was published in 2024, where it was found that an average of 25% in overall success was reported for adult learning courses [8].

In the third place, there is another report called “5th Global Report on Adult Learning and Education,” published by the UNESCO. It was published in 2022, where it was claimed that an average of 37% in overall success was achieved in adult learning education [46].

In the fourth place, there is another report called “Survey on Adult Population Involvement in Learning Activities”, published by the National Statistics Institute in Spain. It was published in 2023, where it was indicated that an average of 34% in the overall success was attained in adult non-formal education [47].

Regarding the results obtained in this study, two different approaches may be taken. The main one considers all learners who started the training scheme. In this sense, an overall success rate of 20% has been achieved, which comes from counting

the 4 learners who got certified in both programming languages out of the 20 learners who began the course. This rate is slightly lower than all four rates found in the literature, even though they are relatively close, especially to the average percentages given in the studies carried out by the European Commission and the OECD.

An alternative approach could consider only the learners who finished the course and sat both final exams and both certification exams, which were actually the aim of the training scheme. If this approach is chosen, then the overall success rises to 33%, which comes from taking the 4 learners who got certified in both programming languages out of the 12 learners who reached the end of the course. This alternative approach considers that those are the students who could eventually be evaluated, so they were the only ones who had the chance to succeed, because the other eight students quit the course beforehand. This rate is a bit higher than the average percentages given in the studies carried out by the European Commission and the OECD, whereas it is slightly lower than the average percentages obtained from the studies undertaken by UNESCO and the Spanish authorities.

However, while both approaches may initially be seen as correct, it seems the main approach is more realistic, as it considers all individuals who had the chance to initially get into the training course, even though some of them did not complete the course for different reasons. In this context, the research hypothesis set in this study can be positively accepted, as the figures obtained are pretty similar to those reported in the literature.

Furthermore, it is to be noted that the average rates found in the literature come from different types of courses set up in different countries with varying socio-economic circumstances and adults of different ages. Nonetheless, the fact that the average rates obtained in this study are somewhat similar to those found in the literature may suggest a common pattern regarding the average success rate in courses for adult education.

However, this study presents certain limitations. The main one is the number of participants in the training course, as a higher number of participants may be required in order to generalize the findings obtained. Besides, the lack of background of the candidates in the subject related to the course could have a certain influence on achieving a steeper learning curve, which could have led some of the initial students to quit the course early.

Moreover, the applicability to practice needs to be considered, as the course furnished the trainees with basic knowledge and skills to get by in positions at entry level in the coding industry, even though the actual skills required in each particular company might be greater. On the other hand, the selection process to choose the candidates avoided any potential biases when it comes to the coding sector, as none of them had either a previous academic background in it or previous experience in the IT labor market.

According to the limitations exposed, future research must include more candidates enrolled in order to be able to generalize the results obtained. Furthermore, recruiting learners with some background in the coding field, either due to academic formation or past positions in the industry, would surely enhance the outcomes achieved. However, this can be a controversial point when it comes to reskilling, as this would be more related to upskilling. Additionally, another point to be considered for upcoming courses could be to extend the portfolio of

courses, thus offering training for more advanced skills, which may improve the capabilities of egressed learners to enter the labor market.

6. Conclusion(s)

In this chapter, an inclusive adult education scheme for reskilling in the IT sector has been proposed. Specifically, training to get reskilled in the coding industry has been presented, where two courses at an entry level were run in parallel, namely a Python course and a JavaScript course. These two programming languages are among the most commonly used in the industry; hence, taking those courses will help students progress from being absolute beginners to acquiring entry-level skills in both languages, which will provide them an edge when it comes to finding a job in the coding sector. The fact of concurrently running both courses will help them consolidate the necessary knowledge about commands and data structures, as many similar concepts are shared between both programming languages.

The course started with 20 students and was run over 14 weeks, although 8 students quit during the course. Hence, only 12 students made it to the final exams at the end of the course, where one specific exam was dedicated to assessing Python skills and another was dedicated to assessing JavaScript skills, both at an entry level. All of the students passed both final exams, so they were able to complete the training successfully. Therefore, 60% of the initial students successfully completed the proposed training.

Additionally, students were given two extra weeks to prepare for the official certification exam for each programming language. Therefore, 12 students took the certification exams for Python and JavaScript at an entry level. It is to be noted that time constraints are quite tight in those exams, so students need to answer the proposed questions quickly, while having little time to review their past answers. These challenges add extra difficulties to passing the exams, such that only truly skilled candidates manage to succeed.

As a result, only six students were able to pass the certification exam in Python, and only four students managed to pass the certification exam in JavaScript, both at the entry level. Hence, 30% of the initial students got officially certified in Python, whereas 20% of the initial students got officially certified in JavaScript. Furthermore, it happened that all students who passed the latter also passed the former, so an overall total of four students got officially certified in both languages, which accounts for 20% of all initial candidates.

Furthermore, an end-of-course survey was delivered to the students who completed the training, where they were asked to rate eight items related to the course on 5-point Likert-type scales. The outcome of this survey shows centralization values near the top marks with low dispersion values, which represents that students highly rated the training setup and content, thus expressing overall satisfaction.

Conflict of interest

The authors declare no conflict of interest.

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Chapter 4

Community Libraries as Conflux Places for Higher Education Service-Learning Activities: Exemplified with Cases from Botswana

Rebecca N. Lekoko and Tiny K. Toto

Abstract

Service learning has now taken center stage to address the need for education with social impact. Service learning is a pedagogical outreach strategy used by higher education institutions (HEIs) to promote the coparticipation of learners with community members in addressing real societal challenges. More academic courses require this practical approach, as is the case in the Department of Adult Education at the University of Botswana. These courses are place- and problem-based, meaning they are carried out in carefully selected places, and community libraries can provide a confluence for these. In Botswana, these libraries are found across the country, in urban and rural villages, positioning them as neutral, friendly, and cultural environments to accommodate projects that satisfy not only the need for education with social impact but also the much-needed life skill of lifelong learning (LLL) for all. LLL, together with other principles of adult education deemed relevant, constitutes frameworks for planning and running service-learning activities, which are discussed in this chapter. Service-learning activities are driven by life needs, such as the lack of skills to engage in self-employment/entrepreneurship; uplifting existing livelihood projects such as food gardening, small livestock, fishing, health and family issues, and others. Students can partner with community groups such as families, social service groups, cultural centers, community-based organizations, businesses, religious organizations, and government ministries to explore these service areas. Community libraries would offer a safe place for these groups to work together on identified projects. The chapter highlights recent developments in Botswana's community libraries that position them as vital conflux places for HEIs' service learning. Additionally, the merging of adult education principles with libraries' information literacy values suggests an operational framework for driving the types of service-learning activities discussed in this chapter. Conditions for community libraries to serve as effective service-learning centers are also outlined.

Keywords: community libraries, service learning, education with social impact, adult education, community service-learning centers

1. Introduction

At a time of rebuilding the nation's economy, founded on the principle of an educated society, intentional investments in systems of learning that promote education with social impact are necessary. As of now, Botswana still experiences poor school performance at foundational levels, while higher education institutions (HEIs) produce graduates who find it difficult to survive in their own living environments. This means that education and challenges in society are not tightly merged. Education, for the most part, is still viewed as a passport to formal employment, divorced from survival skills in respective living environments such as urban and rural villages. Education with social impact, as acknowledged in this chapter, would expose students to general liveable contexts of Botswana, like farming, weaving, pottery, fishing, mining, forestry, and agriculture, just to mention a few. Education with social impact should be aligned with these communities' lifestyles. Service learning is a pedagogical approach used by HEIs to explore and align learning activities with these communities' livelihoods, and this is one way of promoting education with impact on society.

Education divorced from social realities ushers in a number of problems. One such problem is educated youth unemployment, a phenomenon that has recently been declared a national emergency by the Vice President, who is also the Minister of Finance, Mr. Ndaba Gaolathe [1]. This is partly because of the current education system that produces graduates with fixated minds; graduates who do not see diversified forms of survival except formal employment. At the launch of the United Nations Development Program's 4th Botswana National Human Development Report, the Vice President declared youth unemployment as no longer just a youth issue but a national emergency and revealed alarmingly high rates of unemployment: 55.6% for ages 18–24, with women disproportionately affected, while those with secondary education at 52% face the highest unemployment [1]. The situation indeed is at its worst possible state, with 63% of young women lacking marketable skills compared to 50% of young men [1]. Young people who have completed the Botswana General Certificate of Secondary Education face the highest unemployment rates. Unfortunately, this happens after spending 12 or more years in school and emerging with no survival skills other than just waiting in vain for employment opportunities.

A seemingly impossible task for Botswana is how to address the daunting numbers of unemployment. Indeed, Botswana's situation is formidable, and youth unemployment is not just a symptom of economic hardship; other factors are at play [1]. As the Vice President of Botswana rightly fathomed, addressing youth unemployment requires a multifaceted approach to tackle economic factors, skills gaps, education, and training, as well as systemic issues [1]. In the context of this chapter, one among the many approaches to address this problem is to have more HEIs introducing service-learning courses so that civic responsibility becomes an integral part of their education. The idea is to produce graduates who are able to understand the state of unemployment in the country and make better decisions about what to do with the skills and knowledge gained from schooling for their survival, thereby reducing expectations for formal employment. Developing resilience to the challenges of unemployment would not come by chance; schools should intentionally train young people in life skills and survival strategies in their respective communities, such as farming and self-employment. This type of

schooling would address the call for education with social impact, and service learning is one viable strategy to promote this type of education.

Service learning is known as a powerful pedagogical function that fosters civic responsibility and community engagement [2]. It gives students the opportunity to partner with communities on a project that satisfies academic requirements or education with social impact. It, therefore, combines academic instruction with community service in a mutually beneficial manner. The idea of service learning demonstrates intentional efforts by HEIs to link education to community needs. Students connect with communities through structured activities that address community needs [3]. This type of service learning markedly solidifies the essence of education with social impact.

This chapter is organized around key ideas that, woven together, present a coherent argument for using community libraries as service-learning centers, namely: inspirational perspectives for education with social impact; impetus for considering community libraries as suitable service-learning centers; apt drivers of community service learning; adult education and community service learning as synonymous in facilitating education with social impact; conditions for effective use of community libraries as service-learning centers; and, finally, the conclusion.

2. Inspirational perspectives on education with social impact

The growing global momentum for education with social impact, though topical, is not new. It draws from other education reforms rooted in the struggle to transform education from the bookish Western style to education that can be applied to the indigenous social, economic, environmental, and political milieu outside the classroom walls. Bookish education usually promises students formal employment, while in actual fact, proper education is more than preparing students for the labor market; it is about preparing them to be active citizens [4]. To date, education systems in Botswana have fallen short of systematically prioritizing education with social impact, placing this suggested reform as a priority in the current debate and appreciating its deep roots in erstwhile debates, some of which are given below.

2.1 A brief review on challenge-driven education (CDE)

Challenge-driven education is a pedagogical approach used by HEIs to promote education that addresses social challenges. Through the CDE approach, HEIs' learners are challenged to identify and develop solutions for selected problems in their communities. CDE is most valuable and meaningful when students work with communities to address challenges that neither party could effectively tackle without the other. Usually, students look for opportunities to work together with communities to provide solutions to some challenges. Challenges are many. In Botswana, for example, gender-based violence, youth unemployment, older adults' abuse, poverty, and computer literacy may currently top the priority list. CDE's guiding question is, "How do universities then address these [today and tomorrow's] societal problems through education?" [5]. There are clear guidelines for CDE [5]. HEIs usually come up with plans for learners to collaborate with partners interested in addressing social challenges through this type of service learning. Botho University is one institution in Botswana that celebrates CDE as a project-based

approach that promotes connectivity to real-world challenges and offers solutions to these in collaboration with the people most affected. Indeed, Botho University deeply desires to continue using CDE to make a positive contribution to society [6].

