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Integration of Artificial Intelligence in Open and Distance Learning and e-Learning: A Comprehensive Overview

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Preamble

The education sector has witnessed a transformative shift with Artificial-Intelligence (AI) playing a pivotal role in reshaping traditional learning paradigms. AI is an emerging technology to which will revolutionalize Open-and-Distance Learning (ODL) and e-learning. This study comprehensively overviews the integration of AI in Open-and-Distance Learning (ODL) and e-learning by exploring the multifaceted impact of AI on ODL and e-learning implementation strategies and applications, teacher training, benefits, challenges, and prospects. Keywords were searched for in Google, AI websites, and journals such as "Artificial-intelligence", "open-and-distance learning", "e-learning", "AI integrating emerging technologies", "Al applications", "AI transformative impact", "role of AI in addressing access and inclusivity in education", and "challenges". It was found that the integration of AI in ODL is marked by its ability to personalise learning experiences, adapt content delivery based on individual needs, and facilitate a more interactive and engaging educational environment. AI applications that enhance the efficiency and effectiveness of remote education include intelligent tutoring systems, automated grading and personalised learning pathways. Some of the challenges include ethical considerations and data privacy. There is a need to address emerging potential future developments in AI-enhanced ODL such as AI integrating emerging technologies to augment reality and natural language processing.

Keywords: *Open-and-distance learning, e-learning, artificial intelligence, strategies, challenges*

Introduction

The integration of artificial intelligence in Open and Distance Learning is important to enhance a robust academic earning and exposure. Artificial Intelligence (AI) is a sub-field of computer science which creates intelligent agents capable of performing tasks that would have required human intelligence. It is a set of technologies that enable computers to perform tasks such as speech recognition, learning, planning, decision making, data analysis v and problem-solving activities. It is an interdisciplinary science with many approaches. AI can be rule-based and operate under a predefined conditions, or it can use machine learning algorithms to adapt to its environment (Crabtree, 2023). Artificial Intelligence (AI) or machine intelligence is demonstrated by machines, in contrast to the natural intelligence displayed by humans and other animals (Mohammed, 2019; Baum, 2024). Integrating cutting-edge technologies has become paramount to fostering effective and inclusive learning environments in the ever-evolving education landscape. One such transformative force that has reshaped the educational paradigm is Artificial Intelligence (AI). AI has emerged as a pivotal catalyst, revolutionising how education is imparted and consumed in Open and Distance Learning (ODL). This comprehensive overview delves into the dynamic intersection of Artificial Intelligence and ODL, unraveling the myriad ways AI is reshaping the educational experience. From personalised learning pathways and adaptive assessments to intelligent virtual assistants. This exploration encapsulates the multifaceted role of AI in enhancing accessibility, engagement, and effectiveness in remote and online learning environments. This paper dissect the symbiotic relationship between AI and ODL, uncovering the transformative potential that lies at the convergence of advanced technology and educational methodologies.

Multifaceted Impact of AI on ODL and e-Learning

E-learning is the use of ICT and technological tools and platforms to facilitate learning. For example computers, software and hard ware components. ODL is delivering learning at a distance such as teaching learners outside the location of the teacher or the facilitator. So e-learning is useful in delivering the learning thus bridging the gap. Thus, e-learning becomes a critical component of ODL. AI impacts Open and Distance Learning (ODL) and e-learning differently. AI impacts Open and Distance Learning (ODL) and e-learning differently. Integrating AI in ODL institutions addresses various challenges, such as security, quality assurance, and the need for personalised and enriching tailored learning experiences (Fadzil & Munira, 2008). Moreover, the transition towards Open Distance e-learning (ODeL) has significantly influenced the role of distance educators, necessitating them to acquire new skills and competencies to adapt to online teaching methods (Bezuidenhout, 2018). The COVID-19 pandemic has expedited the adoption of e-learning, shedding light on both the advantages and limitations of ODL. While e-learning offers flexibility and accessibility, it poses challenges, such as social isolation and the absence of face-to-face interaction, mainly for practical subjects requiring laboratory work (Ismail *et al.,* 2021). Nevertheless, the pandemic has positively impacted students' readiness to engage in e-learning, with many students expressing high technological readiness and confidence in using online applications for ODL (Allam *et al.,* 2021).

The effectiveness of ODL during crises like the COVID-19 pandemic is influenced by factors such as the provision of hardware and software and their interaction, which positively affect learning outcomes (Suhaimin *et al.,* 2023). Additionally, using mobile learning (m-learning) in ODL systems help to bridge the digital divide, democratise education, and offer quality educational opportunities at an affordable cost (Miglani & Awadhiya, 2017). AI, in conjunction with e-learning

technologies, could transform ODL by enhancing personalised learning experiences, addressing institutional challenges, and improving the efficacy of distance education, especially during unprecedented times like the COVID-19 pandemic.

