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THE ROLE OF ARTIFICIAL INTELLIGENCE (AI) IN ODEL PROVISIONING: A SYSTEMATIC LITERATURE REVIEW

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Abstract:
With the introduction of online courses and exams, technology is having a significant impact on both teaching and learning. Since distance educators are frequently early adopters of new technologies, institutions offering Open Distance e-Learning (ODeL) now provide online learning programs. Artificial intelligence (AI) is an example of a cutting-edge technology that is redefining standards for online learning. In order to improve their ODeL offerings, ODeL institutions must make use of AI, a cutting-edge technology with lots of potential. To study the role of AI in ODeL, a thorough literature review was conducted. 16 papers were selected for the final synthesis out of the 246 publications that were initially found from 2019 to 2023 based on specified inclusion and exclusion criteria.

Keywords: artificial intelligence; ODeL; teaching and learning, PRISMA

1. Introduction

ODeL is a student-centered approach to learning that uses integrated systems and active learning to overcome the time, distance, financial, social, academic, and communication gaps between students and the institution, ODeL practitioners, courseware, and other students (Pretorius, Carow, Wilson, & Schmitz, 2021). The ideals of learner support, learner-centered instruction, recognition of past learning, and lifelong learning are essential to ODeL (Adedoyin, & Soykan, 2019).

It is critical to match ODeL services and components with developing technologies, given the rising usage of online teaching and learning in ODeL. AI is an evolving technology with affordances that ODeL institutions must take advantage of to improve their ODeL offerings.

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AI systems offer effective support for online learning and teaching, including personalising learning for students, automating instructors' routine tasks, and powering adaptive assessments (Seo, Tang, Roll, et al., 2021). Despite the growth in the AI field and ample opportunities for ODeL institutions, few higher education institutions implement AI tools.

To meet the current demands of advanced learning, AI technology is changing the whole virtual learning experience. ODeL institutions now look to automated systems for conducting teaching and learning activities such as assessments and grading.

There are now more prospects in the education field because of the increased use of Generative AI's Large language Models such as ChatGPT, Claude 2, and many others. Students can develop their language abilities by using ChatGPT, which can produce examples and conversational scenarios (Kohnke, Moorhouse & Zou, 2023). Concerns regarding students using AI chatbots to finish projects and essays have been raised, however, as a result of their use in education (Tausczik, & Pennebaker, 2023). This reveals yet another rationale for the disparities in technology use.

AI-enabled text, graphics, audio, and visual learning forms are all created by LMS. As a result, learning is more interesting (Van Eck, 2020). The use of AI allows for the personalisation of learning materials based on the historical performance of each student. AI helps teachers reduce their manual effort. Instructors are free to focus on other tasks while using automated methods, such as online exam proctoring.

2. Contribution

The role of artificial intelligence is examined in this paper, as well as AI applications to ODeL. Theoretically, this paper contributes to the AI literature. Practically, it increases awareness of ways in which AI can be used in ODeL to enhance learning and teaching in ODeL outlining ways in which institutions can benefit from the emerging technology. Given the rapid advancement in recent years and the heightened interest among educators in this field, a review of the literature on AI in ODeL is required.

Systematic literature reviews are useful in defining concepts and understanding the evolution of terminology related to a field of inquiry. Kashem, Shamsuddoha, Nasir, & Chowdhury (2022), conducted a systematic literature review to investigate the role of artificial intelligence and blockchain technologies in sustainable tourism in the Middle East. Mou & Li (2022) reviewed the literature published in one decade to assess the impact of artificial intelligence educational robots in the field of education. Research trends in variations of types of learning, such as the fourth industrial revolution, challenges for artificial intelligence, robotics, and blockchain in higher education are investigated through a systematic literature review (Chaka, 2023).

A literature review on application and theory gaps during the rise of artificial intelligence in education was conducted to summarise and present a status report on learning analytics research (Chen, Xie, Zou, & Hwang, 2020). The expanding usage of AI

technology and the current state of the art are the driving forces behind this study, which examines AI research from the perspective of online distance learning.

The study analyses a total of 276 publications utilising data mining and analytics methods in accordance with a systematic review process. Goru, Dogan Bozkurt Dogan (2023). Researchers must stay up with changes as the field of AI develops and identify trends and patterns in the application of AI-based solutions in the field of education.

