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Prospects for Using E-Learning Tools to Implement the Concept of "Lifelong Learning"

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Abstract: This article examines the current state and prospects of utilising e-learning tools within lifelong learning. The study aims to identify methods for leveraging various e-learning platforms to enhance adult lifelong education and assess the potential effectiveness of electronic tools in advancing "lifelong learning." The research employed a case study approach, analysing existing scientific literature and focusing on nine popular adult e-learning tools, such as Coursera, EdX, Moodle, Udemy, and Google Classroom. To achieve this, 50 scientific articles from various databases were reviewed, and the characteristics and potential applications of popular e-learning tools and the role of artificial intelligence in education were investigated. The findings were



systematically organised and presented in tables and diagrams, showcasing different categories and applications of e-learning tools for lifelong learning. The study categorises these e-learning tools and highlights their features and applications in the context of lifelong learning. Additionally, the study explores the integration of artificial intelligence in e-learning, discussing its various applications and how it can facilitate adult education. The e-learning tools selected for adult education are divided into four categories: Open Educational Resources (OER), Massive Open Online Courses (MOOC), Technical and Vocational Education and Training (TVET) (digital), and Communication tools (MS Teams, Zoom, and Google Classroom). This research contributes to lifelong learning by demonstrating the potential of selected online platforms and programs to increase the accessibility, inclusivity, and personalisation of lifelong learning tailored to individual learner needs.

Keywords: E-learning, lifelong learning, sustainable development education, artificial intelligence, online course.

Introduction

In 2015, the UN General Assembly introduced the 2030 Agenda for Sustainable Development, which serves as an "action plan for people, planet, and prosperity" and includes 17 strategic goals to promote sustainable development (United Nations, 2015). One of these goals, Goal 4, focuses on ensuring inclusive and quality education and fostering lifelong learning for all, emphasising the importance of education as a universal value. The 2030 Agenda highlights education as central to achieving many of the other Sustainable Development Goals, with the educational aspects of these goals rooted in the core principles of adult education, lifelong learning, and related practices (Webb et al., 2017). According to Pazos et al. (2023), education is a fundamental pillar of sustainable development, with the goals serving as a framework for creating solutions and strategies to build a more just and equitable society that can achieve a sustainable and inclusive future.

Lifelong learning encompasses various educational experiences from early childhood to old age (Elfert, 2019), including formal and non-formal adult education. Promoting lifelong learning for everyone means that education must extend beyond the traditional frameworks of primary, secondary, and tertiary institutions (Webb et al., 2019).

Vieira (2019), in his exploration of lifelong learning, suggests that the concept is proving to be valuable for reshaping education and development paradigms. By examining the conceptual roots of lifelong learning and its relationship with the Sustainable Development Goals, Vieira acknowledges that learning and education have far-reaching developmental impacts, with lifelong learning playing a crucial role in fostering development. The 2030 Agenda has renewed focus on lifelong learning, urging countries, policymakers, and academics to reconsider how it can be effectively implemented, promoted, and integrated into educational systems (Vieira, 2019).



English and Carlsen (2019) point out that one of the limitations of the lifelong learning concept within the sustainable development framework is the insufficient emphasis on public education and non-formal learning, which are essential components of a comprehensive lifelong learning system. Public education has historically been a cornerstone of lifelong learning, especially in countries where civil society faces significant challenges. Kopnina (2020) addresses the paradoxes of sustainable development and advocates for education for sustainable development through various alternative and adult education approaches, such as indigenous learning, eco-pedagogy, ecocentric education, and education for sustainable and circular economies. Kopnina highlights the diverse and alternative nature of these educational approaches, intentionally steering clear of the traditional education system as the primary focus of her research.

Recent studies by Ayoko (2024) and Timbi-Sisalima et al. (2022) delve into the concept of "education for sustainable development." Timbi-Sisalima et al. (2022) emphasise the importance of ensuring equitable and quality access to primary and secondary education for all children, as well as equal, non-discriminatory access to quality technical, vocational, and higher education, including university education, for both women and men. They also stress the need to increase the number of people equipped with the necessary skills to secure employment and decent work. However, the authors primarily focus on "traditional" formal education models without addressing the role of non-formal adult education.

Ayoko (2024) shifts the focus slightly by viewing education for sustainable development as a means to expand global knowledge. He advocates for equipping individuals with the competencies, skills, values, and creativity necessary for a sustainable future, integrating innovative ideas related to sustainability—such as poverty alleviation, climate change, disaster management, sustainable consumption, disease control and prevention, and biodiversity—into teaching and learning curricula.

Both works share a common focus on integrating electronic tools and digital innovations to enhance the accessibility and inclusiveness of education. Digital tools can support and transform education and accelerate progress toward achieving Sustainable Development Goal 4 by expanding the globalisation of educational management (Ayoko, 2024). E-learning and information and communication technologies are crucial in promoting "education for all" by incorporating virtual and non-formal education, thus providing access to learning resources anytime and anywhere (Timbi-Sisalima et al., 2022). Digital innovations can facilitate access to educational opportunities, promote inclusivity, ensure quality teaching and learning, pave the way for lifelong education, strengthen learning management systems, and monitor educational processes (Ayoko, 2024).

Chen (2021) advocates for sustainable learning in education, emphasising learning and teaching principles rooted in sustainability, particularly within the "learning to learn," a critical component of lifelong learning. The author points out that e-learning drives sustainable learning, especially in lifelong learning and adult education.



It is important to note that while the concept of lifelong learning has been explored from various perspectives in academic research, there remains a gap in systematic studies examining the relationship between lifelong learning and e-learning, specifically through the lens of digital tools and innovative technologies used in adult education.

Lifelong learning has numerous implications as a strategic goal of sustainable development. In this context, it primarily promotes adult education after completing primary, secondary, or higher education. The relevance of this topic is driven by shifts in educational paradigms and the adoption of lifelong learning to enhance economic capacity, improve professional skills, combat unemployment and poverty, and ultimately raise living standards. Given the widespread availability of digital learning tools, research in this area is necessary and timely.

