Artificial Intelligence for Enhanced Student Engagement in South African Open Distance Learning: A Systematic Review

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Abstract

Artificial intelligence (AI) has emerged as a transformative force across various domains, and open distance and e-learning (ODeL) is no exception. The integration of AI technologies in teaching and learning has the potential to revolutionise traditional educational practices and enhance student outcomes. ODeL plays a crucial role in expanding access to education in South Africa, enhancing student engagement and addressing geographical and socio-economic barriers. However, existing challenges such as large student-to-lecturer ratios and limited student interaction can hinder learning effectiveness. The systematic review was used and aimed to inform stakeholders involved in ODeL institutions about the potential benefits and limitations of AI towards creating a more effective and inclusive learning environment. We critically analysed existing research using Scopus, Google Scholar and ScienceDirect databases on AI applications in ODeL, focusing on South African studies or those with direct relevance to the South African context. Key areas where AI can be used were identified, including personalising learning, providing intelligent support and improving student engagement within the specific constraints and opportunities of the ODeL landscape. However, challenges such as lack of infrastructure, skills and knowledge and ambiguous digital technologies policies appear to be a challenge for successful AI in ODeL.

Keywords: artificial intelligence; open distance and e-learning; student engagement; South Africa; systematic review

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Contextual Background

The global COVID-19 pandemic has acted as a catalyst for digital transformation in open distance and e-learning (ODeL). ODeL is a student-centred approach to learning that uses integrated systems and active learning to overcome the time, distance, financial, social, academic and communication gaps between students, institutions, lecturers and courseware (Pretorius et al. 2021). It facilitates student support, student-centred instruction, recognition of past learning, lifelong learning, and displaces traditional education (Adedoyin and Soykan 2023). In ODeL context, artificial intelligence (AI) has the potential to improve student–lecturer and peer–lecturer interactions and to provide intelligent data collection and 24/7 education (Vincent-Lancrin and Van der Vlies 2020). Also, AI has changed pedagogical practices and the use of technological resources (Blake 2015; Cook and Polgar 2014; Faloye and Ajayi 2021). It supports interactive instruction and bidirectional pedagogical activities (Khlaif and Salha 2022). Ideally, AI allows teaching and learning to occur any time and any place in a collaborative and interactive manner through discussion, sharing and delivery of module material, communication and multimedia (Ramaila and Molwele 2022). The relevance of AI is that it saves time, especially when there are many students in a class (Dexter and Richardson 2020), enhances one-on-one teaching of students who are lagging behind and enables lecturers to cater to students' diverse needs (Ankiewicz 2021). This is important as students come from different academic backgrounds and have different learning styles and approaches. AI has the potential to improve operational efficiency, access to information and resources, equity and quality (Uğur and Kurubacak 2019).

However, the ODeL system in South Africa is sandwiched between contextual and systemic challenges (Bozalek and Ng'ambi 2015; Leibowitz 2012), including the lack of skills by lecturers and students to use AI tools for teaching, learning and assessment (Earl 2012), and negative attitudes towards AI (Neudert et al. 2020). Furthermore, AI may encourage dishonesty and undermining academic integrity (Pangrazio et al. 2022), and high levels of test anxiety in an online assessment (Al-Maqbali and Hussain 2022). Ultimately, the responsible use of AI tools in ODeL can help to transform the way students learn and do research, by developing their skills and promoting the highest standards of scholarship (Tausczik and Pennebaker 2023). It can recommend additional learning resources (Barker 2011; Mousavinasab et al. 2021).

Unisa Context in AI for Enhanced Student Engagement

The University of South Africa (Unisa) is one of the leading global ODeL institutions. In this context, AI can significantly enhance student engagement through using intelligent tutoring systems, adaptive learning systems, or personalised learning platforms, which can customise instruction, provide timely feedback to students and aid in developing adaptive learning resources tailored to individual student needs (Järvelä et al. 2023; Nguyen et al. 2024). AI contributes to a personalised, adaptable, efficient,

accessible and inclusive student learning experience (Almusaed et al. 2023). In addition, students receive specialised recommendations, customised feedback and progress monitoring with the aid of AI, while lecturers can focus on more individualised and exciting training (Limonova et al. 2023). AI assist in bridging educational access barriers and facilitate cross-cultural and cross-linguistic communication. Students from various language backgrounds therefore connect and study together with the support of AI-powered translation technologies, breaking down barriers and establishing a more inclusive and varied learning environment (Nguyen et al. 2024). Furthermore, AI can assist in identifying student data and performance trends, allowing lecturers to detect areas where students may be failing and intervene before the problem becomes more serious.

Importantly, AI helps to overcome educational access gaps by giving students more freedom and accessibility (Almusaed et al. 2023). By leveraging AI, Unisa has managed to significantly enhance student engagement, improve learning outcomes and ultimately achieve its mission of providing quality education to all. However, Unisa's ODeL context faces unique challenges in maintaining student engagement, particularly in a remote learning environment, such as limited uptake of AI, issues related to technological accessibility, the digital divide and pedagogical integration (Nguyen et al. 2020; Nguyen et al. 2022; Strobl et al. 2019). The students are geographically dispersed across South Africa and internationally, making traditional face-to-face interactions difficult. Also, Unisa caters to a diverse student body with varying levels of technological literacy and learning styles. As a public institution, Unisa faces resource constraints that have an impact on the quality of student engagement. However, AI offers a promising solution to address these challenges and enhance the overall student experience.

Problem Statement

The widespread adoption of ODeL for educational delivery was accelerated by the COVID-19 pandemic. While ODeL offers a student-centred approach with the potential to overcome various barriers to education, integrating AI presents both opportunities and challenges. In this context, AI can create dynamic learning ecosystems that combine innovative teaching tools with opportunities for social interaction (Grassini 2023), and fundamentally transform how we learn and teach in ODeL institutions (Du Plessis 2024). However, there are still problems associated with AI in ODeL institutions to influence engagement or interactions between students and lecturers, and how students may abuse or overuse AI platforms. ODeL institutions are therefore struggling to keep pace with the rapid transformation of the educational landscape driven by the emergence of AI, such as student engagement, knowledge acquisition, skill development, and the ability to use resources effectively (Ayoko et al. 2024). There is also a potential for academic dishonesty and increased test anxiety (Al-Maqbali and Hussain 2022; Novick et al. 2022). Therefore, to ensure a successful transformation, ODeL systems must

address these issues while capitalising on the potential of AI to enhance the learning experience.

The following research question is asked:

- How can AI be used to promote student engagement in South African ODeL institutions?

Rationale

A primary rationale for incorporating AI in ODeL institutions is to provide students with personalised and adaptable learning experiences. The rapid advancement of AI presents a transformative opportunity to revolutionise ODeL institutions. ODeL institutions in South Africa can therefore leverage AI to address the unique challenges faced by their diverse student body. By incorporating AI-powered tools and techniques, ODeL institutions can enhance student engagement and improve learning outcomes. AI is likely to disrupt student engagement practices in ODeL context. We have noted that there is limited research on AI in ODeL contexts; therefore, our purpose is to draw attention to the future of student engagement in ODeL institutions in the context of AI.

