

Chapter

Inclusive Adult Education for Reskilling in the IT Sector

*Pedro Juan Roig, Salvador Alcaraz, Katja Gilly,
Cristina Bernad and Carlos Juiz*

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

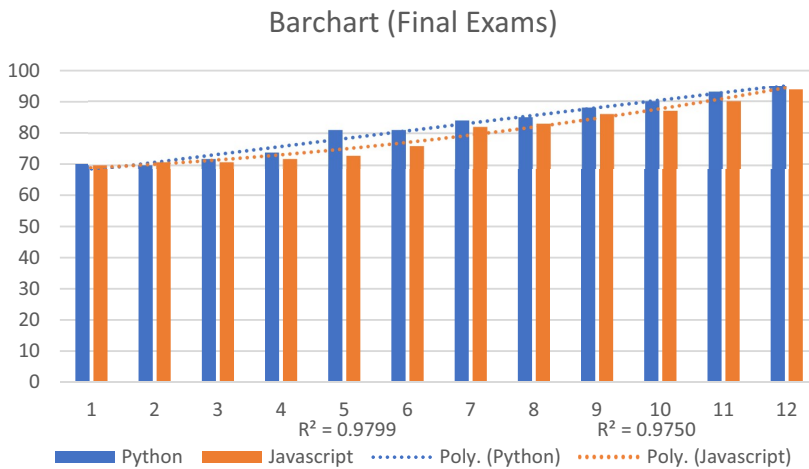


Figure 1.
Bar chart with the results of the final exams.

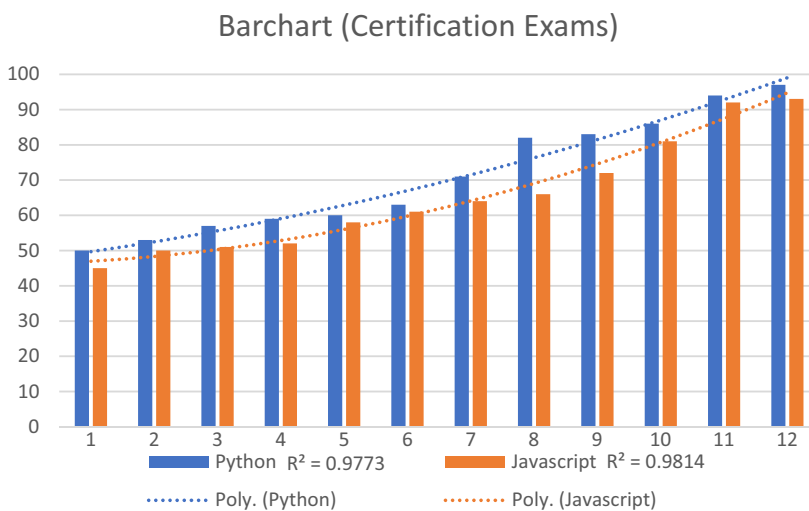


Figure 2.
Bar chart with the results of the certification exams.

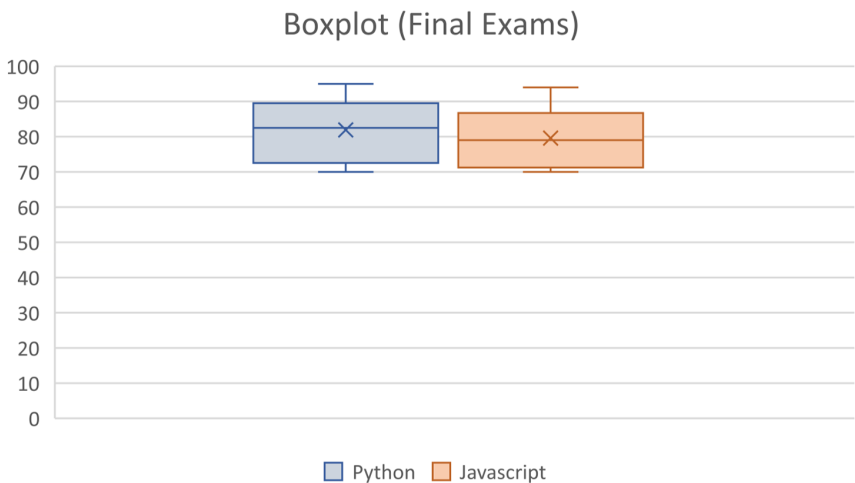


Figure 3.
Boxplot showing the results of the final exams.