2.2 Talloires Network of Engaged Universities

In the Talloires Network of Engaged Universities' Newsletter of June 10, 2025, an urgent call has been made to HEIs to develop ways to structure their research, teaching, and service practices to address urgent local issues, emphasizing that the relevance and social impact of contemporary education systems cannot be compromised [7]. Using civic engagement or service learning as an approach, this mission can be realized. This approach encompasses a broader range of activities aimed at promoting active coparticipation of learners and community members in addressing societal issues. It further motivates learners to contribute to the betterment of their communities and society as a whole [2]. Universities as Frontline Responders, for example, give priority to universities that respond to crises and create infrastructure to proactively tackle challenges such as war, conflict, natural disasters, and public health issues [8]. Universities that take up this challenge invest resources to ensure that distressing situations are addressed. Universities as Frontline Responders persuade all universities to be bold and nimble civic actors and to partner with communities in order to respond swiftly and intelligently to unexpected or ongoing societal challenges [8].

Societies look up to HEIs as beacons of hope to address social challenges, and this trust can be lost if learning activities are not aligned with societal challenges [9]. Several strategies, including service learning, can be used to ensure this alignment. This chapter thus presents community libraries as platforms in which service-learning activities can be coordinated. Community libraries in Botswana are considered hubs for community learning. They connect communities with development agents and, therefore, can offer a safe place for HEIs' students and community members to work together on service-learning projects. The discussion that follows outlines the conditions and potential benefits of community libraries serving as community service-learning centers.

3. Impetus for community libraries as service-learning centers

Community libraries in Botswana are progressive and continue to transform into multi-activity centers, integrating modern ICT learning techniques with the learning traditions of the local community to develop the much-needed life skills and lifelong learning (LLL) aptitudes. In this state, they have the potential to serve as service-learning centers for HEIs, attributing these improvements to Rothschild's contribution (building and refurbishing) and Bill and Melinda Gates' installation of computers and the Internet [10]. They continue to promote literacy and LLL, support school curricula, inform students' research, preserve and showcase local culture, as well as facilitate community programs and events [11]. They are important resources for the development of communities [1].

When creating plans for service learning, HEIs may consider using community libraries as service-learning centers. They are resources that are useful for the active engagement of communities. A key consideration for HEIs is the characteristics of

community libraries that can enable or constrain service-learning activities. Of note in this chapter is the ethos of adult education that is embedded in the roles of community libraries. Prominently, the ethos such as practical application, self-directed learning, goal orientation, problem-solving, and experiential learning correspond with the goals of service learning as “a method involving experiential education for students to develop social and civic responsibility; to make practical connections to theoretical course material and to learn leadership skills while contributing to their community” [12]. These treasured principles can be used to develop a framework for planning and running service-learning activities. They weave together to present a problem-solving orientation to learning, as presented in the section that follows.

4. Community libraries embed adult education ethos

Chakma describes adult education, whose significance lies in addressing the social, economic, political, and cultural transformation of societies and nations [13]. It is a field that requires students to perform duties as responsible citizens at the personal, local, national, and international levels [14]. Just like community libraries, the very core function of adult education is respect for community members as valuable assets in the learning process. This background suggests that andragogy (adult learning principles (ALPs)) can inform service-learning activities carried out within the ambience of community libraries, as discussed below.

4.1 Adult learning principles and service learning

ALPs are many. Only a few are addressed here, though all can be considered integral aspects of community service learning, as demonstrated below.

Figure 1 demonstrates how ALPs can inform community service learning activities. Actually, almost all ALPs are best suited as part of HEIs’ guidelines for engaging in service learning and driving education with social impact.

4.2 Community libraries as hubs for LLL

Lifelong learning (LLL) is a core function of both community libraries and adult education, as the two are essential in “today’s information society” [15]. Education with social impact, on the other hand, is a significant contributor to informed and educated societies. Information literacy and LLL are, therefore, closely connected in a way that strengthens each other, making them essential for the growth and success of individuals, organizations, institutions, and nations in today’s globalized world [16].

Botswana has set itself on a forceful journey of becoming an educated and informed society, and this could not have been conceptualized without the two concepts of LLL and information literacy as pillars of this inclusive development, thus placing HEIs as the main players. LLL is learning that is not restricted to classroom learning but takes place everywhere, like in community libraries, as per the discussion in this chapter. Therefore, during service learning, both members of the community and HEIs’ participants need to acquire this information literacy skill

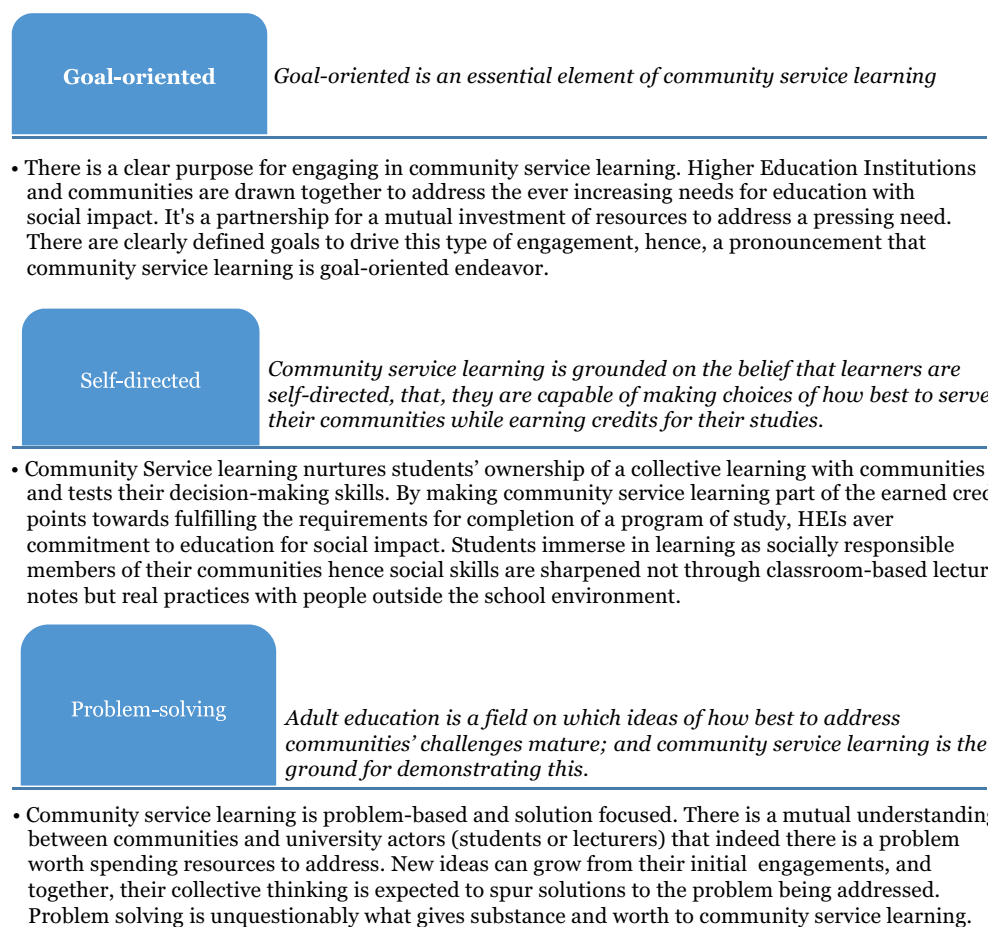


Figure 1.
ALPs in service learning.

of LLL or continuously “learning to learn” new ways to improve communities’ livelihoods.

Lifelong learning is promoted through self-direction, self-motivation, self-empowerment, knowledge socialization, and network literacy, just to mention a few, much like the information literacy offered in libraries [17]. Referring to this connection, one could borrow from Horton’s [18] expressions to say that community libraries and HEIs should work “sybiotically and synergistically with one another” to provide the highly desired LLL individuals who can contribute to education with social impact. Lau [16] posits that LLL exemplifies sustained, voluntary, and self-directed engagements. These types of engagements produce effective service learning or civic responsibility. Therefore, LLL is a principle that can inform service-learning guidelines, enabling individuals to navigate complex societal challenges. A blend of values and principles can thus be used to develop a framework that can energetically drive HEIs’ service learning, and this chapter has suggested some.

5. Apt drivers of community service learning

Higher education institutions converge on a mission to ensure world-class learning that nurtures social responsibility. That said, community service learning becomes integral to their mandates, as it provides learners with opportunities to apply classroom-based knowledge to real challenges in the community environments. At this point, it is important to note that every education level is designed for unique goals. Higher education has different purposes from those of the lower levels of education, as the structure of education in Botswana below shows.

Basically, the four levels of education have been organized by specific age cohorts and years taken to complete each level, as **Figure 2** above indicates. Preprimary is essentially a foundational step to move to primary education, geared at boosting the learners' cognitive and motor development as well as enhancing their social skills [19]. Primary education is completed in seven years, while post-primary comes in two stages: junior and senior secondary education, with durations of three and two years, respectively. The 7-2-3 years of education is primarily designed to provide "an excellent start in education so that learners have a better foundation for future learning" [18]. Clearly, these levels do not embed strong civic responsibility as higher education does, where the mandate is to provide learning beyond nurturing learners' intellect to pursue further education. It promotes the necessary attitudes to contribute to society, including personal development, community, and national development. It is for this reason that discussions on education with social impact are directed toward HEIs.

Service learning, as already explained, is an approach used by HEIs to address the need for education with social impact. Service learning is intended to bridge the gap between passive learning for academic grades within university classrooms and learning for community life and in the community. University students partner with the communities, be it community members, community-based

Education Level		Standard/Grade	Age	Years
Doctorate (PhD)		Tertiary		3 - 4
Masters Degree		Tertriary		1 - 2
Bachelors Degree		Tertiary	18 - 22	4 -5
Vocational Training in - Nursing & Teaching - Artisan & Technician		Vocational	18 - 21	2 - 4
BASIC EDUCATION 13 YEARS	Senior Secondary ('O' Level)	Form 5	17	2
		Form 4	16	
	Junior Secondary (JC)	Form 3	15	3
		Form 2	14	
		Form 1	13	
	Primary	Standard 7	12	7
		Standard 6	11	
		Standard 5	10	
		Standard 4	9	
		Standard 3	8	
Standard 2		6-7		
Standard 1				
	Pre-Primary (limited opportunities)		5	1

Figure 2.
 Educational levels by age range [19].

organizations, non-governmental organizations, and others interested in addressing real-life challenges. These activities come in different forms: as a research project; capacity-building activities such as teaching or training; practical projects such as starting poultry; and many others. Examples are given in the section that follows, illustrating how higher adult education institutions can mobilize community libraries as service-learning centers.

6. Conditions for community libraries serving as effective service-learning centers

6.1 Current status of community libraries in Botswana

As of now, community libraries in Botswana are not fully resourced to serve as service-learning centers for HEIs. However, some good foundations have been made, and if intentionally and resourcefully prepared, they have the potential. Setshwane and Oats view them as gateways to LLL platforms and for independent decision-making [20]. Conditions necessary for them to serve as effective community service-learning centers are many. Among them is the need for working computers, Internet services, and other modern learning devices to cater to the diverse activities. ICTs, when integrated into community learning centers, promote both active learning and meaningful interactions among those engaged. When emphasizing the importance of technology in community learning services, Semenski, Harte, and Preradović indicated that the prominent use of the Internet in community service learning has given birth to an area of Service-e-learning [3], defined by Waldner, McGorry, and Widener as an integrative pedagogy that engages learners through technology in civic inquiry, service reflection, and action [21]. This could involve sharing information, using tools such as webinars and social media for communications and discussions, planning projects, and monitoring and evaluating the quality of civic engagements.