Research Problem

The research problem centres on identifying and systematising e-learning tools, assessing their effectiveness, and addressing the challenges associated with implementing them to support adult lifelong learning. Despite the growing availability and variety of e-learning platforms, there is still limited understanding of their impact on adult learning outcomes. This study seeks to address this gap by evaluating how e-learning tools contribute to continuous learning and personal development in an ever-changing digital landscape.

While existing studies on e-learning in the context of lifelong learning provide insights from different perspectives, this study aims to offer a comprehensive and systematic analysis of e-learning tools in the context of adult education, with a focus on the prospects for their broader adoption and accessibility.

Research Focus

This study emphasises identifying promising areas for e-learning in implementing lifelong learning, aiming to systematise various digital tools and technologies. The goal is to highlight the long-term effects of digital tools in adult education while identifying gaps or areas requiring further development.

Research Aim and Research Questions

This study aims to investigate how various e-learning tools enhance adult lifelong learning and explore their potential effectiveness in advancing the concept of lifelong education.

To achieve this goal, the study will address the following objectives:

1. Define the concept of 'lifelong learning' by referencing current research.
2. Identify current trends in the use of electronic technologies for adult education.
3. Systematize the range of digital tools and technologies that hold potential for implementing lifelong learning.



4. Propose directions for future research to explore specific aspects of adult e-learning.

Literature Review

Lifelong learning has become a prominent topic in the twenty-first century, gaining particular significance with the shift toward a "knowledge society" that demands ongoing professional development and retraining, ideally facilitated by technology (Håkansson et al., 2023). Its inclusion in the Sustainable Development Goals has brought renewed attention to lifelong learning as a central theme in scientific discourse. Current research in this area generally follows several key trends:

1. Exploration of "education for sustainable development" and its connection to lifelong learning.
2. Investigation of digital adult education tools, such as online courses, e-learning platforms, and mobile applications.
3. Examination of methods for controlling and motivating self-directed learning, mainly through digital means.

Education for sustainable development is now recognised as a vital component of education and lifelong learning for all, and it can be implemented through practical e-learning models. According to Zhang et al. (2020), education for sustainable development fosters the creation of a resilient, healthy, and sustainable society by introducing new principles, values, and goals into the education system through a systematic and integrated approach. This education extends beyond traditional school settings to encompass lifelong learning, bringing adult, higher, and technical education into global efforts to achieve sustainable development (English & Carlsen, 2019).

Shulla et al. (2020) examine the interaction between lifelong learning and other Sustainable Development Goals, highlighting how the critical elements of sustainable education are closely linked to broader issues like education, climate change, energy, sustainable cities, natural habitats, and responsible consumption and production. The study underscores the importance of partnerships and non-formal learning in addressing global sustainability challenges.

Thongmak (2021) defines lifelong learning as intentional learning activities that occur throughout an individual's life, from early childhood to retirement, encompassing formal and non-formal education. In this view, individuals are responsible for acquiring the knowledge, skills, and competencies necessary for personal and professional fulfilment.

Many scholars (English & Carlsen, 2019; Shulla et al., 2020; Thongmak, 2021) tend to categorise education into formal (traditional) and non-formal types. Formal education typically refers to structured learning in secondary and higher education institutions, such as schools, colleges, and universities, while non-formal education includes all other learning formats.



Håkansson et al. (2023) delve into the role of higher education institutions within the lifelong learning framework. They suggest that these institutions can ensure that graduates of formal certification programs develop the essential skills for lifelong learning. Furthermore, higher education institutions can offer continuing education courses and programs tailored to the lifelong needs of both current and future learners. Integrating digital resources and technology-based learning facilitates educational programs' flexibility, applicable to lifelong learning and traditional educational tracks. This highlights higher education institutions' central, though not exclusive, role in providing lifelong learning opportunities (Håkansson et al., 2023).

Landberg and Partsch (2023) researched the significance of school education in fostering the skills necessary for lifelong learning. They emphasise that schools often receive insufficient attention in discussions on lifelong learning, despite their research showing that the development of key competencies and foundational skills—such as literacy, critical thinking, problem-solving, and self-regulation—begins in school education. Focusing on these skills in teacher training and school curricula is crucial, as the learning skills cultivated during school years will likely enhance formal and informal learning throughout life.

Lifelong learning, particularly in the context of adult education, is widely regarded by scholars as a critical factor in enhancing nations' social and economic well-being. Adult education plays a crucial role in fostering personal development. When offered in both public and private sectors, it creates substantial employment opportunities, improves job quality, boosts competitiveness, and promotes social inclusion (Bedrule-Grigoruță & Rusu, 2014). The relevance of lifelong learning is growing, especially with the digitalisation of various sectors of the economy, which facilitates continuous, remote learning opportunities in the workplace (James, 2020). Gouthro (2022) suggests that the future of adult education is being shaped by feminist discourses, postmodernism, and a rising emphasis on neoliberal values, which could potentially erode the historically significant social focus of adult education.

Furthermore, the importance of on-the-job training and retraining becomes more pronounced in the context of increasing life expectancy. In this regard, Kim and Park (2020) examine the evolution of education and skills training for a person's life, particularly in light of recent research on human capital and skills development in an era of rapid technological advancement. They argue that solid cognitive skills, basic information technology skills, analytical abilities, and non-cognitive skills, such as creativity, problem-solving, critical thinking, and communication, are essential for lifelong learning (Kim & Park, 2020).

E-learning has emerged as a practical and effective method for developing job-related skills such as internet research and problem-solving using online resources. E-learning programs can be tailored to match academic library collections' specific needs, profiles, and characteristics, offering significant benefits to users and educators and aiding educational institutions (Sivankalai, 2021). Wang et al. (2022) define e-learning as the process of delivering education or knowledge through the Internet, satellite, interactive television, intranet, or extranet, utilising modern technologies and electronic tools to facilitate effective two-way communication with stakeholders



across the global education sector. E-learning can be applied at various educational levels and for different purposes, ranging from school-based learning to workplace training. Several aspects of its use, particularly in the context of lifelong learning, are being explored in contemporary research.