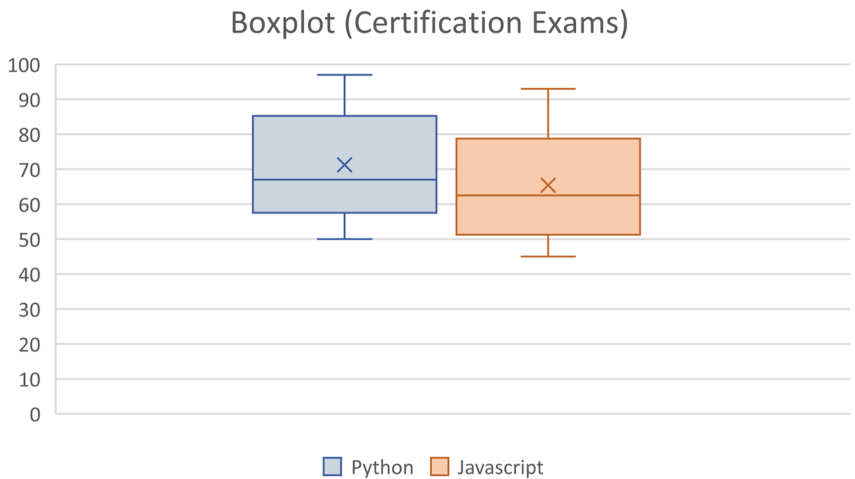


Figure 4.
Boxplot showing the results of the certification exams.

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.

Author details

Pedro Juan Roig^{1*}, Salvador Alcaraz¹, Katja Gilly¹, Cristina Bernad¹ and Carlos Juiz²

¹ Computer Engineering Department, Miguel Hernández University, Elche, Spain.

² Mathematics and Computer Science Department, University of the Balearic Islands, Palma de Mallorca, Spain.

*Address all correspondence to: proig@umh.es

IntechOpen

© 2025 The Author(s). Licensee IntechOpen. This chapter is distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. 

References

- [1] Cedefop (European Commission). Empowering Adults through Upskilling and Reskilling Pathways: Vol. 1: Adult Population with Potential for Upskilling and Reskilling. Vol. **112**. Luxembourg: Publications Office: Cedefop reference series. 2020. pp. 1–104. DOI: 10.2801/691134
- [2] Cedefop (European Commission). Empowering Adults through Upskilling and Reskilling Pathways: Vol. 2: Cedefop Analytical Framework for Developing Coordinated and Coherent Approaches to Upskilling Pathways for Low-skilled Adults. Vol. **113**. Luxembourg: Publications Office: Cedefop reference series. 2020. pp. 1–140. DOI: 10.2801/698251
- [3] Cedefop (European Commission). Going Digital Means Skilling for Digital. Luxembourg: Publications Office. Cedefop reference series; 2023. pp. 1–38. DOI: 10.2801/772175
- [4] EISMEA (European Commission). Intelligent Cities - A Pragmatic Guide to Reskilling. Vol. **1**. Luxembourg: Publications Office; 2021. pp. 1–56. DOI: 10.2826/04206
- [5] Feyer C. Reinventing Skills – Changing Paradigms and the EU Response. *Intereconomics*. 2024;**59**(3):132–135. DOI: 10.2478/ie-2024-0028
- [6] Branki U, Hodge S, Hoggan-Kloubert T, Knight E, Milana M. The European year of skills 2023: Skills for now and in the future? *International Journal of Lifelong Education*. 2023;**42**(3):225–230. DOI: 10.1080/02601370.2023.2212424
- [7] European Commission, Directorate General for employment, social affairs and inclusion. An in-depth analysis of adult learning policies and their effectiveness in Europe. 2015. Available from: https://iefp.eapn.pt/docs/Analise_Políticas_Educacao_Adultos_Eficacia_Europa.pdf [Accessed: 2025-May-29]
- [8] OECD Publishing. Mapping quality assurance indicators for non formal adult learning. Paris: OECD Education Spotlights, OECD Publishing, 2024. Available from: https://www.oecd.org/content/dam/oecd/en/publications/reports/2024/12/mapping-quality-assurance-indicators-for-non-formal-adult-learning_c16fff06/1ce40dfa-en.pdf [Accessed: 2025-May-29]
- [9] Li L. Reskilling and upskilling the future-ready workforce for industry 4.0 and beyond. *Information Systems Frontiers*. 2024;**26**:1697–1712. DOI: 10.1007/s10796-022-10308-y
- [10] Lladós-Masllorens J, Meseguer-Artola A, Vilaseca-Requena J. Upskilling y cambios distributivos en la cadena global de valor de la industria electrónica. *Revista Internacional Del Trabajo*. 2021;**140**(1):123–154. DOI: 10.1111/ilrs.12186
- [11] Martinaitis Z, Christenko A, Antanavicius J. Upskilling, deskilling or polarisation? Evidence on change in skills in Europe. *Work, Employment and Society*. 2020;**35**(3):451–469. DOI: 10.1177/0950017020937934
- [12] Vasilescu MD, Serban AC, Dimian GC, Aceleanu MI. Digital divide, skills and perceptions on digitalisation in the European Union - Towards a smart labour market. *PLOS One*. 2020;**15**(4):e0232032. DOI: 10.1371/journal.pone.0232032