Research Gap

Although there is growing interest in AI-driven educational solutions, the specific application of AI to enhance student engagement in the South African ODeL context remains relatively unexplored. Existing research often focuses on traditional classroom settings or international ODeL institutions. There is a need to understand the unique challenges and opportunities of the South African ODeL landscape and how AI can be tailored to address them effectively. By addressing the research gap and achieving the stated objectives, this study will contribute to a better understanding of how AI can be harnessed to improve the quality and accessibility of ODeL in South Africa and increase student engagement.

Objectives of the Study

- Identify the challenges to student engagement in an ODeL environment that could be addressed through AI.
- Explore the potential applications of AI technologies in the ODeL context to promote student engagement.
- Assess the impact of AI-powered interventions on student engagement in ODeL institutions.

Significance of the Study

The findings of this study will have significant implications for Unisa and other ODeL institutions in South Africa. By demonstrating the potential benefits of AI, this research can provide ways of improving student engagement, motivation, participation and persistence through personalised learning experiences. The findings will provide ways of optimising student engagement in ODeL institutions.

Defining AI

McCarthy (1956) defined AI as the science and engineering of making intelligent machines, especially intelligent computer programs. AI is characterised as a fusion of technologies that integrate data, algorithms and computational capabilities (European Commission 2020), and have the ability of machines to perform cognitive tasks such as thinking, perceiving, learning, problem-solving, decision-making, identifying patterns and adapting (Do et al. 2021; Hwang et al. 2020). It is the creation of computer systems and programs that imitate human intelligence and behaviour (Cabezas-González et al. 2021), and entails the use of communication tools such as computers, the internet, interactive media, satellite and related technological methods to create, support and enhance student engagement in ODeL (Khlaif and Salha 2022; Yilmaz 2021).

Student Engagement

The incorporation of AI in ODeL can enhance student engagement which offers immersive opportunities but also presents several challenges that need to be addressed (Nguyen et al. 2024). According to Kuh (2001), student engagement is the extent to which ODeL institutions create an environment that enables student participation in educationally purposeful behaviours. Trowler (2010) sees student engagement as the interaction between time, effort and resources, aiming to optimise both the student experience and the performance of the institution. Barkley (2010) argues for student engagement as the pedagogical result of interaction between motivation and active learning. In this context, AI can positively influence students' cognitive growth, engagement, development and academic success (Pascarella and Terenzini 2005). Studies on peer learning, however, seem to suggest that smaller class settings of discussions, even when using AI, may promote better student engagement (Hollister et al. 2022). Engagement with diverse others therefore enhances students' academic and personal development, including preparing students to work in diverse environments (Crutcher et al. 2007), and significantly improve student involvement and participation (Bond et al. 2020). Improving student engagement is crucial to maximising the effectiveness of ODeL systems; students are motivated and actively participate in the learning process, leading to better academic outcomes (Loos and Crosby 2017; Pinter et al. 2020).

The Role of AI in ODeL

AI has greatly influenced ODeL leadership and management in many forms and for varied purposes. It has simplified administrative tasks, enhanced lecturers' instruction, and automated student attendance, grading and record-keeping (Sharma et al. 2021). It has also aided in automatically sending academic records and other correspondence to students, scheduled and planned meetings, and sent normal student forms and enrolments (Paek and Kim 2021). It has assisted through giving comments and reviewing student work more efficiently (Hanewicz et al. 2017), which boosted productivity for ODeL (Gandedkar et al. 2021) and greatly reduced lecturers' paperwork, allowing them to focus on teaching and disseminating information according to the curriculum (Chamunyonga et al. 2020).

ODeL institutions have a significant potential to improve access, equity, quality, outcomes and operational efficiency by implementing AI solutions. Gao et al. (2022) opine that AI has the potential to provide an opportunity for individualisation to the ODeL system, including personalised content recommendations, collaborative team tools, adaptive learning and automated feedback creation on assignments and assessments, to estimate student outcomes (Selvaraju et al. 2022), and to facilitate student monitoring, collaborative learning, student engagement, interactions and learning (Kabudi et al. 2021). Based on the advantages of AI, Sharpless (2022) suggests engaging students in shaping and harnessing these AI tools to support learning in ODeL institutions.

Although personalised learning has been acknowledged as an effective method that customises educational experiences to meet the specific needs of individual learners (Xie et al. 2019; Zheng et al. 2021), the significant resources needed to put this model into practice make it challenging to adopt on a large scale (Nguyen et al. 2020). By generating personalised content, assessments and feedback dynamically, AI supports a variety of learning styles and schedules, thereby increasing student engagement and making education more responsive to the diverse needs and lifestyles of students (Nguyen et al. 2024).

Ideally, simulations increase learning by giving students hands-on experience and offering life skills and self-development (Villegas-Ch et al. 2020) through connecting them to virtual classrooms, 3D technologies, virtual reality (VR) and building a worldwide classroom to boost learning usability, enjoyment, excitement, motivation and engagement (Raja and Priya 2021). Augmented reality (AR) and VR learning environments allow students to engage with information and to promote immersion, group learning, student counselling and making learning faster and more engaging (Elkoubaiti and Mrabet 2018; Huda et al. 2018). Students learn at their own pace, time, enhance repetition needs and improve flexible learning (Rad et al. 2018).

Chatbots and virtual assistants are being used to grade students, and offer 24/7 student assistance (Fadzil and Munira 2008; Uğur and Kurubacak 2019) to predict performance,

improve instruction and learning, and achieve better outcomes such as retention and completion (Chen et al. 2018; Kashef et al. 2021). Apparently, ChatGPT can be used to check sentences for plagiarism and originality and prevent cheating (Chia 2023; Novick et al. 2022; Oravec 2022). Also, Turnitin can be used to give suggested grading and facilitate writing and editing (Crossman 2019; Haldorai et al. 2021; Mehtab and Mahmud 2022). Grammarly offers automated writing evaluation, automated essay scoring, and automated written corrective feedback (Taguma et al. 2018). It also detects spelling and grammar errors in English texts and corrects them to the appropriate form, grade, and offers students feedback on their work (Koltovskaia 2020).

Essentially, AI may assess learning progress, including knowledge and understanding (Pinchbeck and Heaney 2022), ensure that the assessment results are fair, reliable and accurate (Cope et al. 2021; Novick et al. 2022; Oravec 2022), and help simplifying content for different learning types and varying learning speeds (Zawacki-Richter et al. 2019). It may also provide automatic and personalised feedback to students (García-Gorrostieta et al. 2018), and provide more accurate and objective assessments at reduced cost (Li and Lalani 2020), leading to student engagement and better learning outcomes in ODeL (Kumar et al. 2021).

Theoretical Framework: Disruptive Innovation Theory

Drawing on the theory of disruption and innovation, we identify the processes that have the potential to significantly alter the shape of student engagement as we know it. Christensen (1997) defines disruptive innovation as a process by which a product or service takes root initially in simple applications at the bottom of a market and then relentlessly moves up market, and eventually displaces established competitors. The disruptive innovation theory identifies and explains AI to have the potential to transform the ODeL institutions in a positive way (Manocha et al. 2022), particularly student engagement. The theory facilitates an understanding of how AI can disrupt established ODeL institutions and explains how AI emerge, gain traction and ultimately replace existing products, services or technologies (Urlaub and Dessein 2022). This paradigm shift in ODeL delivery provides students with low-cost, high-quality, personalised and accessible education, with a focus on flexibility (Manocha et al. 2022), and can automate the teaching, learning and assessment process (Chen et al. 2018; Li and Lalani 2020).