In terms of service areas that are possible through community service-learning centers, Radijeng provides a succinct summary of some already taking place in community libraries in Botswana [1].

In addition to what is shown in **Table 1** above, community service-learning projects in Botswana include adult computer literacy, mentoring and advocacy, relevant entrepreneurship areas such as pottery, sewing, cultural activities such as painting, family literacy, baking and cooking, agriculture, health, and local economic development. These activities are usually guided by practical adult education courses offered by universities. At the University of Botswana, Department of Lifelong Learning and Community Development, for example, one practical course is “Adult Education in Practice,” offered to students in their first year of undergraduate studies. The course is specifically tailored to give students opportunities to explore the vast field of adult education in practice, that is, to familiarize themselves with the different activities within the field of adult education. Students partner with families, groups such as cultural centers, community-based organizations, institutions of learning, businesses, religious organizations, and government ministries to explore some of these service areas.

Location (villages and cities)	Special projects
Moreomaoto Village	Playground for disadvantaged children aged 2–6.
Ramotswa Village	Providing digital content for children with intellectual disabilities.
Botswana Library Services Headquarters (Gaborone)	ICT training and access to ICT resources for the visually impaired.
Francistown (City)	Electronic educational games for individuals with hearing impairments.
Kopong Village	Imparting textile and design skills using ICT, targeting women and youth.
Molalatau Village	Provision of information to farmers through ICT forums.
Palapye Village	Archiving the history of Palapye and disseminating cultural information.
Kasane Public Library	Provision of information (business) using ICT.
Mochudi Public Library	ICT training and mobile ICT access.
Letlhakeng Public Library	Revision assistance and ICT training for primary school children.

Source: Adapted from [11].

Table 1.
Special projects in public libraries.

6.2 Other conditions for the effective use of community libraries as service-learning centers

Developing community libraries into viable service-learning centers requires an intentional move to sustain them beyond a handful of projects. Questions to establish conditions for effective planning and running of these centers should be asked to establish a working platform, among them being:

- Practical resources – Certain resources are needed to devolve clear responsibility to community libraries as community service-learning centers. Key resources include policies to drive effective service-learning courses. Resources should be provided to help students satisfy course requirements while managing these activities in a manner that leaves a desired legacy of education with social impact.
- Community service learning as a required academic course – It is critical that a structured learning environment for service learning be established, for example, having core service-learning courses. It then becomes important that strategies for monitoring and evaluating both the processes and outcomes of service-learning activities weave smoothly with the goals of education with social impact. Subjecting service-learning activities to thorough evaluations leads to better decisions on how to invest resources for a win-win venture. The monitoring and evaluation should answer this important question, among others: “How is social impact credibly proved in HEIs’ community service-learning activities?”

- Clear guidelines be in place for planning and running service-learning activities – Key principles of adult education that can be used to formulate guidelines for effective community service-learning activities have been discussed. These should be embedded in the planning, monitoring, and evaluation frameworks.
- Resourcing community libraries – Clearly, community service-learning centers should be resourced to cater to activities taking place in them. Human resources are the leading support to ensure that libraries are friendly, safe, and conducive places for hosting HEIs' service-learning activities. Another important issue would be the library hours of operation in situations where these need to be altered. Will resources permit this? Other important questions to be addressed include: "How do you manage the expectations of community users (to use their library any time) in the midst of structured service learning activities of HEIs taking place?" Part of the critical resources is digital technology to promote free access, improve reach, and enhance the quality of civic engagements. Service-learning is ideal.
- Inclusive service-learning environments – Community voices should be treated as a valid addition to the HEIs' community service-learning activities. Mentorship and guidance from credible sources should be ensured. The question, "How do HEIs demonstrate that they accessed credible information and advice from community members and provide verified social impact for their service learning courses?" should be answered.
- Documenting the experiences of service learning – The other important question to be considered is, "How do students document the real practical experiences of service learning while at the same time address the requirements of their courses?" Students usually complain about limited time and the structures of academic reports that constrain their freedom to report their practical experiences.

Frameworks can be developed for carrying out effective service-learning activities using some of the guiding questions and ideas presented here, as well as learning from successful stories from around the world.

7. Conclusions

This chapter has presented community libraries as hubs for higher education service-learning activities. In Botswana, community libraries are found across the country, in urban villages, rural villages, and remote areas, placing them in a strategic position to provide a confluence for communities to work with HEIs, be it through practical courses, research, and other community service activities. Conditions for the effective use of these libraries have been suggested. It has, for example, been stated that community libraries in Botswana are equipped with computers and Internet. They can, therefore, offer not only a conducive physical place for social coherence but also a technological ambience that would make it possible for both students and community members to enrich their service-learning activities. Supposing that the computers and Internet function properly, an

atmosphere of LLL can be created in which each participant augments whatever information is needed through the use of the Internet.

Community libraries can indeed serve as a place where HEIs and communities can copartner to address societal challenges. In the realm of HEIs, this function is given different labels such as service learning, community service, and civic responsibility, but each points to a critical function that higher education is expected to perform, that is, promoting education with social impact. Indeed, service learning is supposed to take students away from their classroom or campus life and community members away from their homes, and place them in a neutral, friendly, and cultural environment to work on a project that satisfies not only the need for education with social impact but also imbues the spirit of LLL in both community members and HEIs' participants. Both parties get to appreciate the community environment as a source to inform education with social impact. There is also a possibility of both parties developing a sense of being "one," that is, a deep sense of belonging together to a community they care for and work to see improved. After all, they come together for a common goal: uplifting some identified vulnerabilities within communities and addressing these through a carefully chosen service-learning project. Community libraries, by virtue of being cultural centers, can create a communal space in which coparticipants, from HEIs and the communities, create a special and useful identity as interest groups in the livelihoods of people in the communities, bound by their sense of social responsibility, collective efforts, and the need to bring their unique talents together for the betterment of the communities.

Going forward, and in order to balance both the need for serving the communities and fulfilling academic requirements, important suggestions for effective use must be attended to. Finally, like other social institutions, community libraries in Botswana should keep improving to catch up with contemporary requirements for operating as HEIs' community service learning centers. For HEIs, service learning is not just a lip-service exercise but a core element of education designed to equip learners with practical problem-solving skills. Supporting this important learning is the ultimate goal for many HEIs.

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Chapter 5

Continuous Professional Development: Being Prepared Is Not Enough

Bradley Paul Sookram

Abstract

In today's world of experiencing many disasters, being prepared is not enough. Continuous professional development (CPD) has become a crucial element of effective action during crises. While traditional training provides basic knowledge and skills, the ever-changing nature of emergencies requires a continuous effort to learn and adapt. This chapter prepares us for an important look at why being prepared at just one time is not enough; instead, healthcare professionals must commit to lifelong learning to remain relevant in a constantly evolving environment. This chapter explores the many aspects of CPD, emphasising the need not only to get ready for disasters but also to cultivate a knowledgeable and flexible team that can handle different complex situations. Furthermore, this chapter seeks to highlight the urgent need for better CPD frameworks suited to today's disaster challenges.

Keywords: continuous professional development, quality patient care, ethical considerations, skills, knowledge

1. Introduction

To adequately prepare disaster management teams for disaster events, it is essential to implement a Continuous Professional Development (CPD) system that equips them with the necessary training and skills [1]. CPD systems should be designed to accommodate the ever-evolving disasters, making sure that staff know current procedures and can adjust to unexpected issues. While basic knowledge is important, ongoing training is crucial for developing a flexible workforce that can respond well to various disaster situations, highlighting the need for CPD in disaster preparedness. According to the World Health Organisation (WHO), healthcare professionals cannot maintain the level of competence years after graduating, unless there is continuous participation in active learning [2].

CPD is a key component of the healthcare profession that continues throughout their professional lives [3]. According to the World Federation for Medical Education (WFME), CPD is defined as “a broader concept than CME, refers to the continuing development of the multi-faceted nature of medical practice, covering – in addition to knowledge and skills of medical practice – the wider domains of professionalism (e.g. medical, managerial, social and personal subjects) needed for high-quality

professional performance. It includes all activities that doctors undertake, formally and informally to maintain, update, develop and enhance their knowledge, skills, and attitudes in response to the needs of their patients” [4]. There is a demand for competent healthcare professionals, and CPD is seen to be the driving force for maintaining skills and knowledge [1].

1.1 Implementing continuous professional development

There are many approaches to implementing CPD. CPD has become dynamic and flexible with multiple methodologies such as simulations, blended learning, workshops, conferences, and online classes to name a few [1]. Research findings indicate that lectures with interactive sessions such as simulations and real-life problems change professional practice and are a motivating factor for healthcare professionals to attend such activities [5, 6].

Identifying available resources and learning opportunities is essential for healthcare professionals to pursue their continuing professional development. Here are some ways to discover and access various resources and learning opportunities.

1.2 Importance of CPD simulation exercises for disaster preparedness and response

Two highlighted types of CPD disaster preparation exercises are used to test for disaster preparedness. These include “operation-based exercises (to test procedures, plans, technologies, interagency cooperation, tools, command centres) such as command post/functional exercises, field-based exercises that replicate an emergency response, drills and specific skills (evacuation, triage, communication); and decision-based exercises such as desktop/tabletop exercises and seminar/workshop-based exercises.” [7].

Although operations-based exercises mimic real-life circumstances, decision-based exercises allow the participants to practice and familiarise themselves with the roles, processes, and plans [8]. It is important to note that these exercises are crucial and that disaster management teams must understand their roles when dealing with a disaster. Continuous training will help disaster management teams understand the importance of proactive planning for disaster events [9].

1.3 The role of technology in facilitating CPD

Technology plays a crucial role in facilitating CPD in disaster preparedness and response:

- **Online Learning Platforms:** Online platforms provide access to a wide range of courses, webinars, and training materials, making CPD more accessible to responders in remote locations.
- **Mobile Applications:** Mobile applications can deliver training content, provide access to critical information (such as emergency contacts and weather alerts), and facilitate communication among responders.
- **Virtual Reality and Augmented Reality:** VR and AR technologies can provide immersive training experiences, allowing responders to practice their skills in realistic scenarios without the risks associated with real-world exercises.

- **Data Analytics:** Data analytics can be used to identify training needs, track progress, and evaluate the effectiveness of CPD programs.

1.4 Ethical considerations of CPD in disaster response

Ethical decisions in a disaster event including emergency management necessitate careful considerations and an explicit systematic approach. Effective ethical decisions must inspire community trust and purpose following fairness and justice [10]. According to Leider et al., emergency management courses are focused on disaster management, command control systems, and response mechanisms above ethical decision-making [11]. The importance of a framework for ethical decision-making can affect the equitable distribution of resources or the burden of impact [10].

According to Barnett et al., ten principles were developed to link law, ethics, and decision-making as guidelines for disaster management. These guidelines included “maintaining transparency, community participation, respecting individual rights whilst balancing community need, non-discriminatory consideration of public health needs of individuals and groups, adhering to and communicating applicable standard-of-care guidelines, identify public health priorities based on evidence, implement initiatives in a prioritised and coordinated fashion, assess the public health outcomes, ensure accountability and share personally identifiable health information—with the patient’s consent, where possible—solely to promote the health or safety of patients” [12]. Research has shown that some staff behaviour, attitudes, and actions were not according to the expected ethical guidelines [13].

International humanitarian law indicates the rules for limiting suffering and guidance during a disaster. Studies have found that there is a need for ethical training to inform decision-making in disaster management [13, 14].

2. A framework for CPD in disaster management

2.1 Collaborative governance

A framework for CPD in disaster management can be used in **Figure 1** as an example.