In order to give timely intervention, relevant tools, and assistance to ODeL stakeholders in providing necessary tools and guidelines for artificial intelligence deployment, this study specifically sought to provide a thorough assessment of the role of artificial intelligence in ODeL.

The study sought to address the following research objectives, utilizing a systematic review (Gough, Oliver, & Thomas, 2017; Petticrew & Roberts, 2006):

- To analyse the role of artificial intelligence in the future of OdeL;
- To identify the nature of artificial intelligence applications in the context of OdeL;
- To identify research challenges and opportunities for artificial intelligence in OdeL.

The remainder of the document is organised as follows: Section 2 of the article presents the review's methodology; Section 3 of the study discusses the findings. The conclusion and upcoming study are outlined in Section 4.

2.1 Research method

The study used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) provided by Liberati et al. (2009) due to the paucity of literature on the role of artificial intelligence in open and distance e-learning. The PRISMA model depicts the processes that must be followed while doing a systematic literature review. Because it is mostly employed in healthcare research, several parts are not relevant to educational research (Pahlevan-Sharif, Mura, P. & Wijesinghe 2019).

The PRISMA stages were followed in this review, which comprised source identification, article screening, eligibility, and literature synthesising from included papers.

2.2 Source identification

2.2.1 Sources of items included in the review (search strategy—inclusion/exclusion criteria)

Among the electronic databases we found were IEEE Xplore, Google Scholar, ACM Digital Library, ScienceDirect, and Springer Link. We chose these electronic databases because they are relevant to our study topic and have a high academic impact. When conducting a systematic review, a well-thought-out search strategy is crucial to guide the literature search and ensure that all pertinent studies are included in the search results.

We created search terms to find published articles from 2019 to 2023 (April) that show how artificial intelligence (AI) is used in remote learning. Each electronic database therefore includes the terms "Artificial Intelligence" AND "Distance education" AND

"Distance learning" OR "Open distance learning" OR "Distance education." To ensure that all significant articles were considered for screening, we conducted a citation chain as further research for each retrieved article.

Table 1 contains a list of the papers that were selected from the aforementioned online databases.

Table 1: Papers from various electronic databases that have been published so far

Electronic database	Number of papers
Google Scholar	104
ScienceDirect	6
IEEE Xplore	65
Springer Link	28
ACM Digital Library	42

2.3 Articles selection and screening

2.3.1 Methods used for screening (PRISMA)

2.3.1.1 How many articles were identified, how many screens, and how many were finally reviewed

Only relevant articles are picked in accordance with the inclusion criteria during the screening phase of the PRISMA model. We cited works that expressly discuss the role of AI in ODeL. The articles were chosen based on the following standards. First, we disregarded editorials, works that hadn't been subjected to peer review, disjointed papers, and studies that were undertaken in other languages but didn't have an English translation. Additionally, we disregarded studies that employed AI to improve particular academic disciplines. We also ignored studies with shoddy presentation and unclear methods. Additionally, we used content from reputable publications and writers.

2.4 Source screening and eligibility requirements

All writers double-checked the legitimacy and calibre of every paper. Reading the appropriate article titles and abstracts helped us decide what to explore first. The list of chosen studies was then purged of any irrelevant studies.

The qualifying articles that initially made it through the first step were then put on a list. We eliminated any duplicates during the second eligibility process. We read the entire text of the literature to further confirm its eligibility and to ascertain whether its contribution is pertinent to the study's goals. This helps to further weed out studies that have nothing to do with open and distance learning using artificial intelligence.

2.5 Data analyses and synthesising of literature

The databases' search yielded a total of 246 entries at first. There were 222 entries after we removed duplicates. We avoided papers that had already been published, had no bearing on distance education, or had AI applications that were either generic or specific to domains other than education after performing the triage. We instead looked more closely at the titles and abstracts of the papers. We were left with 120 studies after reading

entire papers and eliminating 55 during the eligibility step. 51 articles that were published in questionable journals were eliminated after further analysis of the remaining 67 articles. Finally, 16 journal articles were chosen based on the aforementioned criteria, which were guided by the PRISMA model.