Essentially, the theory of disruptive innovation highlights the importance of adapting to AI to increase student engagement while maintaining academic integrity. The application of the theory of disruption and innovation to AI implementation provides stakeholders (lecturers, managers and students) in ODeL institutions with the opportunity to use AI tools to enhance interaction, understanding the ethical implications of AI for academic integrity, and for increasing student engagement through online assessment. AI can be considered a possible disruptive innovation that displaces traditional teaching and learning, and transforms online assessment in ODeL institutions and the way students process their teaching and learning material with AI to

facilitate epistemological access (Christensen and Horn 2008; Kumar et al. 2021; Manocha et al. 2022).

Research Methodology

This study set out to ascertain the major areas of concentration in published works on AI integration in ODeL institutions. A systematic review approach was adopted to identify and map knowledge areas through the identification of research patterns (figure 1). The Scopus, Google Scholar and ScienceDirect databases (Chadegani et al. 2013) were chosen for the literature review owing to their extensive coverage across various scientific fields (Guz and Rushchitsky 2009). Widely adopted in bibliometric studies (Chadegani et al. 2013; Vieira and Gomes 2009), Scopus, Google Scholar and ScienceDirect have emerged as leading platforms for literature searches (Hong et al. 2012). Their comprehensive nature surpasses the scope offered by other databases (Hosseini et al. 2018). The search for relevant literature focused on published journal articles in AI and ODeL-related study areas. The choice of selecting journal articles was premised on the fact that articles from journals are considered more reliable sources of knowledge (Ramos-Rodríguez and Ruíz-Navarro 2004), and are deemed more concise and detailed than other sources of information (Zheng et al. 2016).

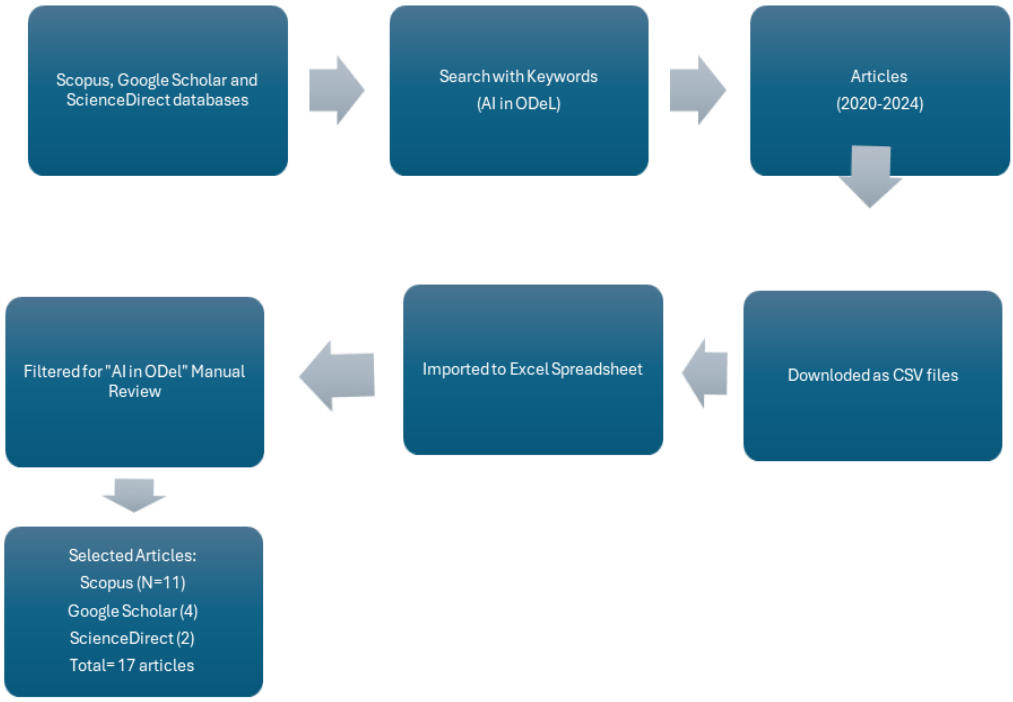

Figure 1: The framework adopted for the research

The articles were searched in titles, abstracts and keywords. The key search words adopted were artificial intelligence, open and distance e-learning and student engagement. As a result, publications with these search words in their title, abstracts and keywords were extracted. The study used a four-year time frame which spanned from 2020 to 2024. This time frame was geared towards understanding the most current AI and ODeL issues in the study area. The literature search was conducted in April 2024 with the initial search producing 80 148 papers with the stated keywords. Since the initial extracted 80 148 covered a wide range of fields, most of which were not AI and ODeL-related, the careful refining of these extractions using the earlier mentioned AI and ODeL-related field, language of publication (English only) and publication type (published journal articles) was necessary. The articles were downloaded on CSV files and exported to MS Excel. After careful refining, a total of 11 articles were extracted as presented in table 1. The results are presented based on the 2020–2024 publications in the Scopus, Google Scholar and ScienceDirect databases.

Table 1: Selected articles and databases

Title	Author(s)	Year of publication	Database
Artificial Intelligence in EFL speaking: Impact on enjoyment, anxiety and willingness to communicate	Zhang et al.	2024	Scopus
AI-enhanced teaching and materials for education: A shift towards digitalization	Syahrizal et al.	2024	Scopus
Understanding the role of study strategies and learning disabilities on student academic performance to enhance educational approaches	Bressane et al.	2024	Scopus
The future role of artificial intelligence (AI) design's integration into Architectural and Interior design education is to improve efficiency, sustainability and creativity	Almaz et al.	2024	Scopus
Generative AI and the future of higher education: a threat to academic integrity or reformation? Evidence from multicultural perspectives	Yusuf et al.	2024	Scopus
Embrace or resist? Drivers of artificial intelligence writing software adoption in academic and non-academic context	Papakonstantinidis et al.	2024	Scopus
ChatGPT for generating multiple-choice questions: Evidence on the use of artificial intelligence in automatic item generation for a rational pharmacotherapy exam	Kiyak et al.	2024	Scopus

Title	Author(s)	Year of publication	Database
Student perspectives on the use of generative artificial intelligence technologies in higher education	Johnston et al.	2024	Scopus
Embracing the future of artificial intelligence in the classroom: the relevance of AI literacy, prompt engineering and critical thinking in modern education	Walter	2024	Scopus
More trust or more risk? User acceptance of artificial intelligence virtual assistant	Xiong et al.	2023	Scopus
A bibliometric mapping analysis of publications on the utilisation of Artificial Intelligence technology in Language learning	Lubisi et al.	2024	Scopus
The impact of artificial intelligence on learner-instructor interaction in online learning. International	Seo et al.	2021	Google Scholar
Managing the strategic transformation of higher education through artificial intelligence	George and Wooden	2023	Google Scholar
Attentive or Not? Toward a machine learning to assessing students' visible engagement in classroom instruction	Goldberg et al.	2021	Google Scholar
Artificial Intelligence (AI) student assistants in the classroom: Designing Chatbots to support student success	Chen, Jensen et al.	2022	Google Scholar
Personalized education and artificial Intelligence in the United States, China and India: A systematic review using a Human-In-The-Loop model	Bhutoria	2022	ScienceDirect
Effects of artificial intelligence-enabled personalized recommendations on learners' learning engagement, motivation and outcomes in a flipped classroom	Huang et al.	2023	ScienceDirect

Summary of Findings, Conclusion and Recommendations

Introduction

The presented findings indicated the impact AI has on ODeL, which remains suboptimal because of a lack of ICT skills, unclear regulatory policies, poor understanding of pedagogy, inadequate resources, lack of technical support and negative attitudes. It is essential that lecturers have basic AI skills and competences, are guided by policy, and are provided with resources and equipment. The research question is:

- How can artificial intelligence (AI) be used to promote student engagement in South African ODeL institutions?