According to Tvenge and Martinsen (2018), digital technologies naturally integrate into education, impacting lifelong learning through several key factors:

- Enhanced learning through access to a broader range of data and knowledge
- Increased learning efficiency
- Learner-centered educational activities
- New collaborative learning environments
- Expanded opportunities for critical thinking and analytical approaches.

Information technologies are paving the way for innovative methods of lifelong learning. One such development is computer-based distance learning, which is rapidly becoming a prominent form of education and represents a novel approach to delivering education overall (Lera et al., 2020).

Sivankalai (2021) examines the e-learning landscape in Canada, focusing on the autonomy inherent in the process. He notes that in e-learning, learners are guided by step-by-step instructions rather than by teachers, reflecting principles of lifelong learning, open education, and social constructivism. Complementary online programs for staff training allow employees to stay updated on the latest developments, address new challenges, and meet the needs of their target audiences. E-learning is increasingly popular in Canadian universities each year.

Khrykov et al. (2023) explore the Ukrainian continuing education system for civil servants, mainly through the lens of e-learning experiences. The authors view e-learning as integral to professional education, encompassing distance learning, blended learning, and incorporating e-learning elements into traditional in-person education. They also examine the role of e-learning in promoting lifelong learning for civil servants.

Rajam et al. (2024) conducted a study in India. They found that the COVID-19 pandemic significantly raised awareness about the importance and potential of e-learning, primarily through online learning platforms. Their research indicates that during the pandemic, the number of enrollments in massive open online courses increased by 25-30%, which they believe will help reduce educational inequality among India's adult population in the future.

In self-education, scholars underscore the importance of literacy, including basic educational skills and digital competencies necessary to utilise e-learning tools effectively. Hanemann and Robinson (2022) emphasise that literacy is crucial for successfully implementing a lifelong learning strategy, arguing that greater attention should be given to creating a literate



environment that fosters motivation, continuity in learning, and integrating literacy into broader learning objectives.

Rethinking literacy within the lifelong learning framework reveals that acquiring knowledge fundamentally depends on mastering specific competencies, with access to information and communication being crucial. The ability to independently and critically process learning materials requires a basic literacy level. Loureiro et al. (2012) suggest that digital literacy, or e-literacy, encompasses a set of competencies that enable individuals to acquire knowledge through digital means. E-literacy involves the skills necessary to use information technologies across various aspects of life—education, work, communication, leisure, and more. These skills include the use of standard digital tools and software, which, in an educational setting, manifest as searching for information, engaging in communication, and utilising online platforms for distance learning, self-directed education, and professional development.

In a deeper exploration of competencies, Tachie-Donkor and Ezema (2023) emphasise the critical importance of information literacy skills for achieving lifelong learning. They note that higher education institutions and academic libraries are pivotal in equipping students to become proficient information seekers and critical thinkers. The authors conclude that information literacy training should be integral to student education to enhance students' information-seeking behaviour and lifelong learning skills.

Lifelong learning is envisioned as fully integrated into society, and from the learner's perspective, it differs significantly from traditional forms of education. According to Conesa et al. (2023), lifelong learning necessitates personalised models tailored to learners' unique needs and constraints. These models must account for the broader range of interests, varying depths of learning, and topics that span work, family, and leisure while also considering the limited time learners have due to the need to balance multiple aspects of life. E-learning tools motivate students, foster their desire to remain engaged in the online learning environment and enhance their teamwork skills and independent thinking (Anyim, 2021).

Reflecting on motivation in self-directed learning, Zhang et al. (2020) describe the progression of learning motivation as consisting of six stages: sparking interest, transitioning from interest to desire, becoming inspired and active, enhancing social and professional networks, achieving a learning balance, and generating innovative outcomes. English and Mayo (2019) stress the importance of comprehensive support for lifelong learning to encourage disadvantaged groups to pursue a decent quality of life.

Conversely, research by Kapo et al. (2021) reveals that personal factors are the strongest motivators for the continued use of e-learning. While environmental influences and technological aspects also positively impact sustained engagement with e-learning, the authors found no empirical evidence to support the hypothesis that professional factors significantly influence continued e-learning usage.



Materials and Methods

This study employed a case study approach to examine the application of e-learning tools in lifelong learning, enabling a detailed investigation of specific e-learning tools and their characteristics. The research was conducted in several stages:

Stage 1: The author selected fifty scientific articles published between 2018 and 2024 that explore various aspects of lifelong learning and e-learning within the context of the Sustainable Development Goals. These articles were sourced from scientometric databases such as ScienceDirect, ResearchGate, and Web of Science, as well as through Google Scholar. Their content was analysed for this study.

Stage 2: The author identified the most popular e-learning tools using Google search trends as of the end of 2023. Nine e-learning tools were selected, and their characteristics and applications for lifelong learning were analysed. The findings are presented in Tables 1 and 2, with a systematisation of e-learning tools into four categories—OER, MOOC, TVET, and communication tools—summarised in Figure 1.

Stage 3: The author examined the potential for using AI in lifelong learning, with the results in Table 3. The study highlights the promising areas where digital tools can be leveraged to implement lifelong learning effectively.

Data Analysis

The author analysed 50 scientific articles from search engines and scientometric databases, along with the analytics of e-learning platforms, systematising this information within the context of the prospective use of electronic resources for lifelong learning. The data was processed using general scientific and specialised research methods. The author employed analysis and synthesis to categorise different e-learning tools, while analytical comparison methods were used to interpret the research findings presented in Tables 1, 2, and 3. The modelling method was used to create Figure 1.

Results

Lifelong learning in the context of sustainable development appears to be a promising area for disseminating education, mainly through e-learning tools. In this regard, Ayoko (2024) introduces the concept of Open Distance e-learning, which involves using digital platforms to provide accessible and flexible learning opportunities.