Collaborative governance plays an important role in that it brings together all stakeholders involved in decision-making to plan for disasters [16]. According to Sookram et al. [15], “for CPD to be effective and meaningful, **Figure 1** identifies ‘drivers’ (regulator, accreditors, service providers, EMC industry and ECPs) that can form part of collaborative governance for CPD. Working collaboratively, as shown in **Figure 1** (Collaborative governance), stakeholders can leverage collective power to drive CPD events by developing CPD guidelines that address the needs of EMC stakeholders, and emerging healthcare-related needs” [15].

Interaction between all stakeholders involved in disaster management should create policies for CPD that address the need for current and up-to-date practices. Furthermore, a CPD structure should be explicit for the disaster management teams that promotes competence and validity and that is relevant [15].

2.2 CPD processes

The CPD process that is illustrated in **Figure 1** has a circular motion of activities, in which one action impacts the other, which ultimately results in the enhancement of CPD activities [15].

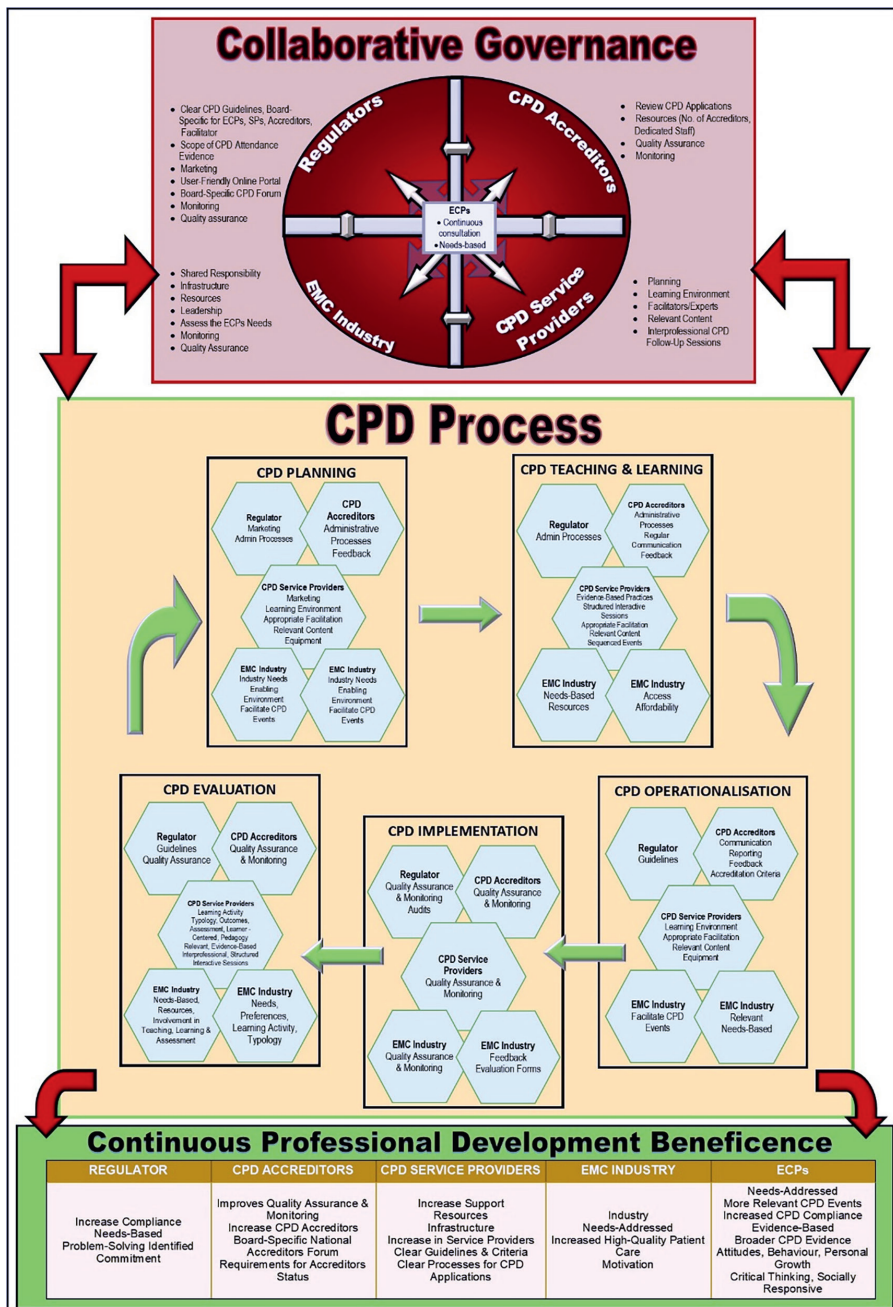


Figure 1.
CPD Framework for ECPS- (directly from Sookram et al. [15]).

2.3 Planning

Meetings should be regularly held with all stakeholders involved in disaster management to discuss the planning of CPD activities. This allows for preparations to be made to assist with quality assurance and monitoring [15].

2.4 Regulator

In the case of the regulator (who oversees the regulations of disaster management), as part of the process of preparing the CPD activities, the regulator should ensure that all the stakeholders are committed to the events. Policies and procedures must be followed for CPD activities to be successful [15].

2.5 Accreditors

Accreditors are institutions that ensure that the CPD process is carried out according to the guidelines established by the disaster management team and ensure that the CPD activities are of quality and standards. In addition, they ensure that the CPD activities are of high standards [15].

2.6 CPD service providers

CPD service providers should ensure that the activities presented are realistic to a disaster event. This can be seen as a motivating factor for attending these activities. Furthermore, service providers must have the latest equipment available and current learning material, enabling effective learning and experience [15].

2.7 EMC industry

There is a requirement for all healthcare professionals to be current, up to date with new knowledge and skills. There should be a commitment from all positions of management to help facilitate these CPD activities. These include the availability of healthcare professionals and skills equipment to name a few [15].

2.8 ECPS (healthcare professionals)

Without the availability of healthcare professionals to respond to any disaster events, there will be a direct effect on lives, healthcare, and other aspects presented. Therefore, it is important to involve them in the preparation of the activities, as it is an ideal way for healthcare professionals to acquire new knowledge when they are taken into consideration during the planning of these events [15].

In the planning of CPD activities especially for a disaster event, a variety of stakeholders are needed, as seen in **Figure 1**. For any teamwork to be effective in interprofessional collaboration, sharing of knowledge and skills is needed. In the end, without each other collaborating, it would be detrimental to both humankind and the ecosystem concerned [15].

3. Conclusion

In summary, the role of CPD plays an important role in being prepared for disasters and responding to those that are involved. Basic knowledge and training are important, but they are not sufficient to meet the ongoing changes in disasters. CPD activities should include new strategies that help healthcare professionals to be ready to adjust to different disaster crises. In addition, the participation of all stakeholders in CPD activities generates new concepts from a variety of areas in practice,

which, in turn, offers fresh ways to interact with communities and enhances team-work during emergencies.

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Perspective Chapter: The Integrated Learning Experience (ILE) Model – Active Pedagogy and Lifelong Learning in Higher Education

Livia Ostafe and Elena Seghedini

Abstract

Higher education today faces a profound tension between credential-driven cultures and the urgent need to prepare adaptable, critical, and resilient lifelong learners. This chapter explores how active pedagogy can serve as a catalyst for reawakening the learner within, moving students beyond passive reception of knowledge toward agency, reflection, and critical engagement. After reviewing key theoretical foundations – adult learning, motivation, transformative and experiential learning, digital literacies, and inclusivity, the chapter introduces the Integrative Learning Experience (ILE) model as an original framework for higher education. The ILE model synthesizes motivational foundations, experiential transformation, digital and epistemic vigilance, and inclusivity and civic growth, providing educators with a holistic, adaptive, and practice-oriented approach. Case studies drawn from psychology teaching demonstrate the practical application of these ideas, including mock trials, gamified puzzle-based learning, and digital media critiques. These examples illustrate how active pedagogy can build resilience, curiosity, empathy, and digital citizenship, while also addressing challenges of equity, confidence, and assessment alignment. The chapter concludes by situating these practices within the wider vision of a learning society, where higher education must prepare graduates not only for employability but also for democratic and ethical participation in uncertain times. By bridging theory, practice, and policy, the chapter argues that reawakening the learner within is both a pedagogical strategy and a social imperative.

Keywords: active pedagogy, lifelong learning, higher education, integrative learning experience (ILE) model, digital citizenship, inclusivity

1. Introduction

Higher education stands at a crossroads. On one side, universities remain entangled in credential-driven cultures, where learning is often reduced to measurable outputs such as grades, completion rates, and employability statistics. On the other, international policy frameworks emphasize that education must cultivate adaptability, resilience, and curiosity – the dispositions that sustain lifelong learning [1, 2]. The tension between instrumental and humanistic purposes of higher education is widely recognized in contemporary scholarship, which warns that the dominance of performative metrics risks narrowing the intellectual and moral horizons of universities [3-5].

Students rarely arrive at university as blank slates; they bring prior experiences, interests, and ways of knowing that, when ignored, can lead to disengagement and alienation. Research indicates that rigid curricula, excessive assessment, and competitive cultures suppress students' intrinsic motivation and sense of belonging [6-8]. Barnett [3] argues that higher education too often "puts the learner to sleep," replacing curiosity with compliance. The challenge, then, is how to reawaken learners' agency and intrinsic motivation within systems still largely oriented toward external validation.

Active pedagogy has been positioned as a transformative response to this dilemma. Grounded in constructivist and humanistic traditions, active pedagogy redefines learning as participation rather than transmission – an interactive process in which learners co-construct knowledge through discussion, experimentation, and reflection [6, 7, 9]. Meta-analyses across disciplines consistently show that students engaged in active learning environments achieve higher performance and lower failure rates than those taught through traditional lectures [10, 11]. Moreover, studies link active approaches to enhanced creativity, critical thinking, and self-regulation – core competencies for lifelong learning [6, 9, 12, 13].

However, scholars caution that the value of active pedagogy lies not in the activity itself but in its intentionality. Without theoretical grounding, active methods risk devolving into entertainment or tokenistic gestures toward engagement [14, 15]. Critics argue that the superficial adoption of "innovative" tools – such as gamified tasks or flipped classrooms – may improve satisfaction scores without fostering deeper conceptual understanding or critical capacity [5, 16]. The central issue is, therefore, not whether to make learning "fun," but how to design experiences that cultivate autonomy, competence, and relatedness – psychological needs identified by Self-Determination Theory (SDT) as essential for sustained motivation [7, 8].

Emerging technologies intensify these debates. Artificial intelligence (AI), social media, and data-driven learning environments promise personalized instruction and efficiency but simultaneously risk creating new forms of passivity and dependency [17–19]. Studies show that when students rely uncritically on algorithmic tools, epistemic vigilance – the capacity to evaluate information sources and credibility – can decline [17, 20]. Thus, digital innovation in higher education must be guided by pedagogical ethics: technology should expand, not replace, active human inquiry [21–23].

This chapter proposes that reawakening the learner within requires more than adopting isolated techniques. It involves integrating psychological, experiential, and

ethical dimensions of learning into a coherent framework that connects motivation, reflection, and inclusivity. Drawing on theories of adult learning, Self-Determination Theory, experiential and transformative learning, and digital literacies, the following sections construct a theoretical foundation for what we term the Integrative Learning Experience (ILE) model – an approach designed to foster agency, curiosity, and resilience across diverse higher-education contexts.

The structure of the chapter follows this logic. Section 2 reviews theoretical foundations underpinning active pedagogy, synthesizing motivational, experiential, and reflective traditions. Section 3 examines how these theories manifest in higher-education practice, highlighting both strengths and risks. Section 4 presents classroom-based case studies developed by the authors, demonstrating how the ILE model operates in practice. Finally, Sections 5–7 situate these insights within the wider policy agenda for lifelong learning and argue that reawakening the learner within is both a pedagogical strategy and a social imperative.