Findings

Opportunities for Using AI in ODeL

The theory of disruptive innovation highlights the importance of adapting to changing technologies, particularly AI, to promote student engagement, while maintaining academic integrity. There is evidence in ODeL that AI tools enable lecturers to make informed decisions on educational approaches, resources and assessment (Bressane et al. 2024), adopt data-driven strategies to enhance teaching methodologies, thereby accommodating varying needs of students, promoting academic success (Bressane et al. 2024), enable lecturers not to engage manually by writing multiple-choice questions (Kiyak et al. 2024), and reduce the challenges of large student-to-lecturer ratios (Walter 2024). AI therefore enable innovative content delivery methods, such as VR and AR and aids in ODeL (Walter 2024).

There is evidence in ODeL that AI tools foster a more inclusive and fair educational landscape (Bressane et al. 2024). It was found that diversity and inclusivity pave the way for transformative approaches to student engagement (Bressane et al. 2024). AI enhances student confidence (Johnston et al. 2024), increases enjoyment (Zhang et al. 2024), and enhances continuous improvement (Bressane et al. 2024). Furthermore, AI enables students to engage in hands-on learning by interacting with AI designs (Syahrizal et al. 2024), and fosters collaborative learning, connecting students globally and transcending cultural barriers (Walter 2024). Essentially, AI saves time, and ensures content generalisation, transparency, unbiased content and privacy-respecting practices (Walter 2024). Through student engagement a wide range of learning can take place with AI, including problem-solving skills, teamwork, time management, commitment and responsibility to self and others, good work ethics and good attitude (Goldberg et al. 2021). The use of AI is therefore aligned with student engagement in ODeL institutions where the learning process is complex, comprehensive and holistic (Lubisi et al. 2024).

The review indicated that AI motivates the shift from the traditional “one-size-fits-all” to a personalised format of learning to make the system student-centred (Bhutoria 2022).

There is reasonable evidence that personalised interventions lead to improved academic outcomes (Bressane et al. 2024), and enhance fair and effective learning, which benefit all students regardless of their cognitive backgrounds or learning challenges (Bressane et al. 2024). Ideally, AI contributes to student engagement that prioritises individual growth and excellence in the pursuit of academic achievement (Bressane et al. 2024). AI therefore has the potential to help ODeL institutions to adapt to individual student needs, accommodating various learning styles and cognitive states (Walter 2024), and promoting equity and accessibility (Yusuf et al. 2024). Therefore, in this context student engagement is related to positive learning outcomes (Huang et al. 2023).

Seo et al. (2021) found that AI could be supportive of student engagement by allowing students to get real-time answers. In the context of ODeL, the flexibility of AI tools changes the way students learn, create and open up opportunities for innovation and creativity (Almaz et al. 2024). It accommodates the diverse needs of students (Bressane et al. 2024), transforms the student engagement process, by making it faster and more efficient, automates tasks and facilitate sustainability (Almaz et al. 2024).

George and Wooden (2023) found that AI can lead to personalised learning pathways through optimally allocating resources and curating high student engagement. AI can therefore provide a wide range of material options or visual aids for students and enhance experimentation (Almaz et al. 2024). This will improve student engagement and retention of the materials (George and Wooden 2023). However, student engagement in this context depends less on resource placement and more on requirements for students to review the materials (Chen et al. 2022).

According to George and Wooden (2023), AI provides individualised instructions to students. The findings indicated that ChatGPT as an AI tool has potential in test development (multiple-choice questions), research, writing assignments, answering exam questions (Kiyak et al. 2024), and supporting literature searches (Yusuf et al. 2024). Furthermore, Grammarly can be used to write essays (Johnston et al. 2024), and Chatbot applications can make scholarly discussions last longer, and create interactive personalised communication between students and computer tools (Lubisi et al. 2024). Integrating these AI tools therefore increase student engagement and improve understanding (Goldberg et al. 2021).

The review indicated that AI enhances the learning process, information retrieval and text paraphrasing, supports content creation (Yusuf et al. 2024), reduces cost, and saves resources while ensuring student performance meets high standards of quality and sustainability (Almaz et al. 2024). It maximises language learning evaluation particularly in providing instant feedback for assessing students' works (Almaz et al. 2024; Lubisi et al. 2024). Goldberg et al. (2021) found that AI in student engagement can be used to provide feedback. AI can assist students with special needs, such as language processing and sensory impairments (Walter 2024). In this regard, AI can

enhance efficiency, content quality, productivity and writing processes (Papakonstantinidis et al. 2024; Yusuf et al. 2024).

Through student engagement a wide range of learning can take place with AI, including promoting communication skills (Goldberg et al. 2021). The review indicated that AI facilitates communication, enables just-in-time personalised support for students at scale, and gives them a feeling of improved connectivity (Seo et al. 2021). AI therefore enhances communication willingness and facilitates a supportive classroom environment (Zhang et al. 2024). The students can work at their own pace and receive targeted support, without having to wait for the lecturer's assistance (George and Wooden 2023). AI therefore benefits student–student or student–lecturer interaction in online learning, which can facilitate student engagement.

Obstacles of Using AI in ODeL

The use of AI in ODeL to enhance student engagement was associated with various obstacles as discussed below.

The lecturers in ODeL have limited exposure to using AI tools and a lack of comprehensive interactive AI; consequently, they tend to rely on traditional media in their daily teaching practices (Syahrizal et al. 2024). ODeL institutions experience large student-to-lecturer ratios (Walter 2024), which tend to affect student engagement.

There are issues on the integrity and originality of works among student engagement, in, particular the potential of academic dishonesty, the possible decline of autonomous and critical thinking (Lubisi et al. 2024), cheating and a lack of ethical guidelines (Yusuf et al. 2024).

There is evidence that ChatGPT sometimes provide inaccurate or outdated content; the generated questions may lack scientific validity and lecturers may not know how their input will precisely affect the output (Kiyak et al. 2024).

It was found that students' lack of knowledge can result in a reliance on AI-generated content without critical evaluation, potentially undermining the quality and integrity of academic work. At the same time, students might also miss out on the opportunity to enhance their learning and critical thinking skills through the proper use of AI (Walter 2024).

Some major obstacles to the development of AI are trust and risk. The evidence showed that trust and risk have negative effects on attitudes towards using AI tools (virtual assistants) (Xiong et al. 2023).

There is reasonable evidence that AI tools experience potential risks and ethical implications, including the possibility of creating factually inaccurate outputs,

exhibiting biases and unfairness, producing contextually inappropriate or irrelevant content and spreading false information (Papakonstantinidis et al. 2024).

The evidence showed that policy guidelines are a necessary step towards regulating AI use and promoting student engagement, but their effectiveness hinges on student compliance, which is not guaranteed since reading the policy documents is voluntary (Walter 2024).