Exploration of the Integration of AI in ODL and e-Learning

Integrating Artificial Intelligence (AI) in Open and Distance Learning (ODL) and e-learning is a multifaceted process involving various aspects such as pedagogy, technology, collaboration, and student support. The exploration of AI in ODL and e-learning encompasses the need for collaborative online learning environments that blend social interaction, virtual presence, and a commitment to collaborative learning (Thorpe, 2002). This integration requires combining pedagogical principles and technological advancements to create enriching learning experiences. Also, AI systems and instructional strategies enhance student-AI collaboration in learning (Kim *et al.,* 2022). The collaborative efforts between students and AI systems could lead to a more comprehensive understanding of AI in education and its implications for educational practices.

The acceptance and adoption of AI technologies in ODL and e-learning are influenced by anxiety, positive attitudes, and the perceived benefits of electronic textbooks and AI applications (Chiu, 2016; Firat, 2023). Overcoming barriers and fostering a positive attitude towards AI integration is crucial for successfully implementing AI in educational settings. Furthermore, integrating AI performance prediction and learning analytics has shown promising results in improving student engagement, collaborative learning performance, and overall student satisfaction with online courses (Ouyang *et al.,* 2023). By leveraging AI technologies, institutions can enhance the quality of teaching, support digital pedagogy, and address challenges such as social isolation and motivation in online learning environments (Ng *et al.,* 2023). The exploration of AI integration in ODL and e-learning involves a comprehensive understanding of collaborative learning environments, student-AI collaboration, acceptance factors, performance prediction, and the transformative potential of AI technologies in enhancing educational practices.

Transformative Impact of AI in ODL and e-Learning

Integrating Artificial Intelligence (AI) in Open and Distance Learning (ODL) and e-learning has transformed educational practices such as putting flexibility in teaching and learning, faster writing of seminars and papers. The sudden shift to online modes of teaching during the COVID-19 crisis highlighted the importance of ODL and e-learning, forcing educators worldwide to adapt to new teaching methodologies (Dhawan, 2020). For example, during the Covid-19 pandemic, while conventional institutions closed down, ODL and e-learning institutions employed their learning tools and platforms to carry on their academic activities such as meetings, facilitations and Semester examinations without shutting down. This popularized ODL and e-learning and made them to gain more recognition and acceptance in Nigeria. This transition has not only accelerated the adoption of online learning but has also emphasised the need for innovative approaches to education delivery. Integrating AI performance prediction and learning analytics in online courses has significantly improved student engagement, collaborative learning performance, and overall student satisfaction (Ouyang *et al.,* 2023). By leveraging AI technologies, institutions could enhance the quality of teaching, personalise learning experiences, and improve student outcomes in online environments.

Despite the challenges associated with the rapid transformation from face-to-face learning to ODL methods, students' satisfaction with learning experiences using ODL during the pandemic has been a focal point (Ahmad *et al.,* 2022). The drastic shift has highlighted the importance of addressing pedagogy, student support, and technological readiness to ensure a seamless transition to online learning. Professional development models such as individually guided development, building a knowledge base, observing models and examples, reflecting on your practice, changing your practice and gaining and sharing expertise focus on learning design and course creation have played a crucial role in mitigating anxiety, embedding lasting change, and leveraging the benefits of ODL for both institutions and students (Olney *et al.,* 2023). These models have helped educators.

Challenges to the Integration of AI in ODL and E-learning

Integrating Artificial Intelligence (AI) in Open and Distance Learning (ODL) and e-learning faces several challenges that impact the effectiveness and efficiency of educational delivery. One significant challenge is the inadequate or lack of stable and reliable infrastructure, including unstable power supply, poor internet connectivity, and inadequate ICT facilities, which hinder access to ODL programs (Isuku, 2018). These infrastructure challenges could impede the seamless integration of AI technologies and limit the reach of online education initiatives. Moreover, individual, institutional, and instructional challenges pose obstacles to the successful integration of AI in ODL and e-learning. Individual challenges include balancing learning with other activities, financial limitations, and poor computer knowledge, which could hinder students' ability to engage effectively in online learning (Cosmas, 2018). Institutional challenges such as the absence of internet and computer facilities in remote areas further exacerbate the digital divide and limit access to quality education (Cosmas, 2018). Financial difficulties, work commitments, and emotional stress are among the challenges in-service teachers enrolled in ODL programs face, highlighting the need for additional support mechanisms to address these issues (Ooi & Othman, 2023). Furthermore, challenges related to internet access, self-efficacy, device issues, and the learning environment affect student engagement and success in online distance learning courses (Ramly *et al.*, 2022). Also, delayed feedback and insufficient study materials present instructional challenges that impact the overall learning experience (Cosmas, 2018).

The COVID-19 pandemic has accentuated challenges such as managing academic schedules, multitasking, slow internet coverage, and technical issues, which have become more pronounced with the rapid shift to online learning modalities (Jing *et al.*, 2022; Mohamad *et al.*, 2020). Additionally, the lack of face-to-face interaction, delayed response times, and the absence of traditional classroom socialisation pose challenges for students adapting to online learning environments (Adnan, 2020). Addressing challenges related to infrastructure, individual readiness, institutional support, and instructional design is crucial for successfully integrating AI in ODL and e-learning, ensuring equitable access and enhanced learning outcomes for all students.