The destination is ambitious: graduates who view themselves not as completers of modules but as lifelong learners capable of curiosity, reflection, and ethical participation in an uncertain world [1-3, 5, 24]. The journey begins by revisiting the theories that explain how learning, motivation, and transformation intertwine.

2. Theoretical foundations

To understand how active pedagogy fosters lifelong learning, this section synthesizes key theoretical traditions that explain why certain educational practices enhance agency, motivation, and critical thinking. These frameworks are often treated separately, yet their complementarities are essential for designing learning environments that respond to the cognitive, emotional, and digital realities of contemporary higher education.

2.1 Theories of adult and motivated learning

Adult learning theories reposition learners as autonomous, experienced, and purpose-driven. Knowles' andragogy highlights adults' readiness to learn when content is relevant and problem-centered, and recognizes the motivational importance of prior experience and self-direction [25]. However, scholars caution against assuming that all learners enter higher education with equal confidence or readiness for autonomy. Merriam and Baumgartner [26] and Illeris [27] emphasize that emotions, identity, and sociocultural contexts shape engagement, meaning autonomy must be intentionally cultivated rather than presumed.

This developmental view is closely aligned with scaffolding approaches. Vygotsky's zone of proximal development illustrates how guidance, dialog, and structure enable learners to move gradually toward independence [28]. Active pedagogy translates these principles into practice through collaborative tasks, formative feedback, and the gradual release of responsibility.

Self-Determination Theory (SDT) offers a complementary psychological account of motivation. It proposes that autonomy, competence, and relatedness are universal needs that, when supported, promote intrinsic motivation and persistence [7, 8]. Autonomy-supportive environments – characterized by choice, meaningful rationales, and reduced pressure – have consistently been shown to enhance engagement and wellbeing. Competence is strengthened through achievable challenges and timely feedback, while relatedness emerges through collaborative, trust-based interactions. Together, these perspectives show that motivation is relational and context-dependent; learning environments that respect students' experiences and agency sustain effort and deepen learning.

2.1.1 Motivation and self-determination theory

To understand why supportive environments energize learning, Self-Determination Theory (SDT) offers one of the most empirically validated frameworks in psychology. SDT posits that the fulfillment of three basic psychological needs – autonomy, competence, and relatedness – is essential for intrinsic motivation and wellbeing [7, 8]. When these needs are met, learners experience self-determination and persistence; when thwarted, they become disengaged or dependent on extrinsic rewards. Meta-analyses confirm that autonomy-supportive teaching increases engagement, retention, and performance across educational levels [25, 26].

Active pedagogy naturally aligns with these principles. Offering meaningful choice nurtures autonomy; scaffolded challenges build competence; and collaborative tasks foster relatedness. However, SDT also exposes the contradictions of contemporary higher education. Institutional constraints – such as rigid assessment policies, surveillance technologies, and performative metrics – can undermine autonomy even in ostensibly student-centered classrooms [29]. Guay et al. [7] emphasize that motivation must be analyzed ecologically, as the product of dynamic interactions between personal, social, and institutional systems.

Complementary frameworks deepen this understanding. Expectancy–Value Theory proposes that effort depends on perceived success and task value [30]. Research shows that interventions enhancing relevance – such as connecting content to personal goals or career pathways – significantly increase persistence, particularly among underrepresented groups [31]. Similarly, Achievement Goal Theory distinguishes mastery-oriented learners, who focus on developing competence, from performance-oriented learners, who seek to demonstrate competence relative to others [32]. Classrooms promoting mastery goals and growth mindsets have been shown to cultivate resilience, curiosity, and self-regulation – hallmarks of lifelong learning [33].

Neuroscientific findings lend biological support to these motivational models. Studies reveal that curiosity and prediction errors activate dopaminergic reward circuits, enhancing memory and learning [34, 35]. Environments that stimulate curiosity through inquiry, experimentation, and surprise, therefore, engage both affective and cognitive systems. This explains why active pedagogy – through debate, simulation, or discovery – produces lasting learning gains.

In practice, effective motivation depends on constructive alignment between instructional design and psychological need satisfaction. Biggs [14] argues that when learning activities and assessments align with intended outcomes, students experience coherence and purpose, which sustains motivation. Dent and Koenka's [36] meta-analysis confirms that autonomy-supportive and mastery-oriented classrooms foster self-regulated learning behaviors such as goal-setting and strategic reflection – core attributes of lifelong learners. Reeve [37] further demonstrates that autonomy-supportive educators not only enhance engagement but also promote wellbeing and persistence long after the course ends.

In summary, literature converges on a key insight: motivation is not a static trait but a dynamic relationship between the learner and the context. Active pedagogy is justified not because it is interactive, but because it satisfies the psychological conditions that sustain meaningful engagement. When learners experience autonomy, competence, and relatedness, they internalize learning as self-relevant and continue learning beyond external incentives – precisely what lifelong learning requires.

2.2 Experience, reflection, and transformation

Active pedagogy's intellectual roots lie in experiential and transformative learning theories, which define learning as an iterative process of doing, feeling, thinking, and redoing. Dewey [38] argued that experience becomes educative only when it is reflected upon and reconstructed through inquiry. In this sense, experience without reflection is mere activity; reflection transforms experience into knowledge. Building on this, Kolb [39] formalized experiential learning as a cyclical process involving four stages: concrete experience, reflective observation, abstract conceptualization, and active experimentation. Empirical reviews confirm that tasks designed through this cycle promote deeper understanding, retention, and transfer than traditional instruction [3, 11].

Yet experiential learning has been criticized for oversimplification. Boud and Walker [40] contend that reflection is embedded in emotion, power, and context, not a neutral stage in a cycle. Similarly, Moon [41] conceptualizes reflection as a continuum – from descriptive recall to critical evaluation – requiring scaffolding through guiding questions and exemplars. Cognitive science corroborates these refinements: active retrieval, elaboration, and feedback are essential mechanisms for consolidating memory and understanding [42, 43]. Active pedagogy incorporates these findings by designing activities that provoke reasoning, prediction, and metacognitive monitoring rather than rote participation.

Transformative learning theory, pioneered by Mezirow [44, 45], extends experiential learning into the realm of meaning and identity. It posits that adults undergo deep learning when they critically reflect on their assumptions in response to “disorienting dilemmas” – experiences that challenge prior worldviews. Transformation, however, is not purely rational. Illeris [27] and Hoggan and Merriam [46] argue that emotion and identity are central to this process; affective discomfort often precedes cognitive restructuring. Neuroscientific research supports this claim, showing that emotion modulates attention and memory, enhancing learning when integrated rather than suppressed [47, 48].

Educational environments that balance challenge with psychological safety are, therefore, essential. Baxter Magolda [39] demonstrated that iterative cycles of uncertainty, reflection, and feedback foster self-authorship – the capacity to define one’s own beliefs and identity. Structured debriefs and reflective writing transform emotional experiences into conceptual insight [17, 49]. Social interaction further amplifies transformation: Vygotsky [28] and Lave and Wenger [50] conceptualized learning as participation in communities of practice, where knowledge is co-constructed through dialog. Active pedagogies employing collaboration, peer review, and debate replicate these communities within the classroom.

Critical pedagogy adds a moral dimension. Freire [51] contended that education should cultivate conscientization – the awareness of social and ethical implications of knowledge. Empirical research in social justice education shows that dialogic, participatory methods increase empathy, moral reasoning, and civic engagement [52]. Thus, experiential and transformative traditions align with both cognitive science and critical theory: learning is not only a cognitive process but a moral, emotional, and social act.

Systematic reviews affirm the efficacy of experiential methods. Prince [11] and Freeman et al. [10] found that active learning significantly improves academic performance and retention across STEM, business, and social sciences. However, poorly structured activities may privilege outspoken students or devolve into “busy work” without reflection [15, 53]. Effective design demands clarity of purpose, inclusivity, and scaffolding – balancing freedom with structure. When these conditions are met, experiential learning builds adaptability, empathy, and critical thinking as skills essential for lifelong learning.

2.3 Critical reflection and digital literacies for lifelong learning

If motivation provides the energy for learning and experience supplies the content, reflection offers the direction. Reflection transforms participation into growth by connecting experience to knowledge and self-awareness. Dewey [54] described reflective thought as “active, persistent, and careful consideration” that reorders experience into understanding. Schön [55] extended this with his concepts of reflection-in-action (thinking while doing) and reflection-on-action (retrospective analysis), which are foundational to professional practice in education, healthcare, and psychology.

Reflection is also a metacognitive process – thinking about one’s thinking. Studies demonstrate that explicit metacognitive instruction improves transfer, problem-solving, and persistence [36, 56]. However, unguided reflection can become descriptive rather than critical [12, 41, 57]. Effective reflection requires scaffolding through prompts, exemplars, and dialogic feedback. Ng and Tan [6] show that structured reflection enhances resilience and self-regulation, while Mercer et al. [58] find that peer dialog strengthens reasoning and collective understanding.

Brookfield [59] reframes reflection as a critical act, aimed at uncovering the assumptions and power relations embedded in knowledge. This aligns with Mezirow’s notion of perspective transformation [44] but situates it explicitly within social and political contexts. Zembylas [52], and Hall and Sutherland [44], provide evidence that critical reflection fosters empathy, civic responsibility, and adaptability – key components of lifelong learning.

In the digital age, reflection must extend beyond personal cognition to epistemic discernment – the ability to evaluate information credibility in complex online environments. Studies reveal that university students often rely on superficial cues, such as website design or popularity, when assessing digital information [60, 61]. The concept of epistemic vigilance explains this limitation: it refers to cognitive mechanisms for assessing the reliability of communicated information [17, 20]. Teaching students to practice lateral reading – verifying sources across multiple sites – significantly improves accuracy and confidence in digital evaluation [61].

Digital learning environments are shaped by commercial, cultural, and political forces that influence how knowledge is produced and valued. Algorithmic feeds curate information in ways that may narrow intellectual horizons and amplify echo chambers [62]. Generative AI adds further complexity: although these tools can support idea generation and academic expression, they also risk encouraging superficial engagement if learners rely on them without critical scrutiny [10, 18, 19]. For this reason, AI should be positioned pedagogically as an object of inquiry. Examining its biases, accuracy, and ethical implications helps students understand how machine-generated outputs differ from peer-reviewed knowledge [21, 23].

Digital literacy is, therefore, inseparable from considerations of ethics and accessibility. Data analytics, plagiarism detection systems, and other monitoring technologies raise legitimate concerns regarding privacy and autonomy, with potential implications for students' sense of agency and relatedness [7, 63]. Transparent, participatory digital policies and inclusive design principles are essential for ensuring that technology enhances, rather than restricts, learner autonomy. Universal Design for Learning supports this by offering flexible pathways for engagement, representation, and expression [53, 64].

European lifelong learning frameworks emphasize “learning to learn” and “digital competence” as transversal skills needed to navigate evolving information environments [65]. Research shows that when reflection and digital critique are embedded throughout the curriculum – through tools such as annotated journals, discussion boards, and digital portfolios – students demonstrate greater adaptability, ethical awareness, and confidence when encountering unfamiliar tasks [53, 66–68]. Cultivating these dispositions strengthens epistemic resilience and prepares learners to participate responsibly in increasingly complex digital landscapes.

2.4 From disconnected theories to synergy: The integrative learning experience (ILE) model

To translate this theoretical synthesis into practice, we introduce the Integrative Learning Experience (ILE) model [10]. Drawing inspiration from integrative approaches in therapy and interdisciplinary research, the ILE model combines complementary theories into a coherent pedagogical framework. It offers educators a structured method for operationalizing the insights outlined above, positioning the model as an original contribution to the field.