In this context, performance, security and privacy issues are barriers to student engagement owing to the speed of diffusion, adoption of AI technologies (Xiong et al. 2023), and a lack of accessibility to AI resources or infrastructure (Walter 2024).

According to Walter (2024), integrating AI into ODeL might experience a lack of comprehensive lecturer and student training and curriculum adaptation. The lack of training could lead to misuse of AI tools, as many lecturers and students might not be aware of how to properly integrate these technologies into their academic work. Also, the ODeL institutions experience large student-to-lecturer ratios and limited interactions.

The evidence showed that monitoring the use of AI in student assignments poses another obstacle. It is difficult to verify whether an assignment has been created with the aid of AI, especially as these tools become more sophisticated (Walter 2024).

Conclusion

AI serves to enhance student engagement, as it acts as a valuable educational resource for blended learning and grants access to an ever-expanding range of learning materials.

Also, in ODeL institutions, large class sizes make it difficult for lecturers to offer individualised teaching and impede swift and direct student support. However, AI negates this challenge by rendering personalised support.

Ongoing training for both lecturers and students is crucial to maximise the potential of AI tools responsibly and to promote student engagement. This requires continuous engagement (through workshops) with AI topics to develop proficiency and to deal with ethical concerns such as bias, privacy and security.

Essentially, evaluating the benefits and challenges of AI tools on student engagement requires informed decisions about resource allocation, training and creating interventions to ensure fair access and to bridge the digital divide. Student-led AI initiatives can further enhance student engagement by promoting hands-on exploration, peer learning and practical application of AI knowledge.

Educating students on best practices for AI, fostering integrity, and designing appropriate assessments are critical to successful implementation and promoting student engagement.

ODeL institutions should prioritise clear and fair policies that are flexible enough to accommodate cultural differences. Investing in technology and ensuring fair access to both technology and clear policies are necessary, particularly for underprivileged communities to promote student engagement.

Recommendations for Practice and Policy

- The review highlights how AI tools can improve student engagement but emphasises the need for clear university policies on appropriate use. These policies should ensure equal access for diverse student groups, address cultural differences and promote ethical considerations.
- To achieve successful AI integration and student engagement, the findings propose staff and student training workshops to develop skills in using these tools responsibly. Collaboration with AI experts and other educational institutions is also encouraged to share best practices.
- The study acknowledges potential challenges such as the digital divide, where students with limited resources might lack the internet connectivity or devices needed to use AI tools effectively. The need for accessible AI solutions that work in various infrastructural contexts is highlighted.
- The review draw attention to the crucial role of supportive measures such as reliable technological infrastructure and improved internet connectivity in ensuring the successful use of AI in ODeL institutions.
- Finally, the study acknowledges that AI provides automatic grading that can be efficient and save resources, suggesting it as a valuable tool to promote student engagement, when implemented correctly.

Recommendations for Future Research

In future, research is required that can clearly establish how ODeL can be optimised by integrating AI to address student engagement. Research designs that can capture the influence of AI in ODeL should therefore focus on exploring the potential of AI in ODeL to support the various components of knowledge and its application while also enhancing efficiency development in learning. Essentially, there is a need for ongoing research and dialogue to better understand the dynamics and to develop more effective guidelines for the responsible and fair incorporation of AI technologies into the ODeL landscape in the Global South to enhance student engagement.

References

Adedoyin, O. B., and E. Soykan. 2023. “Covid-19 Pandemic and Online Learning: The Challenges and Opportunities.” *Interactive Learning Environment* 31 (2): 863–75. https://doi.org/10.1080/10494820.2020.1813180.

Al-Maqbali, A. H., and R. Hussain. 2022. “The Impact of Online Assessment Challenges on Assessment Principles During COVID-19 in Oman.” *Journal of University Teaching & Learning Practice* 19 (2): 73–92. https://doi.org/10.53761/1.19.2.6.

Almaz, A. F., E. A.E. El-Agouz, M. T. Abdelfatah and I. R. Mohamed. 2024. “The Future Role of Artificial Intelligence (AI) Design’s Integration Into Architectural and Interior Design Education is to Improve Efficiency, Sustainability, and Creativity.” *Civil Engineering and Architecture* 12 (3): 1749–72. https://doi.org/10.13189/CEA.2024.120336.

Almusaed, A., A. Almssad, I. Yitmen and R. Z. Homod. 2023. “Enhancing Student Engagement: Harnessing ‘AIED’’s Power in Hybrid Education – A Review Analysis.” *Education Sciences* 13 (7): 632. https://doi.org/10.3390/educsci13070632.

Ankiewicz, P. 2021. “Technology Education in South Africa Since the New Dispensation in 1994: An Analysis of Curriculum Documents and a Meta-Synthesis of Scholarly Work.” *International Journal of Technology and Design Education* 31 (5): 939–63. https://doi.org/10.1007/s10798-020-09589-8.

Ayoko, V. O., V. Orifah, O. Kehinde and F.T. Orifah. 2024. “Open, Distance, and E-Learning (OdeL): A Panacea for Capital Human Development.” *World Scientific News* 190 (2): 285–96.

Barker, T. 2011. “An Automated Individual Feedback and Marking System: An Empirical Study.” *Electronic Journal of E-Learning* 9 (1): 1–14. https://www.learntechlib.org/p/52053/.

Barkley, E. F. 2010. *Student Engagement Techniques: A Handbook for College Faculty*. Jossey-Bass.

Bhutoria, A. 2022. “Personalised Education and Artificial Intelligence in the United States, China, and India: A Systematic Review Using a Human-In-The-Loop Model.” *Computers and Education: Artificial Intelligence* 3: 100068. https://doi.org/10.1016/j.caeai.2022.100068.

Blake, C. 2015. *Skills Students Need for Personal and Professional Success*. Cambridge University Press.

Bond, M., K. Buntins, S. Bedenlier, O. Zawacki-Richter and M. Kerres. 2020. “Mapping Research in Student Engagement and Educational Technology in Higher Education: A Systematic Evidence Map.” *International Journal of Educational Technology in Higher Education* 17 (1): 2. https://doi.org/10.1186/s41239-019-0176-8.

Bozalek, V., and D. Ng'ambi. 2015. "The Context of Learning with Technology." In *Moving Beyond the Hype: A Contextualised View of Learning with Technology in Higher Education*, edited by W. R. Kilfoil. Universities South Africa.

Bressane, A., D. Zwirn, A. Essiptchouk, A.C. V. Saraiva, F. L. de Campos Carvalho, J. K. S. Formiga, L. C. de Castro Medeiros and R. G. Negri. 2024. "Understanding the Role of Study Strategies and Learning Disabilities on Student Academic Performance to Enhance Educational Approaches: A Proposal Using Artificial Intelligence." *Computers and Education: Artificial Intelligence* 6. https://doi.org/10.1016/j.caeai.2023.100196.

Cabezas-González, M., S. C. Martin and A. Garcia-Valcarcel. 2021. "Basic Education Students' Digital Competence in the Area of Communication: The Influence of Online Communication and the Use of Social Networks." *Sustainability* 13 (8): 4442. https://doi.org/10.3390/su13084442.

Chadegani, D. A. A., H. Salehi, M. M. Yunus, H. Farhadi, M. Fooladi, M. Farhadi and N. A. Ebrahim. 2013. "A Comparison Between Two Main Academic Literature Collections: Web of Science and Scopus Databases." *Asian Social Science* 9 (5): 18–26. https://doi.org/10.5539/ass.v9n5p18.