Potential for Creating More Inclusive and Effective Educational Landscape

Creating an inclusive and effective educational landscape ensures equitable access to quality education for all individuals. Several key factors must be considered and implemented within the educational system to achieve this goal. Promoting diversity and multiculturalism within schools is essential to creating an inclusive educational landscape. This can be achieved by implementing multicultural curricula that reflect the experiences and perspectives of diverse groups of students

(Fadzil & Munira, 2008). It has been reported that students are exposed to a more inclusive and representative educational experience by incorporating diverse voices and perspectives into the curriculum (Abbas, 2021). Another crucial element of an inclusive educational landscape is supporting students with diverse learning needs. This can include implementing inclusive teaching practices that cater for different learning styles and abilities as well as provides additional support services for students with disabilities or special educational needs. Education institutions can create a more inclusive learning environment by ensuring that all students have access to the resources and support they need to succeed (Firat, 2023).

In addition to promoting diversity and supporting students with diverse learning needs, creating a practical educational landscape also requires a focus on teacher training and professional development (Chiu, 2016). Teachers are crucial in creating an inclusive classroom environment thus capacity training for them becomes essential to empower them to support and engage the student populations. The provision of necessary tools and resources for teachers could create inclusive learning environment that fosters students needs. Furthermore, fostering strong partnerships between schools, families, and communities is essential for creating an inclusive and effective educational landscape. Through collaboration, these stakeholders could support students learning and well-being inside and outside the classroom.

The Prospects of AI on ODL and e-Learning

Artificial Intelligence (AI) has the potential to revolutionise Open and Distance Learning (ODL) and e-learning by enhancing the effectiveness, accessibility, and personalisation of education. Integrating AI applications into learning management systems led to more adaptive learning environments that cater to individual learning needs (Firat, 2023). AI technologies, such as machine learning and deep learning, promotes the development of adaptive learning environments that are flexible, inclusive, personalised, engaging, and effective (Choi, 2020). By leveraging AI, e-learning systems delivers personalised content to learners, leading to improved learning outcomes (Murtaza *et al.,* 2022). Moreover, AI can play a significant role in enhancing the quality of education by providing innovative teaching and learning approaches (Jokhan *et al.,* 2022). AI technologies can support science learning, improve educational processes, and create better learning experiences (Koc-Januchta *et al.,* 2020). AI in e-learning services can provide practical solutions and resources to students, catering to diverse learning needs and increasing overall learning experiences (Shehzadi *et al.,* 2021).

Furthermore, the adoption of AI in education is gaining traction globally, with reports highlighting AI in Education (AIEd) as an emerging field in educational technology (Zawacki-Richter *et al.,* 2019). The potential of AI to improve education quality, understand educational courses better, and enhance critical thinking has been recognised in various educational settings, including military colleges (Alnaqbi & Yassin, 2021). AI have contributed to the development of personalised e-learning systems that cater to individual student needs and preferences (Bozkurt *et al.,* 2021). The prospects of AI on ODL and e-learning are promising, with AI technologies offering opportunities to create more personalised, engaging, and effective learning environments. As AI advances, its integration into educational settings is expected to play a crucial role in shaping the future of learning and teaching practices.

Conclusion

Successfully integrating AI in ODL and e-learning requires a multifaceted approach encompassing policy support, quality assurance, professional development, student support services, curriculum restructuring, and ongoing research and development efforts. AI-powered tools can bridge the educational gap by providing accessible, affordable, quality learning experiences to diverse populations. AI integration into education is expected to be dynamic, requiring collaboration between stakeholders and policymakers to harness its full potential. By implementing these strategies, educational institutions could harness the full potential of AI to create more engaging, personalised, and effective learning environments for students in the digital age.

Suggestions

Integrating Artificial Intelligence (AI) in Open and Distance Learning (ODL) and e-learning offers a transformative opportunity to enhance educational practices and outcomes. The following suggestions might be important in achieving these outcomes:

1. Policy Development and Administrative Changes: There is a need for policy development and administrative changes which will support innovative teaching practices across educational institutions is crucial.

2. Quality Assurance Systems: Robust quality assurance systems should be implemented to ensure the effectiveness and reliability of AI-integrated ODL and e-learning platforms.

3. Professional Development: Educators should be provided training and professional development opportunities to equip them with the necessary skills to utilise AI technologies in teaching and learning effectively which will enable educators to create engaging and personalised student learning experiences.

4. Student Support Services: Enhancing student support services in digital distance and e-learning contexts is essential by reconfiguring student support structures to leverage the affordances of AI and learning design which will improve overall student success.
5. Curriculum Restructuring: Educational institutions should consider restructuring their curricula to align with the electronic environment and optimise the use of AI technologies such as designing curriculum content compatible with AI-integrated e-learning platforms which will enhance student engagement and learning outcomes.

6. Research and Development: There is a need for further research and development in AI in education for the advancement of innovative practices and technologies which will lead to continuous improvements in educational delivery.

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