Unlike established single-lens approaches – such as Kolb's experiential learning cycle [39], which foregrounds cognitive processes of experience and reflection, or Self-Determination Theory (SDT) [69], which emphasizes psychological needs and

motivation – the ILE model conceptualizes learning as a multidimensional process. It integrates motivational, experiential, digital, relational, and inclusive dimensions into a unified framework that more accurately reflects the complex environments students navigate in contemporary higher education.

The ILE model is built on the recognition that students do not learn within discrete cognitive, emotional, or digital domains. Their development is shaped by prior experiences, motivations, socio-cultural identities, and the digital environments through which they navigate knowledge. Pedagogical approaches grounded in a single theoretical lens risk overlooking aspects that meaningfully influence engagement and learning. By contrast, the ILE framework provides a systematic way of weaving together diverse theoretical strands into a unified practice.

In subsequent sections, we demonstrate how the ILE model operates in real classroom environments. Across these examples, core principles such as autonomy, competence, and relatedness – central to Self-Determination Theory – are enacted through meaningful choice, scaffolded challenges, collaborative inquiry, and structured reflection. These design elements illustrate how the ILE model translates theory into pedagogical strategy, supporting students' motivation, confidence, and sense of belonging.

To operationalize this integrative framework, the ILE model is organized around four interdependent pillars that structure how learning is designed, enacted, and reflected upon.

These pillars are not sequential steps but mutually reinforcing dimensions that shape students' engagement and development. Each draws on the theoretical foundations discussed above, translating them into practical considerations for curriculum design and teaching.

Motivational foundations

- Draws from andragogy and Self-Determination Theory [7, 25].
- Prioritizes autonomy, competence, and relatedness as preconditions for sustained engagement.
- Pedagogical implication: scaffold learner choice, build confidence incrementally, and nurture belonging within academic communities.

Experiential transformation

- Informed by Kolb's learning cycle and transformative learning [39, 44].
- Emphasizes iterative cycles of doing, reflecting, conceptualizing, and experimenting, with attention to affective and embodied dimensions.
- Pedagogical implication: employ role play, debates, and puzzle-based tasks that provoke both intellectual insight and emotional engagement.

Digital and epistemic vigilance

- Anchored in Media Learning Skills (MLS) and AI literacies [17].

- Addresses the challenges of misinformation, bias, and dependency in digital environments.
 - Pedagogical implications integrate algorithm audits, critical analysis of TED Talks, and student-generated digital artifacts to develop critical digital citizenship.

Inclusivity and civic growth

- Grounded in Universal Design for Learning and moral dilemma discussions [64, 70].
- Ensures pedagogy is accessible to neurodiverse and multilingual learners, while cultivating moral and civic dispositions.
- Pedagogical implication: provide multiple pathways for participation, foreground ethical reasoning, and value diverse perspectives in assessment and dialog

The ILE model (**Figure 1**) represents a multidimensional pedagogical framework that integrates motivational foundations, experiential transformation, digital and epistemic vigilance, inclusivity, and civic growth. It visualizes how learners' motivation, reflective experience, digital discernment, and inclusive engagement interact dynamically to support sustained curiosity, agency, and lifelong learning.

2.5 Why the ILE model matters?

The ILE model demonstrates that no single theoretical framework fully accounts for the complexity of lifelong learning. Andragogy highlights autonomy, SDT emphasizes psychological needs, experiential learning deepens engagement, and digital literacies build critical awareness – yet each remains partial when considered alone. By integrating these perspectives, the ILE model offers an approach that is holistic, adaptive across diverse learning environments, and attentive to issues of equity and belonging. Its strength lies in bringing together cognitive, emotional, digital, and social dimensions of learning to support both academic development and the broader formation of reflective, engaged citizens.

Imagine the traditional pedagogy is like serving students a pre-prepared meal, the ILE model is more like inviting them into the kitchen. Learners bring their own ingredients: experiences, identities, perspectives, while educators provide the recipes, tools, and scaffolding. The process may be untidy at times, but it is generative. Students leave not only nourished but also equipped with the skills and confidence to continue “cooking” for themselves across a lifetime.

2.6 Linking theory to practice

The significance of the ILE model lies in how readily its principles can be enacted in higher education. Its four pillars manifest across a range of pedagogical practices from co-created learning agreements to puzzle-based inquiry, digital critique, and dialogic simulations. These approaches illustrate how motivational, experiential,

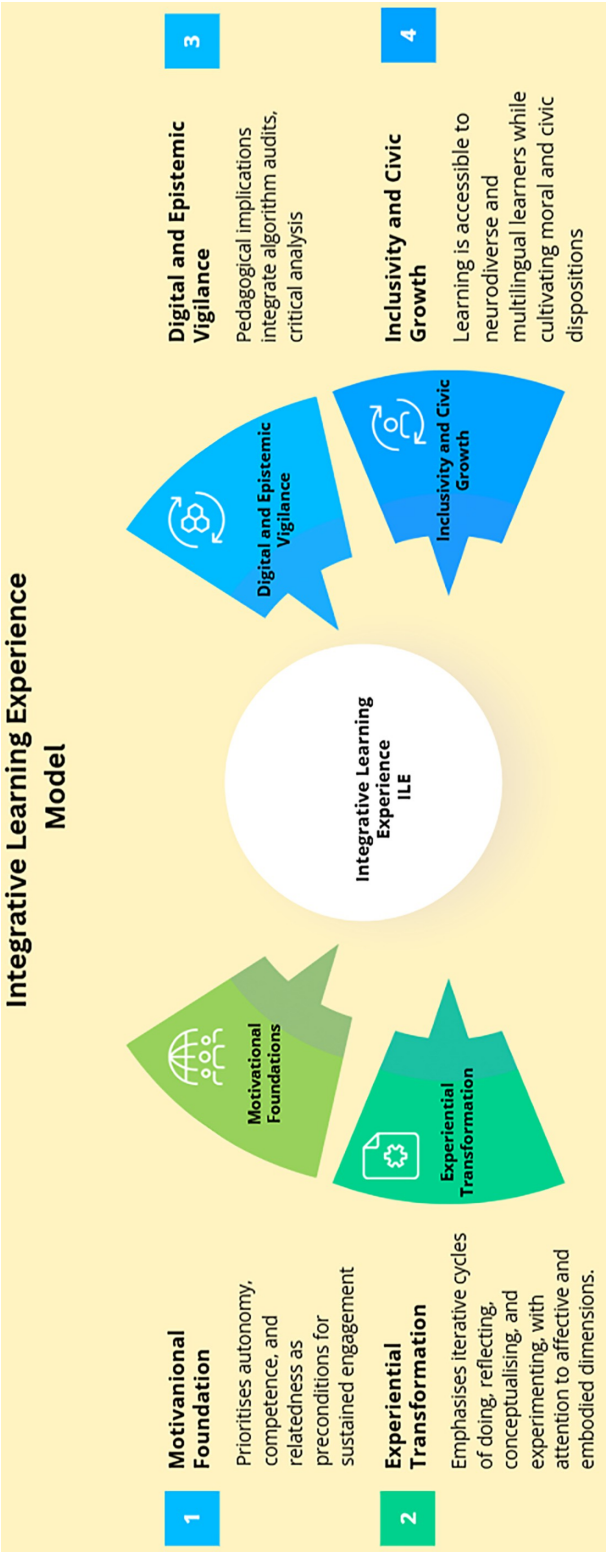


Figure 1.
ILE model.

digital, and inclusive considerations can intersect within authentic learning environments.

The subsequent chapters demonstrate this movement from framework to practice. Chapter 3 explores active pedagogy more broadly, and Chapter 4 presents concrete examples from undergraduate psychology teaching, showing how the ILE model informs activities such as the Psychology Trial, Gestalt Puzzles, and TikTok analysis tasks. In this way, theory and practice remain mutually reinforcing; theoretical insight guides design, and lived practice refines and strengthens the model.

3. Active pedagogy in higher education

Active pedagogy is often defined in contrast to traditional transmission models of education, in which knowledge flows unidirectionally from teacher to student. Instead of positioning learners as passive recipients, active approaches involve them cognitively, socially, and emotionally through discussion, problem-solving, simulation, and reflection [10, 14]. The core principle is that knowledge is constructed through engagement where learners make meaning by applying, questioning, and reframing ideas within authentic contexts [11, 15].

Empirical evidence consistently demonstrates the superiority of active learning over lecture-based instruction. Freeman et al. [10] found, across 225 STEM courses, that active methods increased student performance and reduced failure rates by more than 50%. Prince [11] reported similar findings across engineering and social sciences, while Bedenlier et al. [6] and Healey et al. [9] showed that collaborative and inquiry-based learning improve motivation, creativity, and self-efficacy. These gains hold across online, hybrid, and face-to-face environments when activities are designed with clear outcomes and reflective components [53, 71].

The theoretical basis of active pedagogy lies in constructivist and humanistic traditions. Constructivism, originating with Piaget and Vygotsky, posits that learners build understanding through interaction and social negotiation [28, 50]. Humanistic psychology, through the work of Rogers and Maslow, positions education as a process of self-actualization and growth rather than compliance [72]. Together, they underpin a vision of learning as participatory, relational, and purpose-driven.

Self-Determination Theory (SDT) operationalizes this vision at the motivational level, identifying autonomy, competence, and relatedness as prerequisites for intrinsic motivation [7, 8]. Studies confirm that classrooms supporting these needs produce higher engagement, persistence, and wellbeing [36, 37]. In practice, autonomy emerges through choice and dialog; competence through scaffolding and feedback; and relatedness through collaboration and trust. Active pedagogy thus provides the social and cognitive architecture through which intrinsic motivation flourishes [8, 37].

However, not all activity is educationally meaningful [73]. Bonwell and Eison [74] warned that “busyness” without reflection can lead to shallow learning. Effective design requires constructive alignment – a deliberate connection between tasks, learning outcomes, and assessment criteria [14]. Even simple interventions, such as brief peer discussions or reflective pauses during lectures, can improve

comprehension and retention if explicitly linked to learning goals [75]. The emphasis is, therefore, not on activity itself but on intentional participation that cultivates agency and metacognition.

Active pedagogy also aligns with contemporary educational paradigms, such as students-as-partners, which reframe learners as co-creators of knowledge and curriculum [9]. This approach empowers students to shape learning environments collaboratively, enhancing ownership and professional identity [12]. Research indicates that partnership models increase motivation and engagement, particularly when students perceive their input as valued rather than symbolic [76].

In essence, active pedagogy reframes the university classroom as a participatory space where students act, reflect, and create meaning collaboratively. It is not merely an instructional technique but a philosophical stance that positions learners as active citizens of knowledge communities [7].

3.1 Gamification and motivational frameworks

Gamification – the integration of game mechanics such as points, levels, feedback loops, and challenges into learning – has become a popular tool for enhancing engagement in higher education [13, 63, 77]. Its success lies in its capacity to translate abstract learning goals into immediate, tangible progress markers. By activating the same psychological mechanisms that drive enjoyment and persistence in games, well-designed gamification can sustain motivation and promote mastery [13, 77].

Empirical reviews support its effectiveness. Indriasari et al. [63] found that gamified learning improved motivation in 72% of studies and academic performance in 61%. Dichev and Dicheva [77] concluded that gamification fosters persistence and collaboration when grounded in solid pedagogy, especially in group tasks. Zhang [13] demonstrated that “ludic” design – combining challenge, autonomy, and curiosity – enhances academic buoyancy and resilience, particularly among students facing high assessment pressure.

From a theoretical standpoint, gamification operationalizes SDT’s three psychological needs. Autonomy is fostered through voluntary participation and meaningful choice; competence through progressive challenge and immediate feedback; and relatedness through collaboration and shared goals [7, 8]. However, the literature also cautions against “pointsification” – the use of extrinsic rewards (badges, leaderboards) detached from learning outcomes [16]. When rewards replace intrinsic interest, motivation becomes contingent and short-lived [78].