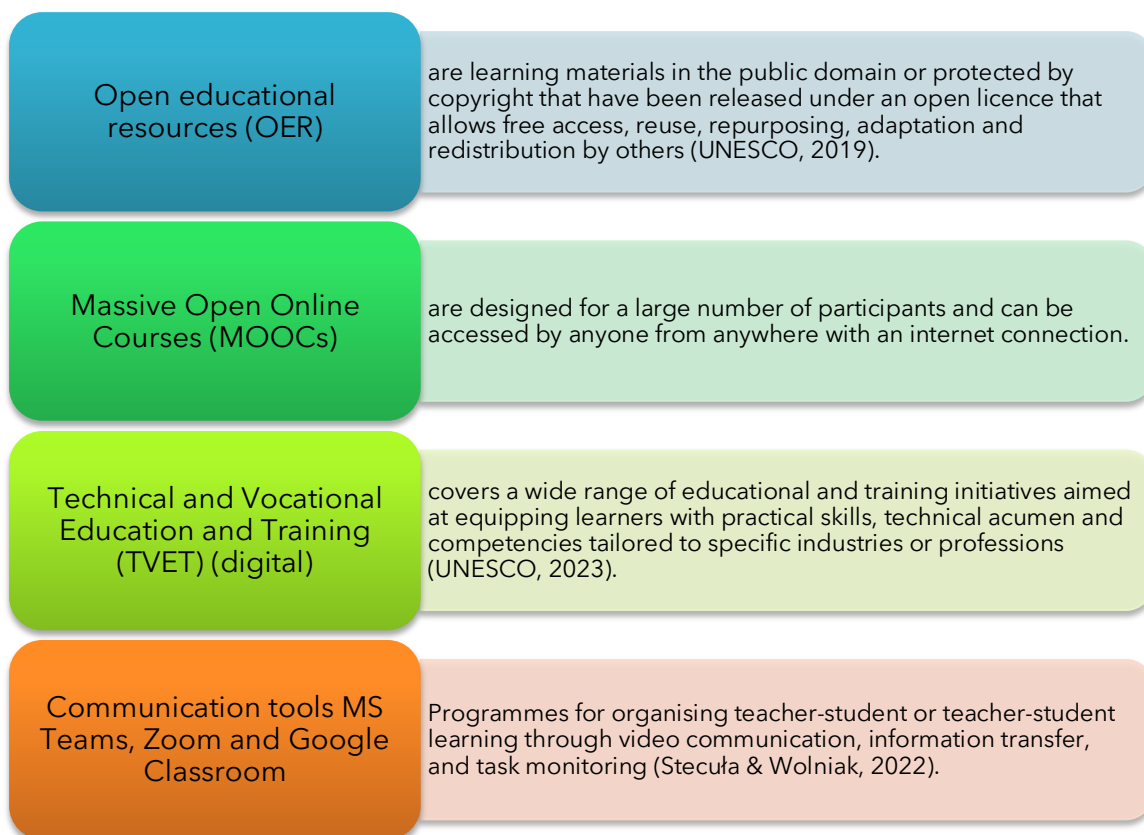
As e-learning technology evolves, it is becoming more innovative, resulting in user-friendly e-learning systems and reduced technological barriers. The fundamental idea is that lifelong learning, facilitated by e-learning and adopting new technologies, will be synergistic.

This study aims to categorise e-learning tools for integrating lifelong learning into specific categories outlined in the scientific literature.



Figure 1

Classification of E-Learning Tools



Source: Author's elaboration.

Each category of e-learning tools presented in Figure 1 offers significant potential for advancing lifelong learning. Open Educational Resources (OER) facilitate large-scale learning opportunities, with major OER platforms attracting millions of users annually (Rets et al., 2020).

Massive Open Online Courses (MOOCs) represent a continually evolving learning model that is being adapted to better meet the diverse needs of learners (Bozkurt et al., 2018). MOOCs have revolutionised education by challenging traditional methods and providing accessible, flexible, and globally available lifelong learning opportunities. They are noted for their scalability and interactive elements, enabling them to engage a worldwide audience (Anson, 2024) effectively.

The COVID-19 pandemic accelerated the adoption of innovative e-learning tools in higher education, particularly platforms such as MS Teams, Zoom, and Google Classroom. Research by Stecula and Wolniak (2022) identified video conferencing tools, especially MS Teams and Zoom, as the most frequently used e-learning tools during the pandemic.

Technical and Vocational Education and Training (TVET) tools are essential for bridging the skills gap and equipping individuals with the competencies modern workplaces require. These programs effectively connect formal education with the dynamic demands of the labour market,



creating pathways for young learners and seasoned professionals to gain the necessary skills and certifications for employment, entrepreneurship, and career advancement (Adaobi, 2024). TVET's focus on inclusivity and adaptability fosters an environment that supports lifelong learning, allowing individuals to succeed in the fast-evolving modern world (UNESCO, 2019).

Beyond these categories, mobile e-learning (MeL) is gaining traction due to its increasing development and convenience, providing quick access to a wide range of learning resources. Recognising the potential of MeL, higher education institutions and foundations are actively developing MeL applications to support various adult learning programs (Saidani et al., 2021).

E-learning encompasses many tools and platforms, from traditional online systems to mobile applications designed to expand education access and facilitate learning. Tables 1 and 2 offer a comprehensive overview of the current e-learning tools.

Table 1

Characteristics of E-Learning Tools

Tool	Characteristics	Author
Coursera https://www.coursera.org	A platform for online courses from universities and organisations	Daphne Koller, Andrew Ng
EdX https://www.edx.org	Online courses from leading universities and institutions	Harvard University
Moodle https://moodle.org	Open platform for creating and managing online courses	Martin Dagiamas
Khan Academy https://www.khanacademy.org	Free educational resources and courses for self-education	Salman Khan
Udemy https://www.udemy.com	A platform for online courses on a wide range of topics	Eren Bali, Gagop Gazaryan
LinkedIn Learning https://www.linkedin.com/learning	Professional courses and training with a focus on career development	Linda Weinman
Blackboard https://www.blackboard.com	A platform for learning management and interaction between teachers and students	Michael Chazen, Matthew Pittinsky
Google Classroom https://classroom.google.com	A tool for managing classes and creating assignments	Google
MS Teams https://www.microsoft.com/en-us/microsoft-teams	A tool for organising training, workplace education, distance learning	Microsoft

Source: Author's elaboration.