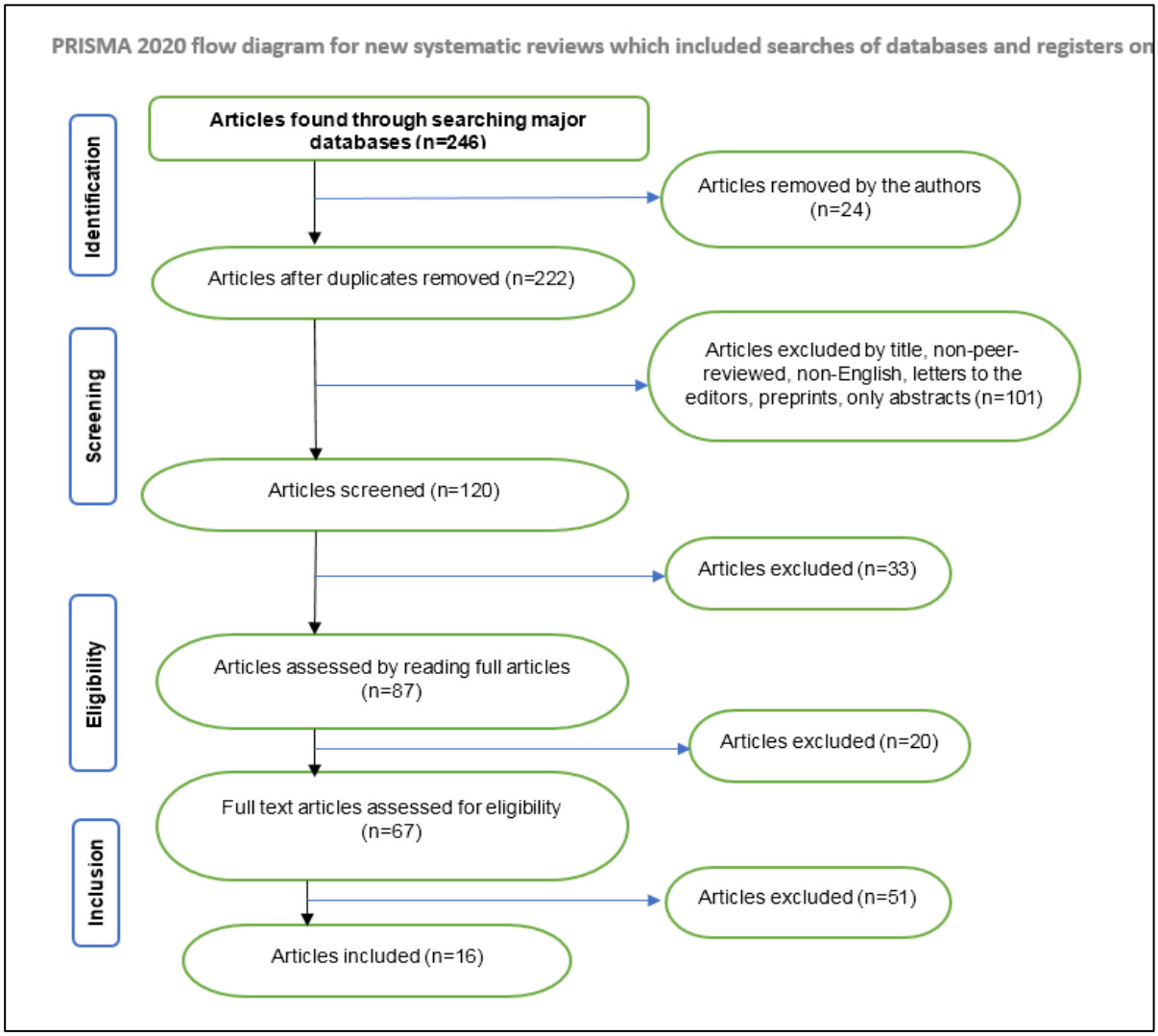

Figure 1: PRISMA model

Table 3 displays the journals or publishers of the chosen papers. We evaluated the categories or themes inherent in AI applications and technology as well as the study limits when analysing and synthesising the literature. The publishers where the chosen papers were published are listed in Table 2.