Chamunyonga, C., C. Edwards, P. Caldwell, P. Rutledge and J. Burbery. 2020. "The Impact of Artificial Intelligence and Machine Learning in Radiation Therapy: Considerations for Future Curriculum Enhancement." *Journal of Medical Imaging and Radiation Sciences* 51 (2): 214–20. https://doi.org/10.1016/j.jmir.2020.01.008.

Chen, C. M., C. H. Wang and J. C. Liang. 2018. "The Effects of Competitive Gaming Scenarios and Personalized Assistance Strategies on English Vocabulary Learning." *Educational Technology & Society* 21 (3): 146–58.

Chen, Y., S. Jensen, L. J. Albert, S. Gupta and T. Lee. 2022. "Artificial Intelligence (AI) Student Assistants in the Classroom: Designing Chatbots to Support Student Success." *Information Systems Frontiers* 25: 161–82. https://doi.org/10.1007/s10796-022-10291-4.

Chen, X., X. Deng, K. Chai, H. J. So and Z. Qiao. 2022. "Application and Theory Gaps During the Rise of Artificial Intelligence in Education." *Computers & Education* 172: 104239.

Chen, X., D. Zou, H. Xie, G. Cheng and C. Liu. 2022. "Two Decades of Artificial Intelligence in Education." *Educational Technology & Society* 25 (1): 28–47.

Chia, O. 2023. "Teachers vs ChatGPT: Schools Face New Challenge in Fight Against Plagiarism." *The Straits Times*. https://www.straitstimes.com/tech/teachers-v-chatgpt schools-face-new-challenge-in-fight-against-plagiarism.

Christensen, C. M. 1997. *The Innovator's Dilemma*. Havard Business School Press.

Christensen, C. M., and M. B. Horn. 2008. *Disrupting Class: How Disruptive Innovation Will Change the Way the World Learns*. McGraw-Hill Education.

Cook, A. M., and J. M. Polgar. 2014. *Assistive Technologies: Principles and Practice*: Elsevier Health Sciences.

Cope, B., M. Kalantzis and D. Searsmith. 2021. “Artificial Intelligence for Education: Knowledge and Its Assessment in AI-Enabled Learning Ecologies.” *Educational Philosophy and Theory* 53 (12): 1229–45. https://doi.org/10.1080/00131857.2020.1728732.

Crossman, K. 2019. “Is This in my Contract? How Part-Time Contract Faculty Face Barriers to Reporting Academic Integrity Breaches.” *Canadian Perspectives on Academic Integrity* 2 (1): 32–9. https://doi.org/10.55016/ojs/cpai.v2i1.68934.

Crutcher, R. A., R. Corrigan, P. O’Brien and C. G. Schneider. 2007. *College Learning for the New Global Century*. National Leadership Council of Liberal Education and America’s Promise (LEAP).

Dexter, S., and J. W. Richardson. 2020. “What Does Technology Integration Research Tell Us About the Leadership of Technology?” *Journal of Research on Technology in Education* 52 (1): 17–36. https://doi.org/10.1080/15391523.2019.1668316.

Do, H. T., L. H. Truong, M. T. Nguyen, C. F. Chien, H. T. Tran, H. T. Hua, C. V. Nguyen, H. T. T. Nguyen and N. T. T. Nguyen. 2021. “Energy-Efficient Unmanned Aerial Vehicle (UAV) Surveillance Utilizing Artificial Intelligence (AI).” *Wireless Communications and Mobile Computing* 1–11. https://doi.org/10.1155/2021/8615367.

Du Plessis, E. 2024. “The Impact of Artificial Intelligence on Teacher Training in Open Distance and Electronic Learning.” *ScienceOpen Preprints* 1–15.

Earl, L. M. 2012. *Assessment as Learning: Using Classroom Assessment to Maximize Student Learning*. Corwin Press.

Elkoubaiti, H., and R. Mrabet. 2018. “A Survey of Pedagogical Affordances of Augmented and Virtual Realities Technologies in IoT-Based Classroom.” In *IEEE 5th International Congress on Information Science and Technology (CiSt)* 334–41). https://doi.org/10.1109/CIST.2018.8596654.

European Commission. 2020. *White Paper on Artificial Intelligence: A European Approach to Excellence and Trust*. European Commission.

Fadzil, M., and T. A. Munira. 2008. “Applications of Artificial Intelligence in an Open and Distance Learning Institution.” In *2008 International Symposium on Information Technology* 1–7. IEEE. https://doi.org/10.1109/ITSIM.2008.4632043.

Faloye, S. T., and N. Ajayi. 2021. “Understanding the Impact of the Digital Divide on South African Students in Higher Educational Institutions.” *African Journal of Science, Technology, Innovation and Development* 14 (7): 1734–44. https://doi.org/10.1080/20421338.2021.1983118.

Gandedkar, N. H., M. T. Wong and M. A. Darendeliler. 2021. “Role of Virtual Reality (VR), Augmented Reality (AR) and Artificial Intelligence (AI) in Tertiary Education and Research of Orthodontics: An Insight.” *Seminars in Orthodontics* 27 (2): 69–77. https://doi.org/10.1053/j.sodo.2021.05.003.

Gao, P., J. Li and S. Liu. 2022. “An Introduction to Key Technology in Artificial Intelligence and Big Data-Driven E-Learning and E-Education.” *Mobile Networks and Applications* 26: 2123–6. https://doi.org/10.1007/s11036-021-01777-7.

García-Gorrostieta, J. M., A. López-López and S. González-López. 2018. “Automatic Argument Assessment of Final Project Reports of Computer Engineering Students.” *Computer Applications in Engineering Education* 26 (5): 1217–26. https://doi.org/10.1002/cae.21996.

George, B., and O. Wooden. 2023. “Managing the Strategic Transformation of Higher Education Through Artificial Intelligence.” *Administrative Sciences* 13 (9): 196. https://doi.org/10.3390/admsci13090196.

Goldberg, P., Ö. Sümer, K. Stömer, W. Wagner, R. Göllner, P. Gerjets, E. Kasneci and U. Trautwein. 2021. “Attentive or Not? Toward a Machine Learning to Assessing Students’ Visible Engagement in Classroom Instruction.” *Educational Psychology Review* 33: 27–49. https://doi.org/10.1007/s10648-019-09514-z.

Grassini, S. 2023. “Shaping the Future of Education: Exploring the Potential and Consequences of AI and ChatGPT in Educational Settings.” *Education Sciences* 13 (7): 692. https://doi.org/10.3390/educsci13070692.

Guz, A. N., and J. J. Rushchitsky. 2009. “Scopus: A System for the Evaluation of Scientific Journals.” *International Applied Mechanics* 45 (4): 351–62. https://doi.org/10.1007/s10778-009-0189-4.

Haldorai, A., S. Murugan and A. Ramu. 2021. “Evolution, Challenges, and Application of Intelligent ICT Education: An Overview.” *Computer Applications in Engineering Education* 29 (3): 562–71. https://doi.org/10.1002/cae.22217.

Hanewicz, C., A. Platt and A. Arendt. 2017. “Creating a Learner-Centered Teaching Environment Using Student Choice in Assignments.” *Distance Education* 38 (3): 273–87. https://doi.org/10.1080/01587919.2017.1369349.