**Table 2***Areas of Use of E-Learning Tools*

Tool	Direction of use	Author
Coursera https://www.coursera.org	Higher education, personal development, and professional courses	Daphne Koller, Andrew Ng
EdX https://www.edx.org	Higher education, vocational training, personal development	Harvard University, MIT
Moodle https://moodle.org	Higher education, vocational training	Martin Dagiamas
Khan Academy https://www.khanacademy.org	Basic education, exam preparation, self-education	Salman Khan
Udemy https://www.udemy.com	Personal development, professional courses, hobbies, adult education	Eren Bali, Gagop Gazaryan
LinkedIn Learning https://www.linkedin.com/learning	On-the-job training, career development, professional skills, leadership	Linda Weinman
Blackboard https://www.blackboard.com	Higher education, vocational training, organisation of educational process or self-education	Michael Chazen, Matthew Pittinsky
Google Classroom https://classroom.google.com	Higher education, organisation of educational process or self-education	Google
MS Teams https://www.microsoft.com/en-us/microsoft-teams	Higher education, organisation of the learning process in the workplace, distance education	Microsoft

Source: Author's elaboration.

Therefore, the e-learning tools listed in Table 1 and Table 2 are the most popular platforms for adult learning, based on Google searches, highlighting their direct applications in lifelong learning.

Although the e-learning tools in Tables 1 and 2 have extensive experience in educational delivery and have been the subject of numerous research studies, a new research field known as AI in Education (AIED) is emerging to explore how artificial intelligence can enhance teaching and learning practices.



Artificial intelligence (AI) is poised to revolutionise lifelong learning by enabling personalised learning experiences, continuous access to educational resources, adaptive content delivery, real-time feedback and assessment, natural language processing capabilities, data-driven insights, and support for collaborative learning environments.

Table 3

Elements of AI Support for Implementing the Concept of Lifelong Learning

AI element	Characteristics
Personalised training	The ability to continue learning at any stage of life; AI adapts the course content to current knowledge and learning preferences.
Constant availability	The ability to access educational resources anytime and from anywhere
Adaptive content delivery	AI modifies information based on the learner's experience and ambitions, allowing it to move from fundamental concepts to more complex topics while remaining in continuous development.
Instant feedback and evaluation	Rapid AI feedback offers immediate feedback on performance, assisting learners in recognising areas for enhancement and providing direction for their subsequent efforts to enhance their skills.
Data-driven statistics	AI data analysis demonstrates student growth rates, strengths, and areas for attention.
Natural language processing (NLP)	Using the power of NLP AI to seek clarification, drill down and explore the nuances of language
Help and support	Assistance in the form of virtual assistants and chatbots accompanies the learning process
Personal learning assistants	AI-powered personal assistants help students stay organised and provide recommendations.
Specialised learning resources	AI offers personalised resources based on the request and helps to fill in knowledge gaps by exploring a variety of subjects.
Effective time management	AI optimises study plans and provides time management recommendations to balance education with other student activities.

Source: Authors' elaboration based on Carvalho et al. (2022), Masrek et al. (2024), and Poquet and De Laat (2021).



Thus, the data in Table 3 demonstrate that incorporating AI support into a lifelong learning system improves all aspects, making learning more accessible, personalised and sustainable throughout a person's life. With technological advancements, utilising electronic tools to bolster a learning system that fosters ongoing and interactive learning is imperative. AI facilitates hands-on and inventive education, enabling the development of new learning approaches.

Discussion

Indeed, sustainable development strategies cannot be executed without a robust and effective education system prioritising lifelong learning. The conventional linear learning model appears to fail to address these global challenges.

Loureiro et al. (2012) define lifelong learning as any educational endeavour that occurs across one's lifespan, encompassing formal, non-formal, informal, or natural settings. It aims to enhance knowledge, skills, and competencies in personal, civic, social, and professional contexts.

For the classical form of education, material and technical support, the creation of appropriate learning conditions, and the spatial and temporal boundaries of learning remain essential. E-learning blurs the boundaries and is not tied to a schedule. In the context of lifelong learning, digital tools can complement classical education and provide independent educational services for adults. Of course, digital learning requires access to a gadget - a computer, a phone - and the Internet. If not, such access can be provided at the workplace (Khrykov et al., 2023), in a scientific library, etc. Despite the active research into various aspects of lifelong learning, issues still lack attention, such as strategies for financing lifelong learning and programmes for the education of marginalised groups (Elfert, 2019).

The study's results demonstrate many e-learning tools used to implement lifelong learning, especially in adult education. Freely available online OERs, MOOCs, and programmes (algorithms) for organising the learning process are relevant ways of learning that are accessible to the majority of the adult population. Most courses offer financial aid, benefits and discounts to increase inclusiveness, making learning virtually accessible.

In terms of access and inclusivity, the two most important groups targeted by e-learning in lifelong learning are

- 1) employees in need of advanced training and retraining, and
- 2) people working in public and private organisations (Institute for Lifelong Learning, 2023).

Continuous professional growth is fundamental to lifelong learning, often facilitated through e-learning platforms. However, there has been a noticeable lack of focus on marginalised populations and unconventional learners, whose access to learning is complicated by various circumstances.



To meet the diverse needs of lifelong learners, more flexible timing, locations and modalities of learning are needed, as well as shorter non-degree programmes and alternative certificates to validate learning outcomes. While traditional learning formats prevail over their more flexible counterparts, according to UNICEF (2023), flexible formats are becoming more widespread.

Educational technologies can take different forms (one-to-many, one-to-one, peer-to-peer) and use different technological tools (computers, laptops, mobile phones and tablets). In addition, digital tools can work in many ways and be used for different purposes, such as teaching, assessing and monitoring student progress, and managing information (Razquin et al., 2023).

In their research, the authors categorised e-learning tools into four distinct groups, broadly combining the various available digital learning tools and programs. Similarly, Stecuła and Wolniak (2022) identified three categories of e-learning tools: widely used services and applications adapted for e-learning, popular synchronous meeting applications used for e-learning, and other synchronous and asynchronous e-learning methods.