- [13] Jiménez-Martínez RC, Cisneros-Zúñiga CP, Ricardo-Velázquez M, Vásquez-Llerena EM. Fortaleciendo la empleabilidad: Upskilling y Reskilling como clave para un futuro laboral en perpetua transformación. *Dilemas Contemporáneos: Educación Política Y Valores*. 2023;**11**:47. DOI: 10.46377/dilemas.v11iEspecial.3910
- [14] Almanza AR. Upskilling, Reskilling, herramientas para la gestión del talento ciber. *Sistemas*. 2024;**172**: 55–66. DOI: 10.29236/sistemas.n172a6
- [15] Gallardo S. Upskilling y reskilling frente a las tecnologías emergentes. *Sistemas*. 2024;**172**:16–23. DOI: 10.29236/sistemas.n172a3
- [16] Morandini S, Fraboni F, de Angelis M, Puzzo G, Giusino D, Pietrantonio L. The impact of Artificial Intelligence on workers' skills: Upskilling and reskilling in organisations. *Informing Science: The International Journal of an Emerging Transdiscipline*. 2023;**26**:39–68. DOI: 10.28945/5078
- [17] Goel A, Dede C, Garn M, Ou C. AI-ALOE: AI for reskilling, upskilling, and workforce development. *AI Magazine*. 2024;**45**:77–82. DOI: 10.1002/aaai.12157
- [18] Jaiswal A, Arun CJ, Varma A. Rebooting employees: Upskilling for artificial intelligence in multinational corporations. *The International Journal of Human Resource Management*. 2022;**33**(6):1179–1208. DOI: 10.1080/09585192.2021.1891114
- [19] Samuvel K, Gilsha KG. A study on impact of upskilling or reskilling of employees in IT services. *International Journal of Advanced Research in Science Communication and Technology*. 2023;**3**(3):359–363. DOI: 10.48175/IJARSCT-11457
- [20] Heredia-Cardona S Importancia del reskilling y upskilling en el sector IT. November 21, 2022. Available from: <https://openwebinars.net/blog/importancia-del-reskilling-y-upskilling-en-el-sector-it/>
- [21] Anshari M, Hamdan M. Understanding knowledge management and upskilling in Fourth Industrial Revolution: Transformational shift and SECI model. *VINE Journal of Information and Knowledge Management Systems*. 2022;**52**(3):373–393. DOI: 10.1108/VJIKM S-09-2021-0203
- [22] Rikala P, Braun G, Järvinen M, Stahre J, Hämäläinen R. Understanding and measuring skill gaps in industry 4.0 - A review. *Technological Forecasting and Social Change*. 2024;**201**:123206. DOI: 10.1016/j.techfore.2024.123206
- [23] Fritz M, Gresham A. Diversity, equity, inclusion: where do you start? *Nursing Administration Quarterly*. 2024;**48**(1):5–10. DOI: 10.1097/NAQ.0000000000000614
- [24] Morrison V, Hauch RR, Perez E, Bates M, Sepe P, Dans M. Diversity, equity, and inclusion in nursing: The pathway to excellence framework alignment. *Nursing Administration Quarterly*. 2021;**45**(4):311–323. DOI: 10.1097/NAQ.0000000000000494
- [25] Russen M, Dawson M. Which should come first? Examining diversity, equity and inclusion. *International Journal of Contemporary Hospitality Management*. 2024;**36**(1):25–40. DOI: 10.1108/IJCHM-09-2022-1184
- [26] Rynarzewska AI, Tanner JFF, Edmondson DR. An introduction to the