To avoid this, gamification should be designed around meaningful engagement. For instance, quizzes can be re-framed as level-based missions where each stage requires deeper reasoning rather than mere recall. Leaderboards can track team progress to encourage cooperation instead of competition. Reflection tasks at the end of each “game level” can consolidate conceptual understanding and link the experience back to learning goals.

Studies by Hamari and Koivisto [79] show that the motivational effects of gamification are strongest when learners perceive activities as voluntary, socially connected, and competence-enhancing. In practice, educators should, therefore, combine game elements with narrative, reflection, and authentic challenges. When

embedded within active pedagogy, gamification becomes a vehicle for autonomy-supportive learning rather than a distraction.

In this sense, gamification embodies the motivational foundation of active pedagogy: it connects challenge, feedback, and meaning, transforming engagement from compliance to curiosity [80].

3.2 Experiential, dialogic, and digital pedagogies

Experiential and dialogic methods, such as debate, drama, and role play, place students in situations where knowledge must be interpreted, questioned, and defended. These approaches require learners to adopt perspectives, navigate uncertainty, and engage with ethical and disciplinary tensions capacities central to professional judgment and civic participation [73]. Research shows that well-structured role play enhances empathy, communication, and ethical reasoning, while simulated debates deepen disciplinary understanding and strengthen confidence in articulating complex ideas [16, 66].

The educational value of these methods lies in how they create purposeful disequilibrium. By inhabiting roles – researcher, participant, policymaker – students confront assumptions, practice deliberation, and encounter the emotional dimensions of decision-making. Such experiences align with transformative learning principles, inviting shifts in perspective as students negotiate meaning in interaction with others [44]. To ensure equitable participation, activities must be supported through role cards, clear briefing, and reflective debriefing, which help balance voices and make learning accessible to students with diverse communication preferences.

Digital and social media platforms offer parallel opportunities for active and critical engagement. When used intentionally, tools such as TikTok, YouTube, and TED Talks support multimodal expression and situate learning within students' lived digital environments. Studies indicate that these platforms can enhance creativity, collaboration, and confidence in public communication when framed within clear academic expectations [4, 73]. Their familiarity increases authenticity and helps bridge formal and informal learning spaces.

However, digital participation is pedagogically valuable only when paired with critical inquiry. Research shows that students frequently rely on surface-level cues when evaluating online content [61]. Tasks such as algorithm audits, source triangulation, or comparative analyses of digital and peer-reviewed texts help cultivate epistemic vigilance and digital discernment. When students create or critique digital artifacts for example, producing a short video summarizing a theory accompanied by a scholarly commentary, they practice both creativity and evidence-based reasoning.

Integrating these experiential and digital approaches supports a broader goal of humanizing learning. Rather than treating digital platforms as distractions or drama tasks as performance exercises, both are framed as opportunities to rehearse reasoning, empathy, and ethical judgment. When facilitated carefully, they help students develop the confidence to express ideas publicly, the critical skills to evaluate information responsibly, and the interpersonal capacities needed to navigate disagreement constructively. Together, these pedagogies provide complementary pathways through which learners engage intellectually, socially, and ethically with contemporary knowledge landscapes [81].

3.3 Limitations and conditions for effective practice

Despite strong evidence of its benefits, active pedagogy is not without challenges. A persistent concern is the risk of tokenism: when activities are introduced for novelty rather than purpose, they may simulate engagement without generating deeper understanding [15, 16]. Research shows that poorly structured or misaligned tasks can confuse students and offer little cognitive value, especially when their relevance to assessment is unclear [11].

Equity presents a second challenge. Group work, debate, and performance-based tasks can inadvertently reproduce social hierarchies if participation is not intentionally scaffolded [64, 71]. Quiet, multilingual, or neurodiverse learners may be overshadowed unless multiple avenues for contribution – written, visual, or verbal – are offered. Universal Design for Learning provides helpful guidance for ensuring flexibility and accessibility in both participation and assessment [64].

Structural pressures within higher education further shape the feasibility of active pedagogy. Heavy workloads, research expectations, and rigid assessment frameworks may discourage experimentation, while performative cultures in universities often prioritize measurable outputs over pedagogical innovation [4, 5]. Without institutional recognition, the adoption of active approaches remains uneven and dependent on individual educators' commitment.

Assessment alignment also remains a critical issue. Many systems still prioritize recall-based individual exams, which can undermine the value of collaborative or inquiry-oriented tasks [14]. Clear rubrics, reflective components, and constructive alignment are essential to ensure coherence between learning experiences and evaluative practices [75].

These critiques do not diminish the value of active pedagogy but highlight the conditions under which it thrives: purposeful design, inclusive facilitation, and institutional support. When these elements are present, active approaches can expand students' sense of capability, belonging, and intellectual agency.

3.4 From activity to agency

Across the research base, one finding is consistent: active methods are most effective when they cultivate agency rather than simply increase activity. Students progress when they understand the purpose of their participation, feel ownership over their learning, and are encouraged to take intellectual risks within a supportive structure.

Autonomy-supportive and mastery-oriented classrooms foster dispositions associated with lifelong learning – curiosity, persistence, and self-efficacy [8, 36, 37]. Experiential strategies, such as debate and role play, develop empathy and ethical reasoning [16, 66]; gamified tasks can bolster motivation and resilience [13, 77]; and digital creation or critique strengthens critical literacy and epistemic discernment [17, 20, 73]. Together, these practices help students internalize the value of learning rather than merely completing tasks.

Agency develops gradually as students encounter challenges, reflect on feedback, and learn to articulate their own interpretations. This progression mirrors broader models of self-authorship, in which learners shift from relying on external authority

to constructing independent viewpoints [39, 46]. The educator's role is not to remove difficulty but to design environments where challenges are paired with guidance, dialog, and opportunities for reflection.

Ultimately, active pedagogy is defined not by what students do, but by how they grow through doing. By supporting agency, it transforms learning from episodic performance into an ongoing practice of inquiry, reflection, and identity formation – the foundation of lifelong learning.

4. Reawakening the learner within: Practice in action

Moving from theoretical models to lived pedagogy is rarely linear. In our undergraduate psychology teaching at Coventry University, active pedagogy has served as a catalyst for shifting students from passive receivers of information to engaged participants in their learning. The case studies that follow emerge from our own classroom practice, refined over several academic years as part of an ongoing inquiry into how engagement, reflection, and agency develop in authentic learning environments. They are, therefore, not borrowed illustrations but activities we have designed, implemented, and evaluated in situ.

The ILE model offers a useful lens for understanding this work. Activities that support autonomy, competence, and relatedness do more than generate short-term motivation; they invite students to assume responsibility for their thinking. Experiential approaches – such as role play or collaborative puzzles – encourage learners to test concepts through lived interaction, consistent with research emphasizing the role of dissonance and perspective-shifting in deep learning [44]. Integrating digital tools, meanwhile, supports critical engagement with the complexities of online information ecosystems, echoing evidence on the importance of media literacy in higher education [17]. Inclusive design ensures that participation is accessible to all students, aligning with the principles of Universal Design for Learning [64].

The case studies presented here – the Psychology Trial, puzzle-based gamification, and digital media critique tasks – illustrate how the ILE model translates into practice. Each example has evolved across multiple iterations in our modules, demonstrating how active pedagogy can be adapted, scaffolded, and refined to meet the diverse needs of contemporary learners.

4.1 Case example 1: The psychology trial: Ethics in action

One of the most impactful active learning strategies in our undergraduate psychology modules is the Psychology Trial, a courtroom simulation in which students evaluate classic studies such as Milgram's obedience experiments or Zimbardo's Stanford Prison Experiment [82]. Students adopt roles – including defense, prosecution, expert witnesses, and jury members – and debate the methodological, theoretical, and ethical issues raised by the research.

The activity operationalizes the four pillars of the ILE model. It promotes motivation by giving students ownership of their roles; supports experiential learning by immersing them in contested ethical dilemmas; develops digital and epistemic vigilance through the evaluation of online sources; and prompts civic and moral reflection as students consider questions of responsibility, harm, and justice.

These elements combine to make ethics an applied, emotionally resonant encounter rather than a set of abstract principles.

Students frequently note that the trial is the first time they have *experienced* the ethical tensions of psychological research. The simulation transforms ethical guidelines from static rules into issues that must be argued, defended, and scrutinized from multiple perspectives.

From a practical standpoint, structured role cards help students prepare, while a short written reflection ensures that all voices – including quieter learners – can articulate their reasoning. Integrating the trial with subsequent assessments, such as essays on research ethics, strengthens coherence and reinforces the relevance of the activity.

Evaluation data gathered across three academic years show consistently positive outcomes. In end-of-module surveys, **82–88%** of students reported increased confidence in evaluating ethical issues, and **79%** stated that the trial improved their ability to construct evidence-based arguments. Reflective writing also demonstrated deeper engagement with methodological and ethical complexities, with many students linking the experience to improved essay performance. Overall, the Psychology Trial appears to enhance engagement while supporting measurable gains in ethical reasoning and critical analysis.

4.2 Case example 2: Gamifying theory: Turning schemas into play

Explaining abstract concepts, such as Gestalt principles or schema theory, can be challenging when students struggle to relate theoretical ideas to lived experience. To address this, we designed a puzzle-based gamification activity in which students worked in small groups to assemble fragmented images. Several puzzles were intentionally incomplete, creating moments of ambiguity, frustration, and interpretation.

The activity operationalizes key elements of the ILE model. The game-like structure sustains attention and encourages persistence, consistent with findings that thoughtfully designed gamification can enhance motivation [13]. The embodied act of constructing patterns mirrors core Gestalt insights about perception and coherence [39], allowing students to grasp the concept of “incomplete wholes” not only intellectually but also emotionally. Drawing parallels between missing puzzle fragments and digital information gaps – such as algorithmic filtering on social media – extends the activity into the domain of digital and epistemic vigilance, highlighting the importance of critical interpretation in contemporary information environments [73]. Collaborative group work further supports inclusivity by enabling students with different strengths to contribute meaningfully.

Students frequently describe this session as particularly memorable, noting that the physical and affective dimensions helped them internalize complex ideas.

From a practical standpoint, the activity is easy to implement: puzzles can be produced from printed materials at minimal cost, and the learning value lies primarily in the debrief. Tutors should guide students to connect their experiences with relevant theories and invite them to generate personal analogies or examples. Encouraging learners to design their own puzzles or metaphors in subsequent sessions deepens engagement and strengthens conceptual transfer.

Evaluation data from four delivery cycles indicate consistently positive outcomes. In post-session polls, approximately 85% of students agreed that the activity

improved their understanding of Gestalt principles, and 81% reported that the embodied, problem-solving format made abstract ideas easier to remember. Tutors also noted more precise and example-based explanations in later assessments. These patterns suggest that puzzle-based gamification can significantly enhance conceptual clarity and retention.

4.3 Case example 3: Tiktok and TED talks: From distraction to digital literacy

Students often describe platforms such as TikTok and YouTube as sources of distraction. Yet, when reframed pedagogically, these platforms can be powerful tools for cultivating digital literacy and critical thinking. In one activity, psychology undergraduates were asked to produce a 60-second video explaining a theory – such as attachment styles or classical conditioning – in a format accessible to a general audience. Others were tasked with critically evaluating a TED Talk, identifying whether the speaker relied primarily on evidence, storytelling, or charisma.

These tasks activated several dimensions of the ILE model. On a motivational level, they leveraged students' familiarity with digital platforms, fostering creativity and relevance. At the experiential level, the challenge of condensing complex theory into a short format encouraged deep understanding, echoing learning through doing and reflecting [39]. Critically, the activities developed digital and epistemic vigilance, requiring students to consider how algorithms, brevity, and media esthetics shape what counts as knowledge [73]. Finally, by valuing multiple forms of expression – visual, verbal, and performative – the activity supported inclusivity and gave students with diverse strengths opportunities to succeed [64].