The growing popularity of Open Educational Resources (OER), learning management systems, and Massive Open Online Courses (MOOCs) has brought significant attention to accessible lifelong learning. Emerging practices in lifelong learning underscore the importance of more personalised, social, and collaborative learning approaches that encourage the active use and co-creation of educational resources, thereby enhancing the learning process and addressing individual learner needs (Yen et al., 2019).

Whether formal, informal, or non-formal, learning is inherently personal, collaborative, constructive, networked, and pervasive. Some studies (Razquin et al., 2023; Yen et al., 2019) highlight a more individualistic focus in digital learning, mainly through the use of Personal Learning Environments (PLEs), which can be integrated into formal and informal educational settings.

PLEs represent a promising pedagogical approach. They offer a way to blend formal and informal learning in digital formats while supporting self-regulated learning among students (Yen et al., 2019).

However, using MOOCs and OERs presents challenges such as low completion rates, learner engagement, quality assurance, access, monetisation, and integration, all of which require targeted strategic interventions (Anson, 2024). E-learning tools should aim to ensure global accessibility, support lifelong learning, cater to diverse learning styles, incorporate innovative technologies, address industry skills gaps, and promote collaborative learning.

Through the use of e-learning tools, students develop and refine essential skills for lifelong learning, including:



- Foresight: The ability to envision a better future and understand how to shape personal development and the surrounding world.

- Critical Thinking and Reflection: The capacity to objectively evaluate the nature of phenomena and processes and to accurately assess the structural elements of a system.

- Systems Thinking: Understanding the complex relationships and interactions within systems to formulate effective solutions to problems.

- Building Partnerships: Developing dialogue and negotiation skills to facilitate collaboration.

Participation in Decision-Making: Empowering individuals to contribute actively to decision-making processes (Zhang et al., 2020).

This study looks at e-learning from the user's perspective - someone who receives education through digital technologies, either independently or professionally. Other aspects of e-learning, such as the creation of educational programmes, their management, and the participation of teachers in these processes, were left out of our attention. In this context, the study by Panitsides and Karapistola (2020) indicates the role of teaching staff in developing methods and techniques of active online learning, as well as the problems of efficiency and self-control of e-learning learners. The authors stress the importance of providing comprehensive support to academic faculty at various stages to integrate e-learning into their teaching practices effectively. The future trajectory of education envisions a transition towards a lifelong learning culture by the year 2050 (Institute for Lifelong Learning, 2020).

- Access to information and quality

- Cost containment and accessibility

- Globalization of human activity

- Transformation of the employment sector

- Key opportunities of the twenty-first century

- Continuous expansion and integration of technology

Conclusions and Implications

The study suggests that addressing humanity's challenges requires fostering a "knowledge society," wherein individuals view themselves as lifelong learners. The Sustainable Development Goals outlined in the 2030 Agenda have reinvigorated the concept of lifelong learning as a comprehensive, inclusive, and human-centred approach grounded in rights-based principles.

The widespread adoption of e-learning tools has been further accelerated by the COVID-19 pandemic, making distance learning via digital platforms a daily reality for many. This educational



model offers significant advantages, including improved access to education, cost reduction, enhanced information dissemination and exchange, professional skills development, and acquiring new competencies.

Digital transformation through e-learning is undoubtedly broadening access to quality, affordable, and flexible education for people in both developing and developed nations. By examining examples of widely used digital platforms and tools for adult education, the study highlights their accessibility and inclusiveness, demonstrating their potential to support lifelong learning.

In conclusion, the e-learning tools analysed in this study show promise for further integration into educational practices across all stages of learning, serving as both primary and supplementary methods of instruction. This aligns with the core principles of lifelong learning, which emphasise values such as justice, equality, tolerance, sufficiency, and responsibility.

Emerging perspectives on learning underscore the importance of leveraging digital tools to personalise the educational process and ensure it meets the diverse needs of learners. Additionally, the research findings suggest that artificial intelligence will play a pivotal role in future education systems at all levels, becoming a fundamental element in promoting lifelong learning.

Suggestions for Future Research

Building on the findings of this study, the author recommends exploring the following areas in future research:

- Investigating e-learning accessibility for marginalised groups, particularly those without reliable online resources.
- Exploring the concept of digital literacy in the context of lifelong learning and identifying strategies to close gaps in digital education.
- Examining the targeted use of AI tools in organising educational processes, developing lifelong learning methodologies, and enhancing control and motivation during the learning experience.

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Conflict of Interest

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References

- Adaobi, N.U. (2024) E-learning strategies in TVET: Enhancing accessibility, engagement and practical skill development. *International Journal of Innovation Research and Advanced Studies*, 4(2). <https://harvardpublications.com/hijiras/article/view/143>
- Anson, A. M. (2024). Beyond the classroom: MOOCs and the evolution of lifelong learning. *Journal of Computer Science Application and Engineering (JOSAPEN)*, 2(1), 6-10. <https://journal.lenterailmu.com/index.php/josapen/article/view/22>
- Anyim, W. O. (2021). Sustainable Development Goal on quality education: A review of e-learning resources and pedagogy in the university system. *Library Philosophy and Practice (e-journal)*, Article 5578. <https://digitalcommons.unl.edu/libphilprac/5578>
- Ayoko, V. O. (2024). Open, Distance and e-Learning (ODEL): A panacea for effective actualisation of education for Sustainable Development Goal 4 (SDG4). *World Scientific News*, 192(2024), 128-137. <https://worldscientificnews.com/wp-content/uploads/2024/03/WSN-192-2024-128-137.pdf>
- Bozkurt, A., Kilgore, W., & Crosslin, M. (2018). Bot-teachers in hybrid massive open online courses (MOOCs): A post-humanist experience. *Australasian Journal of Educational Technology*, 34(3). <https://doi.org/10.14742/ajet.3273>
- Carvalho, L., Martinez-Maldonado, R., Tsai, Y.S., Markauskaite, L., & De Laat, M. (2022). How can we design for learning in an AI world?. *Computers and Education: Artificial Intelligence*, 3, Article 100053. <https://doi.org/10.1016/j.caeai.2022.100053>
- Charytanowicz, M. (2019). E-learning technologies in lifelong learning: Opportunities and challenges. In L. Gómez Chova, A. López Martínez, & I. Candel Torres (Eds.), *ICERI2019 Proceedings* (pp. 9414-9421). IATED. <https://doi.org/10.21125/iceri.2019.2278>
- Chen, F.-H. (2021). Sustainable education through e-Learning: The case study of iLearn 2.0. *Sustainability*, 13(18), Article 10186. <https://doi.org/10.3390/su131810186>
- Conesa, J., Garcia-Alsina, M., Batalla-Busquets, J. M., Gómez-Zúñiga, B., Martínez-Argüelles, M. J., Monjo, T., ... Gil, M. D. C. C. (2023). A vision about lifelong learning and its barriers. *International Journal of Grid and Utility Computing*, 14(1), 62-71. <https://doi.org/10.1504/IJGUC.2023.129706>
- Duke, C., & Hinzen, H. (2014). University engagement and the post-2015 agenda. What are the roles and functions to support adult education and lifelong learning?. *Procedia - Social and Behavioural Sciences*, 142, 29-35. <https://doi.org/10.1016/j.sbspro.2014.07.582>
- Elfert, M. (2019). Lifelong learning in Sustainable Development Goal 4: What does it mean for UNESCO's rights-based approach to adult learning and education?. *International Review of Education*, 65(4), 537-556. <https://doi.org/10.1007/s11159-019-09788-z>