- “The role of inclusion, diversity, equity, & access (IDEA) in today’s global marketing environment” special issue. *Journal of Global Scholars of Marketing Science*. 2024;**34**(1):1–4. DOI: 10.1080/21639159.2023.2264312
- [27] Dewidar O, Elmestekawy N, Welch V. Improving equity, diversity, and inclusion in academia. *Research Integrity and Peer Review*. 2022;**7**:4. DOI: 10.1186/s41073-022-00123-z
- [28] Minich M, Loya L, Culver KB, Needle JP. A skills-driven approach to diversity, equity and inclusion in Journalism curricula. *Journalism Practice*. 2024;**1**:1–19. DOI: 10.1080/17512786.2024.2311312
- [29] Mitsea E, Drigas A, Mantas P. Soft skills & metacognition as inclusion amplifiers in the 21st century. *International Journal of Online and Biomedical Engineering*. 2021;**17**(4):121–133. DOI: 10.3991/ijoe.v17i04.20567
- [30] Adbool R, Godkin D, Honan L, Gamage A. A quality improvement initiative to strengthen equity, diversity and inclusion and anti-racism considerations in the IDEA Framework. *Healthcare Management Forum*. 2025;08404704251329026. DOI: 10.1177/08404704251329026
- [31] OECD. Equity and Inclusion in Education: Finding Strength through Diversity. Paris: OECD Publishing; 2023. DOI: 10.1787/e9072e21-en
- [32] Health Data Research Network Canada. Inclusion, Diversity, Equity & Accessibility. Available from: <https://www.hdrn.ca/en/data-equity/idea/> [Accessed: 2025-May-29]
- [33] RMIT University. (n d). Inclusion, Diversity, Equity and Access (IDEA) Framework. Available from: <https://www.rmit.edu.au/content/dam/rmit/au/en/about/our-values/diversity-and-inclusion/rmit-idea-framework-executive-summary-accessibility-tagged.pdf> [Accessed: 2025-May-29]
- [34] Macaway JA, Goldman A, Zegwaard KE. Practicing equity, access and inclusion in work-integrated learning. *Equity, Access and Inclusion in Work-Integrated Learning*. 2024;**25**(1):1–22. Available from: https://www.ijwil.org/files/IJWIL_25_1_1_21.pdf
- [35] Li F, Lo C, Tang CS. Will diversity equity and inclusion commitment improve manufacturing firms’ performance? a signaling theory perspective on DEI announcements. *Production and Operations Management*. 2024;**34**(3):1–32. DOI: 10.2139/ssrn.4318187
- [36] Wang ML, Gomes A, Rosa M, Copeland P, Santana VJ. A systematic review of diversity, equity, and inclusion and antiracism training studies: Findings and future directions. *Translational Behavioral Medicine*. 2023;**14**(3):156–171. DOI: 10.1093/tbm/ibad061
- [37] Park CH, Park S, Kwon B. Forty-five years of research on diversity, equity and inclusion in management. *Management Decision*. 2025;**63**(13): 66–95. DOI: 10.1108/MD-11-2023-2181
- [38] Thakur P, Dhar RL. Impact of diversity training on employees and consumers: A review and research agenda. *International Journal of Consumer Studies*. 2022;**46**(5): 1665–1690. DOI: 10.1111/ijcs.12823
- [39] McCarter SA, Wilson ML, Anderson D. Evidence-based strategies to improve the effectiveness of diversity, equity, and inclusion training.

Journal of Ethnic & Cultural Diversity in Social Work. 2024;**33**(6):327–339.
DOI: 10.1080/15313204.2023.2210850

[40] Hovdhaugen E, Opheim V. Participation in adult education and training in countries with high and low participation rates: Demand and barriers. *International Journal of Lifelong Education*. 2018;**37**(5):560–577. DOI: 10.1080/02601370.2018.1554717

[41] Kosyakova Y, Bills DB. Formal adult education and socioeconomic inequality: Second chances or Matthew Effects? *Sociology Compass*. 2021;**15**(9): e12920. DOI: 10.1111/soc4.12920

[42] Vaculiková J, Kalenda J, Kocvarová I. Participation in non-formal adult education within the European context: Examining multilayer approach. *Frontiers in Education*. 2024;**9**:1380865. DOI: 10.3389/feduc.2024.1380865

[43] Rott KJ, Schmidth-Hertha B. Transforming adult learning in the digital age: Exploring environmental, content, and technological changes. *International Journal of Lifelong Education*. 2024;**43**(4):319–323. DOI: 10.1080/02601370.2024.2367395

[44] Cedefop (European Commission). Microcredentials for labour market education and training: The added value for end users. Luxembourg: Publications Office: Cedefop reference series. 2023. pp. 1–118. DOI: 10.2801/141643

[45] Roig PJ, Alcaraz S, Gilly K, Bernad C, Juiz C. Design and Assessment of an Active Learning-Based Seminar. *Education Sciences*. 2024;**14**(4):0371. DOI: 10.3390/educsci14040371

[46] UNESCO. 5th Global Report on Adult Learning and Education. 2022.

Available from: https://www.uil.unesco.org/sites/default/files/medias/fichiers/2022/06/GRALE5_EN_FullReport15June2022.pdf [Accessed: 2025-May-29]

[47] National Statistics Institute of Spain (INE). Survey on Adult Population Involvement in Learning Activities (EADA). 2023. Available from: https://www.ine.es/en/prensa/eada_2022_en.pdf [Accessed: 2025-July-4]