Table 2: Number of publications published in top journals

Journal/Publisher	Number of papers
Science Direct	6
ACM digital library	42
IEEE Xplore	71
Springer Link	12

Table 3: An overview of each study chosen for the systematic review

Reference	Title	Publisher	AI Application area	Limitations stated by the authors
Xiaogang, Liu;	A research on distance education systems based on artificial intelligence technology		AI applications and technologies in distance learning	The article does not discuss the potential of AI to support collaborative learning. Collaboration is an important part of many ODeL courses
Gautam, Amit; Dua, Anshula;	Applications of Artificial Intelligence in Open and Distance Learning	New Delhi Publishers	AI applications and technologies in distance learning	The article could discuss the potential of AI to support lifelong learning.
Kurjak, Asim;	Distance Learning and Artificial Intelligence: New Challenges for Donald School Educational Activities		AI applications and technologies in distance learning	No specific limitations stated.
Cavalcanti, Anderson Pinheiro; Barbosa, Arthur; Carvalho, Ruan; Freitas, Fred; Tsai, Yi-Shan; Gašević, Dragan; Mello, Rafael Ferreira;	Automatic feedback in online learning environments: A systematic literature review	Elsevier	AI for student assessment and feedback	Limited by search terms and databases used for the literature review.
Al-Shaikhli, Abdullah Raed Fadhil;	Estimation of students' performance in Distance Education using ensemble-based machine learning	Springer	AI for student assessment and feedback	Uses only quantitative data from student records. Does not incorporate qualitative data.
Aydoğdu, Şeyhmus;	Predicting student final performance using artificial neural networks in online learning environments	Springer	AI for student assessment and feedback	Limited features used for predictive modeling. Did not consider psychosocial factors.
Bates, Tony; Cobo, Cristóbal; Mariño, Olga; Wheeler, Steve;	Can artificial intelligence transform higher education?	SpringerOpen	AI ethics, challenges, and future directions	Conceptual analysis with minimal primary data. Lacks empirical grounding.
Chen, Xieling; Xie, Haoran; Zou, Di; Hwang, Gwo-Jen;	Application and theory gaps during the rise of artificial intelligence in education	Elsevier	AI ethics, challenges, and future directions	Focused only on past research. Does not address future directions.
Dogan, Murat Ertan; Goru Dogan, Tulay; Bozkurt, Aras;	The use of artificial intelligence (AI) in online learning and distance education processes: A systematic review of empirical studies	MDPI	AI ethics, challenges, and future directions	Small number of empirical studies suitable for review.
Gao, Peng; Li, Jingyi; Liu, Shuai;	An introduction to key technology in artificial intelligence and big data-driven e-learning and e-education	Springer	AI ethics, challenges, and future directions	Does not provide critical analysis of AI technology.
Guan, Chong; Mou, Jian; Jiang, Zhiying;	Artificial intelligence innovation in education: a twenty-year data-driven historical analysis	Elsevier	AI ethics, challenges, and future directions	Historical analysis limited to articles in one database.
Woolf	Two decades of artificial intelligence in education	Jstor	AI ethics, challenges, and future directions	Current AI is not yet at a stage to replace human teachers, as teaching is an extremely complex undertaking requiring social, emotional, and contextual understanding.
Kuleto, Valentin; Ilić, Milena; Dumangiu, Mihail; Ranković, Marko; Martins, Oliva MD; Păun, Dan; Mihoreanu, Larisa;	Exploring opportunities and challenges of artificial intelligence and machine learning in higher education institutions	MDPI	AI ethics, challenges, and future directions	Literature review only, no primary research conducted.

We determined the time period of publication for the articles we chose, which are displayed in Table 3. According to the study, the majority of the chosen articles were published between 2019 and 2023, with 2020 accounting for the majority (37%), as shown in Figure 2.