- English, L. M., & Carlsen, A. (2019). Lifelong learning and the Sustainable Development Goals (SDGs): Probing the implications and the effects. *International Review of Education*, 65(2), 205-211. <https://doi.org/10.1007/s11159-019-09773-6>
- English, L. M., & Mayo, P. (2019). Lifelong learning challenges: Responding to migration and the sustainable development goals. *International Review of Education*, 65(2), 213-231. <https://doi.org/10.1007/s11159-018-9757-3>
- Gouthro, P. A. (2022). Lifelong learning in a globalised world: The need for critical social theory in adult and lifelong education. *International Journal of Lifelong Education*, 41(1), 107-121. <https://doi.org/10.1080/02601370.2022.2033863>
- Håkansson, L. M., Mozelius, P., Jaldemark, J., & Cleveland, I. M. (2023). Higher education transformation towards lifelong learning in a digital era - a scoping literature review. *International Journal of Lifelong Education*, 43(1), 24-38. <https://doi.org/10.1080/02601370.2023.2279047>
- Hanemann, U., & Robinson, C. (2022). Rethinking literacy from a lifelong learning perspective in the context of the sustainable development goals and the international conference on adult education. *International Review of Education*, 68(2), 233-258. <https://doi.org/10.1007/s11159-022-09949-7>
- Institute for Lifelong Learning. (2020). *Embracing a culture of lifelong learning: Contribution to the Futures of Education initiative*. UNESCO. <https://unesdoc.unesco.org/ark:/48223/pf0000374112>
- Institute for Lifelong Learning. (2023). *International trends of lifelong learning in higher education: Research report*. UNESCO. <https://unesdoc.unesco.org/ark:/48223/pf0000385339>
- James, D. (2020). Is lifelong learning still useful? Disappointments and prospects for rediscovery. *Journal of Education and Work*, 33(7-8), 522-532. <https://doi.org/10.1080/13639080.2020.1852509>
- Kapo, A., Mujkic, A., Turulja, L., & Kovačević, J. (2021). Continuous e-learning at the workplace: The passport for the future of knowledge. *Information Technology & People*, 34(5), 1462-1489. <https://doi.org/10.1108/ITP-04-2020-0223>
- Khrykov, Y. M., Ptakhina, O. M., Sych, T. V., & Dzvinchuk, D. I. (2023). Exploring the e-learning landscape for lifelong education of public servants: Trends, challenges, and implications. *CTE Workshop Proceedings*, 10, 64-84. <https://doi.org/10.55056/cte.546>
- Kim, J., & Park, C. (2020). Education, skill training, and lifelong learning in the era of technological revolution: A review. *Asian-Pacific Economic Literature*, 34(2), 3-19. <https://doi.org/10.1111/apel.12299>



- Klašnja-Miličević, A., & Ivanović, M. (2021). E-learning personalisation systems and sustainable education. *Sustainability*, 13(12), Article 6713. <https://doi.org/10.3390/su13126713>
- Kopnina, H. (2020). Education for the future? A critical evaluation of education for sustainable development goals. *The Journal of Environmental Education*, 51(4), 280-291. <https://doi.org/10.1080/00958964.2019.1710444>
- Landberg, M., & Partsch, M. V. (2023). Perceptions on and attitudes towards lifelong learning in the educational system. *Social Sciences & Humanities Open*, 8(1), Article 100534. <https://doi.org/10.1016/j.ssaho.2023.100534>
- Lera, M., Tachtsoglou, K., Frantzana, A., & Kourkouta, L. (2020). Nurses' attitudes towards lifelong learning via new technologies. *Asian/Pacific Island Nursing Journal*, 5(2), 89-102. <https://doi.org/10.31372/20200502.1088>
- Loureiro, A., Messias, I., & Barbas, M. (2012). Embracing web 2.0 & 3.0 tools to support lifelong learning-Let learners connect. *Procedia - Social and Behavioural Sciences*, 46, 532-537. <https://doi.org/10.1016/j.sbspro.2012.05.155>
- Masrek, M. N., Susantari, T., Mutia, F., Yuwinanto, H. P., & Atmi, R. T. (2024). Enabling Education Everywhere: How artificial intelligence empowers ubiquitous and lifelong learning. *Environment-Behaviour Proceedings Journal*, 9(SI18), 57-63. <https://doi.org/10.21834/e-bpj.v9iSI18.5462>
- Milana, M., Brandi, U., Hodge, S., & Hoggan-Kloubert, T. (2024). Artificial intelligence (AI), conversational agents, and generative AI: Implications for adult education practice and research. *International Journal of Lifelong Education*, 43(1), 1-7. <https://doi.org/10.1080/02601370.2024.2310448>
- Mundt, M., Hong, Y., Pliushch, I., & Ramesh, V. (2023). A wholistic view of continuous learning with deep neural networks: Forgotten lessons and the bridge to active and open world learning. *Neural Networks*, 160, 306-336. <https://doi.org/10.1016/j.neunet.2023.01.014>
- Panitsides, E. A., & Karapistola, A. (2020). Enhancing the role of the Hellenic Open University as a lifelong learning organisation: Crossing the Rubicon into the e-learning era. *Innovations in Higher Education Teaching and Learning*, 33, 89-104. <https://doi.org/10.1108/S2055-364120200000033006>
- Pazos, V. C., Farias, J. V. L. L., Calixter, A. L., Medeiros, J. M. M., & De Andrade, L. M. S. (2023). Education for sustainability - The reabilita E-learning course and the 2030 agenda in Brazil: Perspectives and influences on the professional life of graduates. *Contribuciones a las ciencias sociales*, 16(8), 8436-8452. <https://doi.org/10.55905/revconv.16n.8-014>
- Poquet, O., & De Laat, M., (2021) Developing capabilities: Lifelong learning in the age of AI. *British Journal of Educational Technology*, 52(4), 1695-1708. <https://doi.org/10.1111/bjet.13123>