Students often reported that the exercise gave them a new appreciation for the challenges of communicating psychological knowledge responsibly. For many, it was the first time they had considered the fine line between accessibility and oversimplification.

Practical implications for tutors: Clear scaffolding is essential. Providing rubrics that emphasize both accuracy and critical reflection prevents the task from sliding into performance without substance. Requiring students to submit short reflective commentaries alongside their videos ensures that digital outputs are linked to theoretical frameworks and scholarly sources.

Across two cohorts ($n \approx 140$), short evaluative questionnaires indicated that between 76% and 83% of students felt more confident in distinguishing between evidence-based claims and persuasive presentation techniques after engaging in the TikTok and TED Talk activities. Analysis of reflective commentaries showed improvements in students' ability to identify bias, rhetorical devices, and gaps in evidence. Additionally, several students reported a notable shift in how they approached online content, indicating stronger epistemic vigilance and critical digital literacy, key competencies for both academic work and responsible digital citizenship.

To deepen these insights, we introduced a "Comparative AI–Academic Text Analysis" activity, where students critically evaluate the differences between AI-generated explanations and peer-reviewed sources. Working in small groups, students generate an AI explanation of a chosen psychological theory, then systematically assess it against an academic text using criteria such as conceptual accuracy, citation integrity, presence of nuance, and potential bias. Students found

the activity revealing: many noted how AI texts appeared convincing at first glance but lacked depth, evidence, or conceptual precision. This practical comparison developed not only digital literacy but also critical thinking and epistemic vigilance – key aspects of the ILE model’s “Digital and Epistemic Vigilance” pillar.

4.4 Reflection and resilience: What students say

The effectiveness of active pedagogy is most clearly visible in students’ reflections. Across activities such as the Psychology Trial, puzzle-based gamification, and digital media critiques, students consistently highlight not just what they learned but how they learned it.

Many describe a sense of increased confidence, particularly in speaking, collaborating, and defending arguments. This aligns with research suggesting that active pedagogy builds communication skills and resilience by placing learners in uncertain but supported situations [53]. Others emphasize the value of learning through struggle; for instance, the frustration of incomplete puzzles was reported as a catalyst for deeper engagement with Gestalt theory. Still, others noted the relevance of using platforms like TikTok or TED Talks, which made theory feel less abstract and more applicable to everyday life [73].

Importantly, several students reflected on resilience: the capacity to persevere when learning felt uncomfortable. As one student put it in a course evaluation, “I realised that it’s okay not to get it straight away – sometimes confusion is the point.” Such reflections suggest that active pedagogy does more than teach content; it nurtures dispositions – adaptability, criticality, and resilience – that are essential for lifelong learning [3].

Course evaluation data across modules consistently highlights increased confidence, resilience, and willingness to participate, with 80–90% of students citing active pedagogy tasks as a key factor supporting their learning.

4.5 Challenges and the ongoing process of awakening the learner

Active pedagogy offers powerful opportunities for engagement, but its effectiveness depends on recognising and addressing its challenges. Activities such as debate, role play, or digital creation can inadvertently privilege extroverted or fluent speakers unless participation is carefully scaffolded [64]. Confidence and anxiety also influence engagement; some students find public or performance-based tasks intimidating, making structured roles, rehearsal time, and alternative modes of contribution essential [71]. Language, cultural background, and existing power dynamics shape who participates and whose perspectives are heard, underscoring the need for inclusive design and reflective facilitation.

These considerations highlight that active pedagogy is not inherently transformative; it becomes so only through intentional planning that foregrounds equity alongside engagement. When thoughtfully designed, activities such as the Psychology Trial, puzzle-based gamification, or digital media critique create varied entry points into learning – ethical reasoning, embodied problem-solving, or critical digital literacy. Each pathway can spark curiosity, confidence, or self-reflection in different learners.

Reawakening the learner is, therefore, not a single outcome but an ongoing developmental process. Students encounter moments of insight in different ways,

and the educator's task is to cultivate environments where these moments can emerge and be sustained. In this sense, awakening is less a product to be delivered and more a continuous practice, shared by students and educators as they navigate learning together.

5. Toward a learning society

Higher education contributes to more than the awarding of degrees; it cultivates the dispositions that sustain a learning society – adaptability, curiosity, critical thinking, and ethical engagement. A learning society relies on citizens who continue to learn, unlearn, and relearn throughout life, and higher education plays a central role in shaping these capacities [1, 2, 24]. As Barnett [3] and Marginson [5] remind us, transformation occurs less in strategic plans than in classrooms, where educators model curiosity, resilience, and intellectual openness.

Global policy frameworks reinforce this imperative. The European Skills Agenda and UNESCO's *Reimagining Our Futures Together* identify continuous learning as essential for navigating technological change, demographic shifts, and ecological uncertainty [1, 24]. Micro-credentials and short learning cycles have emerged as flexible responses, widening access and supporting rapid upskilling. Yet, scholars caution that an exclusive focus on employability risks narrowing the civic, cultural, and ethical purposes of education [3, 5]. The challenge is to design pedagogies that develop professional competence while also nurturing critical, reflective citizens.

The classroom cases outlined in this chapter illustrate how active pedagogy can contribute to this broader mission. The Psychology Trial enabled students to practice ethical reasoning and civic dialog [16, 66]. Puzzle-based gamification showed how cognitive struggle and collaboration foster resilience and self-efficacy, echoing research on the benefits of challenge-based learning [13, 77]. TikTok and TED Talk critiques reframed familiar digital spaces as opportunities for epistemic vigilance and media literacy [17, 20, 73]. Across these examples, students developed habits of mind – confidence, reflection, adaptability – that extend beyond formal education and into lifelong learning [7, 9, 44].

Taken together, these practices demonstrate that educators are pivotal in sustaining a learning society. By embedding active, reflective, and critically informed pedagogies, they cultivate the dispositions that enable individuals to thrive in uncertain futures and participate meaningfully in democratic and professional life.

5.1 Recommendations for educators

Based on the synthesis of research and practice, the following strategies can help educators contribute meaningfully to a learning society:

- Make active pedagogy routine.
Integrate both small-scale strategies (think–pair–share, reflective pauses, short debates) and larger immersive tasks (mock trials, digital projects). Regular exposure normalises active learning as part of students' academic identity rather than an occasional novelty [14, 75].

- Use reflection to build resilience.
Support metacognitive awareness through reflective journals, guided debriefs, and iterative feedback. These practices help students reframe uncertainty, confusion, or challenge as productive components of deep learning [41, 55].
- Frame digital tools critically.
Engage with, rather than avoid, AI and social media. Assignments involving digital artefacts, algorithm critique, or multimodal communication should include reflection on bias, authorship, and ethics to cultivate critical digital literacy [17, 18, 21].
- Design for inclusivity from the outset.
Apply Universal Design for Learning principles to ensure multiple forms of participation – discussion, written responses, visual work, and digital contributions – so that multilingual, neurodiverse, and less confident learners can engage meaningfully [53, 64].
- Connect classroom activities to broader purposes.
Make explicit how learning tasks translate into life-wide skills. Role play can foster empathy and ethical reasoning; gamified problem-solving can develop persistence and adaptability; and digital critique can strengthen media literacy – skills essential for lifelong learning [13, 16, 44].

Developing a learning society requires more than policy innovation; it calls for a cultural shift within higher education. This shift begins in everyday teaching practices, where educators create learning environments that are active, inclusive, and reflective. By modeling curiosity and resilience, educators embody the dispositions they aim to foster in their students [3, 5]. The responsibility is therefore both institutional and personal: active pedagogy functions not merely as a method but as an ethical commitment to designing learning experiences that empower rather than instruct, engage rather than inform, and inspire rather than prescribe [7, 10, 44]

6. Higher education and the learning society: A transformative closing

It is fitting to close not with a traditional conclusion but by returning to the metaphor that has guided this chapter: reawakening the learner within. Active pedagogy transforms education from the transmission of information into a participatory process that cultivates the habits of questioning, reflecting, and adapting, which underpin a learning society [1, 2, 24]. Its impact extends beyond graduation, shaping dispositions that carry into personal, professional, and civic life.

At its strongest, active pedagogy creates the conditions for agency. In our practice, the Psychology Trial required students to confront ethical dilemmas; puzzle-based gamification embodied the struggle to create meaning from ambiguity; and digital critique tasks repositioned learners as critical producers of online knowledge. These examples illustrate how motivation, experience, digital discernment, and inclusivity – core pillars of the Integrative Learning Experience (ILE) model – can work together to support curiosity, empathy, and resilience [7, 39, 44].

The broader responsibility of higher education is not only to prepare graduates for employment but also to foster informed, ethical participation in democratic societies. As Barnett [3] and Marginson [5] argue, universities serve civic as well as economic purposes. Students who learn to evaluate evidence, engage respectfully in debate, and collaborate across diverse viewpoints are better equipped to contribute to pluralistic and resilient communities [52, 66]. Classrooms thus become microcosms of the learning society, where reflection, dialog, and digital vigilance are rehearsed as civic competencies necessary for navigating misinformation, inequality, and technological disruption [17, 62, 73].

Looking ahead, artificial intelligence and emerging digital ecosystems will profoundly shape educational practice. While AI tools offer opportunities for personalization, they also risk embedding bias and diminishing critical thinking if used uncritically [17, 18, 21]. The task for educators is not to reject these technologies but to integrate them ethically, guiding students to interrogate digital outputs as co-constructors of knowledge [23]. Global challenges – climate change, inequality, migration – further underscore the need for global citizenship education, which fosters empathy, ethical reasoning, and intercultural competence [1, 3, 24]. Active pedagogy, through dialog, collaboration, and reflection, provides fertile ground for developing these capacities [76].

Reawakening the learner is, therefore, both a pedagogical and a social imperative. It begins with small acts – inviting students to puzzle, question, debate, and reflect – but these experiences accumulate, shaping enduring habits of curiosity and resilience. The ILE model offers a framework for embedding such moments intentionally, aligning motivation, experience, and inclusivity in everyday teaching.

As Dewey observed, “education is not preparation for life; education is life itself” [54]. Through active, reflective, and critically informed pedagogy, educators do more than teach content – they cultivate learners capable of navigating uncertainty and imagining new possibilities. In doing so, higher education fulfills its deepest purpose: not only to reawaken individual learners, but to renew the collective capacity of societies to learn, adapt, and build more ethical and hopeful futures together.

Acronyms and abbreviations

AI	Artificial intelligence
HE	Higher education
STEM	Science, technology, engineering and mathematics
MLS	Media learning skills
SDT	Self-Determination Theory
ILE	Integrative Learning Experience
UDL	Universal Design for Learning
CAST	Center for Applied Special Technology
UNESCO	United Nations Educational, Scientific and Cultural Organization
OECD	Organisation for Economic Co-operation and Development
PNAS	Proceedings of the National Academy of Sciences
TED	Technology, Entertainment, Design

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Lifelong education is accorded a high priority within the global educational community and is actively promoted by UNESCO. It is an essential part of educational development. Through continuous knowledge renewal, lifelong learning effectively fosters individual development across different life stages and promotes participation in aging societies. In the context of the accelerating new industrial revolution, digital transformation, and societal change, lifelong learning has become the driving force behind the development of a Learning Society and the promotion of a sustainable educational ecosystem. Against this backdrop, this volume brings together scholars from relevant fields to share their insights and research findings on lifelong learning and the development of the Learning Society, providing academic communities and policymakers with verifiable results and evidence.

*Katherine Meltzoff,
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