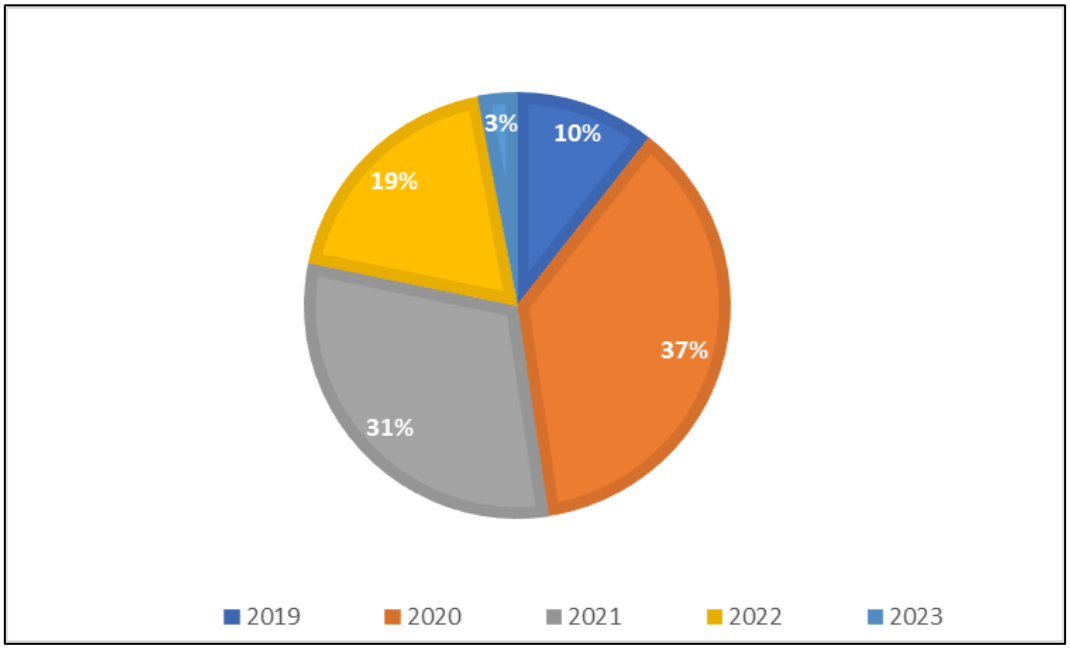

Figure 2: Frequency of articles per publication year

3. Findings

3.1 Description of the findings

In order to forecast student performance, identify at-risk learners early, provide targeted interventions, and improve retention, completion rates, and other outcomes, AI techniques like predictive modelling, machine learning, and natural language processing can be used (Chen et al., 2020; Kashef et al., 2022). Through features like automated chatbots, virtual assistants, adaptive learning platforms, feedback systems, content creators, and recommendation engines tailored to individual learners' needs and interests,(Dogan et al., 2023; Seo et al., 2021) AI has the potential to enable more individualised, adaptive, and intelligent functions in ODeL environments.

As ODeL grows through automated enrolment management, data-driven intervention techniques, and scalable intelligent learning systems, adopting AI solutions could boost access, equity, quality, and operational efficiency (Uur & Kurubacak, 2019). As of the present time, chatbots and virtual assistants are being used to automate operational and administrative chores, grade students, and offer 24/7 learner assistance (Fadzil & Munira, 2008; Uur & Kurubacak, 2019). In experimental implementations, AI is also used for personalised content recommendations, collaborative team tools, automated feedback creation on assignments and assessments, and tailored study planning Gao, Peng; Li, Jingyi; Liu, Shuai (2022). In order to predict performance,

dropout risk, and other outcomes, deep learning predictive modelling approaches evaluate streams of student data and online activity logs (Kashef et al., 2022; Mou & Li, 2022).

The creation of ethical AI systems, knowledge of how AI influences relationships and duties between students and teachers, prevention of misuse or abuse by students, and protection of student data privacy are key issues (Chen, Xieling; Xie, Haoran; Zou, Di; Hwang, Gwo-Jen, 2022). Predictive algorithms can be expanded beyond online activities by incorporating more diverse data sources, such as motivation, psychosocial features, study habits, and environmental context (Dogan et al., 2023; Seo et al., 2021). The larger higher education community could benefit from research led by ODeL institutions on the implications of AI, its ethical applications, and human-centered applications (Kuleto, Valentin; Ili, Milena; Dumangiu, Mihail; Rankovi, Marko; Martins, Oliva MD; Păun, Dan; Mihoreanu, Larisa, 2023). They were early adopters of online education, which explains why.

3.2 Synthesis of the findings

Through features like predictive analytics to increase student achievement, data-driven intervention methods, and scalable intelligent systems that generate more individualised, adaptive, and egalitarian learning experiences, AI is set to play a transformative role in developing ODeL. With ODeL's continued growth, there is a significant potential to improve access, equity, quality, outcomes, and operational efficiency by implementing AI solutions.

Automation, evaluation, and support chatbots are the main focuses of current applications. Adaptive learning, tailored suggestions, feedback systems, and predictive modelling of student data are some experimental AI applications that are being used to predict performance and risk. The programs are designed to improve instruction, learning, and operations while minimising tedious manual labour.

The findings highlight important ethical and human-centered design concerns with regard to student data privacy, unexpected consequences on learner roles and relationships, and preventing misuse. Algorithms and adaptive systems can benefit from the addition of multidimensional student data. For the advancement of all higher education, ODeL universities can set the standard for moral AI use and applications.