Hollister, B., P. Nair, S. Hill-Lindsay and L. Chukoskie. 2022. “Engagement in Online Learning: Student Attitudes and Behavior During COVID-19.” *Frontiers in Education* 7. https://doi.org/10.3389/feduc.2022.851019.

Hong, Y., D. W. M. Chan, A. P. C. Chan and J. F. Y. Yeung. 2012. “Critical Analysis of Partnering Research Trend in Construction Journals.” *Journal of Management in Engineering* 28 (2): 82–95. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000084.

Hosseini, M. R., M. Maghrebi, A. Akbarnezhad, I. Martek and M. Arashpour. 2018. “Analysis of Citation Networks in Building Information Modeling Research.” *Journal of Construction Engineering and Management* 144 (8): 1–13. https://doi.org/10.1061/(ASCE)CO.1943-7862.0001492.

Huang, A. Y. Q., O.H. T. Lu and S. J. H. Yang. 2023. “Effects of Artificial Intelligence-Enabled Personalised Recommendations on Learners’ Learning Engagement, Motivation, and Outcomes in a Flipped Classroom.” *Computers & Education* 194: 104684. https://doi.org/10.1016/j.compedu.2022.104684.

Hwang, G. J., H. Xie, B. W. Wah and D. Gašević. 2020. “Vision, Challenges, Roles and Research Issues of Artificial Intelligence in Education.” *Computers and Education: Artificial Intelligence*. https://doi.org/10.1016/j.caeai.2020.100001.

Johnston, H., R. F. Wells, E. M. Shanks, T. Boey and B. N. Parsons. 2024. “Student Perspectives on the Use of Generative Artificial Intelligence Technologies in Higher Education.” *International Journal for Educational Integrity* 20: 1–21. https://doi.org/10.1007/s40979-024-00149-4.

Kabudi, T., I. Pappas and D. H. Olsen. 2021. “AI-Enabled Adaptive Learning Systems: A Systematic Mapping of the Literature.” *Computers and Education: Artificial Intelligence*. https://doi.org/10.1016/j.caeai.2021.100017.

Kashef, M., A. Visvizi and O. Troisi. 2021. “Smart City as a Smart Service System: Human–Computer Interaction and Smart City Surveillance Systems.” *Computers in Human Behavior* 124: 106923. https://doi.org/10.1016/j.chb.2021.106923.

Khlaif, Z. N., and S. Salha. 2022. “Exploring the Factors Influencing Mobile Technology Integration in Higher Education.” *Technology, Pedagogy and Education* 31 (3): 347–62. https://doi.org/10.1080/1475939X.2022.2052949.

Kiyak, Y. S., O. Coskun, I. I. Budakoglu and C. Uluoglu. 2024. “ChatGPT for Generating Multiple Choice Questions: Evidence on the Use of Artificial Intelligence in Automatic Item Generation for a Rational Pharmacotherapy Exam.” *European Journal of Clinical Pharmacology* 80: 729–35. https://doi.org/10.1007/s00228-024-03649-x.

Koltovskaia, S. (2020). Student engagement with automated written corrective feedback (AWCF) provided by Grammarly: A multiple case study. Assessing Writing, 44, 100450. https://doi.org/10.1016/j.asw.2020.100450.

Kuh, G. D. 2001. “Assessing What Really Matters to Student Learning: Inside the National Survey of Student Engagement.” *Change* 33 (3): 10–17. https://doi.org/10.1080/00091380109601795.

Kumar, A. P., P. Pjuari and N. Gupta. 2021. “Artificial Intelligence: Technology 4.0 as a Solution for Healthcare Workers During COVID-19 Pandemic.” *Acta Universitatis Bohemiae Meridionalis* 24 (1): 19–35. https://doi.org/10.32725/acta.2021.002.

Leibowitz, B. 2012. “Understanding the Challenges of the South African Higher Education Landscape.” In *Community, Self and Identity: Educating South African University Students for Citizenship*, edited by B. Leibowitz, L. Swartz, V. Bozalek, R. Carolissen, L. Nicholls and P. Rohleder. HSRC Press.

Li, C., and F. Lalani. 2020. “The COVID-19 Pandemic Has Changed Education Forever. This Is How.” https://www.weforum.org/agenda/2020/04/coronavirus-education-global-covid-19-online-digital-learning.

Limonova, V., H. S. Mamede, A. Santos and V. M. Filipe. 2023. “The Context of Research in Artificial Intelligence and Gamification to Improve Student Engagement and Attendance in Higher Education.” *REaD-Revista de Educacao a Distancia e Elearning* 6 (2). https://doi.org/10.34627/redvol6iss2e202309.

Loos, L. A., and M. E. Crosby. 2017. “Gamification Methods in Higher Education.” In *Learning and Collaboration Technologies. Novel Learning Ecosystems*, edited by P. Zaphiris and A. Ioannou, 474–86. https://doi.org/10.1007/978-3-319-58509-3_37.

Lubisi, A. H., D. Samsudin, R. Triarisanti, M. I. Jerusalem and Y. Hwang. 2024. “A Bibliometric Mapping Analysis of Publications on the Utilization of Artificial Intelligence Technology in Language Learning.” *Journal of Advanced Research in Applied Sciences and Engineering Technology* 38 (1): 156–76. https://doi.org/10.37934/araset.38.1.156176.

Manocha, S., P. Pujari and A. Naseeha. 2022. “Disruptive Technologies Transforming Lives with Reference to COVID-19 Online Education: A Review Paper.” *Acta Universitatis Bohemiae Meridionalis* 25 (2): 80–90. https://doi.org/10.32725/acta.2022.010.

McCarthy, J. 1956. “AI as Sport.” *Science* 276 (5318): 1518–9. https://doi.org/10.1126/science.276.5318.1518.

Mehtab, F. H., and A. Mahmud. 2022. “Robots in the Neighbourhood: Application and Criminalization of the Artificial Intelligence in Education.” In *Technologies, Artificial Intelligence and the Future of Learning Post-COVID-19*, edited by A. Hamdan, A. E. Hassanien, T. Mescon and B. Alareeni. Springer. https://doi.org/10.1007/978-3-030-93921-2_22.

Mousavinasab, E., N. R. Zarifsanaiey, S. Niakan Kalhori, M. Rakhshan, L. Keikha and M. Ghazi Saeedi. 2021. “Intelligent Tutoring Systems: A Systematic Review of Characteristics, Applications, and Evaluation Methods.” *Interactive Learning Environments* 29 (1): 142–63. https://doi.org/10.1080/10494820.2018.1558257.

Neudert, L. M., P. Howard and B. Kollanyi. 2019. “Sourcing and Automation of Political News and Information During Three European Elections.” *Social-Media + Society* 5 (3). https://doi.org/10.1177/2056305119863147.

Nguyen, A., Y. Hong and L. Gardner. 2020. “A Taxonomy of Digital Learning Activities for Digital Inclusion.” *Proceedings of the 28th European Conference on Information Systems (ECIS)*. https://aisel.aisnet.org/ecis2020_rp/135.

Nguyen, A., S. Järvelä, Y. Wang and C. Róse. 2022. “Exploring Socially Shared Regulation with an AI Deep Learning Approach Using Multimodal Data.” *Proceedings of International Conferences of Learning Sciences (ICLS)*. https://2022.isls.org/proceedings/.