- Rajam, V., Banerjee, S., & Alok, S. (2024). Can MOOCs be a medium of lifelong learning? Examining the role of perceived reputation and self-efficacy on continuous use intention of MOOCs. *Journal of e-Learning and Knowledge Society*, 20(1), 1-14. <https://doi.org/10.20368/1971-8829/1135788>
- Razquin, P., Strath, A., & Kosbar Y. (2023). *A review of alternative country models and strategies for financing digital learning*. UNESCO. <https://doi.org/10.54676/IEVL4162>
- Rets, I., Coughlan, T., Stickler, U., & Astruc, L. (2020). Accessibility of open educational resources: How well are they suited for English learners?. *Open Learning: The Journal of Open, Distance and e-Learning*, 38(1), 38-57. <https://doi.org/10.1080/02680513.2020.1769585>
- Saidani, N. O., Setiawan, R., Jayanthi, P., Vanithamani, S., Sharma, D. K., Regin, R., ... Sengan, S. (2021). An educational tool for enhanced mobile e-Learning for technical higher education using mobile devices for augmented reality. *Microprocessors and Microsystems*, 83, Article 104030. <https://doi.org/10.1016/j.micpro.2021.104030>
- Sivankalai, S. (2021) Academic libraries support e-learning and lifelong learning: A case study. *Library Philosophy and Practice (e-journal)*, 8(18), 1-18. <https://digitalcommons.unl.edu/libphilprac/6154>.
- Shulla, K., Filho, W. L., Lardjane, S., Sommer, J. H., & Borgemeister, C. (2020). Sustainable development education in the context of the 2030 Agenda for sustainable development. *International Journal of Sustainable Development & World Ecology*, 27(5), 458-468. <https://doi.org/10.1080/13504509.2020.1721378>
- Stecula, K., & Wolniak, R. (2022). Influence of Covid-19 pandemic on disseminating innovative e-learning tools in higher education in Poland. *Journal of Open Innovation: Technology, Market, and Complexity*, 8(2), Article 89. <https://doi.org/10.3390/joitmc8020089>
- Tachie-Donkor, G., & Ezema, I. J. (2023). The effect of information literacy skills on university students' information-seeking behaviour and lifelong learning. *Heliyon*, 9(8), Article e18427. <https://doi.org/10.1016/j.heliyon.2023.e18427>
- Thongmak, M. (2021). A model for enhancing employees' lifelong learning intention online. *Learning and Motivation*, 75, Article 101733. <https://doi.org/10.1016/j.lmot.2021.101733>
- Timbi-Sisalima, C., Sánchez-Gordón, M., Hilera-Gonzalez, J. R., & Otón-Tortosa, S. (2022). Quality assurance in e-learning: A proposal from accessibility to sustainability. *Sustainability*, 14(5), Article 3052. <https://doi.org/10.3390/su14053052>
- Tvenge, N., & Martinsen, K. (2018). Integration of digital learning in Industry 4.0. *Procedia Manufacturing*, 23, 261-266. <https://doi.org/10.1016/j.promfg.2018.04.027>
- United Nations. (2015). *Transforming our world: The 2030 Agenda for Sustainable Development*. <https://sdgs.un.org/2030agenda>.



- UNESCO. (2019). *Recommendation on open educational resources (OER)*. <https://www.unesco.org/en/legal-affairs/recommendation-open-educational-resources-oer>.
- Vieira, D. (2019). Lifelong learning and its importance in achieving the sustainable development goals. In W. Leal Filho, A. Azul, L. Brandli, P. Özuyar, & T. Wall (Eds.), *Quality Education. Encyclopedia of the UN Sustainable Development Goals* (pp. 1-9). Cham: Springer. https://doi.org/10.1007/978-3-319-69902-8_7-1
- Webb, S., Holford, J., Hodge, S., Milana, M., & Waller, R. (2017). Lifelong learning for quality education: Exploring the neglected aspect of Sustainable Development Goal 4. *International Journal of Lifelong Education*, 36(5), 509-511. <https://doi.org/10.1080/02601370.2017.1398489>
- Webb, S., Holford, J., Hodge, S., Milana, M., & Waller, R. (2019). Conceptualising lifelong learning for sustainable development and education 2030. *International Journal of Lifelong Education*, 38(3), 237-240. <https://doi.org/10.1080/02601370.2019.1635353>
- Yen, C.-J., Tu, C.-H., Sujo-Montes, L. E., Harati, H., & Rodas, C. R. (2019). Using personal learning environment (Ple) management to support digital lifelong learning. *International Journal of Online Pedagogy and Course Design*, 9(3), 13-31. <https://doi.org/10.4018/IJOPCD.2019070102>
- Zhang, T., Shaikh, Z. A., Yumashev, A. V., & Chład, M. (2020). Applied model of e-learning in the framework of education for sustainable development. *Sustainability*, 12(16), Article 6420. <https://doi.org/10.3390/su12166420>