3.3 Critique of the findings

Claims about the transformative function and advantages of AI are not critically analysed enough. To assess the presumptions that the adoption of AI will inevitably improve access, equity, quality, and efficiency in ODeL environments, a more thorough study is required. Examining the long-term and unanticipated effects is necessary. The emphasis on automation and predictive analytics ignores how artificial intelligence (AI) could improve instruction, learning, evaluation, and assistance in more varied and inventive ways. Critical perspectives on the requirement that students develop cooperation skills in AI in addition to machine capabilities are lacking in the literature.

The focus of current literature is on technical and ethical issues; however, further research into the dangers of over-automation, the impact of AI on human relationships and agency, and the political ramifications of AI in education is lacking. Trade-offs require a more critical and comprehensive research perspective to be examined.

4. Discussion and conclusion

The results show that AI will be crucial to the development of ODeL in the future. Predictive modeling, one of the AI tools that can be used to estimate student performance and identify at-risk students, can be used to guide interventions that will help students achieve better outcomes like retention and completion (Chen et al., 2020; Kashef et al., 2022). Beyond forecasts, ODeL institutions will be able to perform increasingly automated, customised, and intelligent tasks because to AI's strengths in several areas: natural language processing, computer vision, and machine learning. This comprises personalised recommendation systems, adaptive learning platforms, virtual assistants, feedback generators, content producers, and feedback generators (Dogan et al., 2023; Seo et al., 2021). As ODeL continues to grow, implementing AI technologies has the potential to improve operational efficiency, access, equity, and quality.

According to Fadzil & Munira (2008) and Uur & Kurubacak (2019), current AI applications in ODeL are concentrated on automating administrative activities, student assessment, and providing learner assistance through chatbots and virtual assistants. AI is also used in experimental implementations for personalised recommendations, adaptive learning, collaborative tools, and feedback generation. Using information from online activity logs, clickstreams, discussion forums, and student records, deep learning algorithms' predictive modeling skills are being used to estimate student outcomes (Selvaraju, Srinivasan, & Murugan, 2022). The applications' overall goal is to improve teaching and learning while minimising manual labor for teachers.

Despite increasing use, there are still issues with ethical AI design, how it affects student-teacher interactions, and how students may misuse or rely too much on AI (Cruz-Benito, López-Garca, & Sánchez-Alonso, 2021). These issues call for further research. To create governance guidelines and best practices for adopting human-centered AI, more research is required. Predictive algorithms and adaptive systems can also be improved by combining more diverse data sources, such as psychosocial aspects, that go beyond online actions. ODeL institutions have the opportunity to pioneer research on the implications and uses of AI for the greater higher education sector.

Despite growing usage, there are still problems with ethical AI design, how it influences interactions between students and teachers, and how students may abuse or overuse AI (Cruz-Benito, López-Garca, & Sánchez-Alonso, 2021). More study is necessary for these problems. More research is needed to develop governance standards and industry best practices for implementing human-centered AI. Additionally, by merging more varied data sources, such as psychosocial characteristics that go beyond online actions, predictive algorithms, and adaptive systems can be made better. For the greater

higher education market, ODeL schools have the opportunity to spearhead research on the effects and uses of AI.

While many AI applications require a strong digital infrastructure and are frequently data and computationally-heavy, some applications, such as chatbots that run on mobile devices, are already being deployed in low-resource settings. Building more accessible AI solutions adapted for various infrastructural contexts is possible as a result of the rapid rate of technological breakthroughs lowering the price of AI. Applications with less intensive processing requirements, offline capabilities, and multilingual user interfaces fall under this category (Anoop Kumar, Safiya Umoja Noble, and Been Kim, n.d.).

Through business models that make AI technologies available for free or at a low cost to students and institutions most in need, collaborations between edtech businesses and local ODeL providers can also contribute to increasing access to AI. However when institutions with varied levels of funding implement AI, there are worries that this could exacerbate achievement inequalities and inequality in education. To guarantee ethical and equitable AI integration in ODeL across all socioeconomic circumstances, proactive policy and financial measures will be crucial. As a result, it is necessary to create context-specific research and application frameworks that take into account regional needs, difficulties, and goals.

Conflict of interest statement

The authors declare that there is no conflict of interest.

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