Nguyen, A., M. Kremantzis, A. Essien, I. Petrounias and S. Hosseini. 2024. “Enhancing Student Engagement Through Artificial Intelligence (AI): Understanding the Basics, Opportunities, and Challenges.” *Journal of University Teaching and Learning Practice* 21 (6). https://doi.org/10.53761/caraaq92.

Novick, P. A., J. Lee, S. Wei, E. C. Mundorff, J. C. Santangelo and M. Timothy. 2022. “Maximizing Academic Integrity While Minimizing Stress in the Virtual Classroom.” *Journal of Microbiology & Biology Education* 23 (1). https://doi.org/10.1128/jmbe.00292-21.

Oravec, J. A. 2022. “AI, Biometric Analysis, and Emerging Cheating Detection Systems: The Engineering of Academic Integrity?” *Education Policy Analysis Archives* 30: 175. https://doi.org/10.14507/epaa.30.5765.

Paek, S., and N. Kim. 2021. “Analysis of Worldwide Research Trends on the Impact of Artificial Intelligence in Education.” *Sustainability* 13 (14): 7941. https://doi.org/10.3390/su13147941.

Pangrazio, L., N. Selwyn and B. Cumbo. 2022. “A Patchwork of Platforms: Mapping Data Infrastructures in Schools.” *Learning, Media and Technology* 48 (1): 65–80. https://doi.org/10.1080/17439884.2022.2035395.

Papakonstantinidis, S., P. Kwiatek and F. Spathopoulu. 2024. “Embrace or Resist? Drivers of Artificial Intelligence Writing Software Adoption in Academic and Non-Academic Contexts.” *Contemporary Educational Technology* 16 (2). https://doi.org/10.30935/cedtech/14250.

Pascarella, E. T.. and P. T. Terenzini. 2005. *How College Affects Students: A Third Decade of Research (Vol. 2)*. Jossey-Bass.

Pinchbeck, J., and C. Heaney. 2022. “The Impact of Online Forum Use on Student Retention in a Level 1 Distance Learning Module.” *Athens Journal of Education* 9 (1): 103–18. https://doi.org/10.30958/aje.9-1-7.

Pinter, R., S. M. Cisar, Z. Balogh and H. Manojlovic. 2020. “Enhancing Higher Education Student Class Attendance Through Gamification.” *Acta Polytechnica Hungarica* 17 (2): 13–33. https://doi.org/10.12700/APH.17.2.2020.2.2.

Pretorius, R., S. Carow, G. Wilson and P. Schmitz. 2021. Using real-world engagements for sustainability learning in ODeL in the Global South: Challenges and opportunities. International Journal of Sustainability in Higher Education. https://doi.org/10.1108/IJSHE-08-2020-0287.

Rad, P., M. Roopaei, N. Beebe, M. Shadaram and Y. Au. 2018. “AI Thinking for Cloud Education Platform with Personalized Learning.” *Proceedings of the 51st Hawaii International Conference on System Sciences*. Presented at the Hawaii International Conference on System Sciences. https://doi.org/10.24251/HICSS.2018.003.

Raja, M., and G. G. Priya. 2021. “Conceptual Origins, Technological Advancements, and Impacts of Using Virtual Reality Technology in Education.” *Webology* 18 (2). https://doi.org/10.14704/WEB/V18I2/WEB18311.

Ramaila, S., and A. J. Molwele. 2022. “The Role of Technology Integration in the Development of 21st Century Skills and Competencies in Life Sciences Teaching and Learning.” *International Journal of Higher Education* 11 (5). https://doi.org/10.5430/ijhe.v11n5p9.

Ramos-Rodríguez, A. R., and J. Ruíz-Navarro. 2004. “Changes in the Intellectual Structure of Strategic Management Research: A Bibliometric Study of the *Strategic Management Journal*, 1980–2000.” *Strategic Management Journal* 25 (10): 981–1004. https://doi.org/10.1002/smj.397.

Selvaraju, K., S. Srinivasan and M. Murugan. 2022. “Deep Learning for Student Performance Prediction.” *Journal of Educational Data Mining* 14 (1): 127–52.

Seo, K., J. Tang, I. Roll, S. Fels and D. Yoon. 2021. “The Impact of Artificial Intelligence on Learner–Instructor Interaction in Online Learning.” *International Journal of Educational Technology in Higher Education* 18: 54. https://doi.org/10.1186/s41239-021-00292-9.

Sharma, U., P. Tomar, H. Bhardwaj and A. Sakalle. 2021. “Artificial Intelligence and Its Implications in Education.” In *Impact of AI Technologies on Teaching, Learning, and Research in Higher Education*, edited by S. Verma and P. Tomar, 222–35. https://doi.org/10.4018/978-1-7998-4763-2.ch014.

Sharples, M. 2022. “Automated Essay Writing: An AIED Opinion.” *International Journal of Artificial Intelligence in Education* 32 (4): 1119–26. https://doi.org/10.1007/s40593-022-00300-7.

Strobl, C., E. Ailhaud, K. Benetos, A. Devitt, O. Kruse, A. Proske and C. Rapp. 2019. “Digital Support for Academic Writing: A Review of Technologies and Pedagogies.” *Computers & Education* 131: 33–48. https://doi.org/10.1016/j.compedu.2018.12.005.

Syahrizal, S., F. Yasmi and T. Mary. 2024. “AI-Enhanced Teaching and Materials for Education: A Shift Towards Digitalization.” *International Journal of Religion* 5 (1): 203–17. https://doi.org/10.61707/j6sa1w36.

Taguma, M., E. Feron and M. H. Lim. 2018. *Future of Education and Skills 2030: Conceptual Learning Framework*. Organization of Economic Co-operation and Development.

Tausczik, Y. R., and J. W. Pennebaker. 2023. “The Impact of AI Chatbots on Academic Integrity: A Review of the Literature.” *Educational Technology Review* 33 (1): 1–21.

Trowler, V. 2010. *Student Engagement Literature Review*. Higher Education Academy.

Uğur, S., and G. Kurubacak. 2019. "Technology Management Through Artificial Intelligence in Open and Distance Learning." In *Handbook of Research on Challenges and Opportunities in Launching a Technology-Driven International University*, 338–68). IGI Global.

Urlaub, P., and E. Dessein. 2022. "From Disrupted Classrooms to Human–Machine Collaboration? The Pocket Calculator, Google Translate, and the Future of Language Education." *L2 Journal* 14 (1): 45–59. https://doi.org/10.5070/L214151790.

Vieira, E. S., and J. A. N. F. Gomes. 2009. "A Comparison of Scopus and Web of Science for a Typical University." *Scientometrics* 81 (2): 587–600.

Villegas-Ch, W., M. Román-Cañizares and X. Palacios-Pacheco. 2020. "Improvement of an Online Education Model with the Integration of Machine Learning and Data Analysis in an LMS." *Applied Sciences* 10 (15): 5371. https://doi.org/10.3390/app10155371.

Vincent-Lancrin, S., and R. van der Vlies. 2020. "Trustworthy Artificial Intelligence (AI) in Education: Promises and Challenges." OECD Publishing. https://doi.org/10.1787/a6c90fa9-en.

Walkington, C., and M. L. Bernacki. 2020. "Appraising Research on Personalized Learning: Definitions, Theoretical Alignment, Advancements, and Future Directions." *Journal of Research on Technology in Education* 52 (3): 235–52. https://doi.org/10.1080/15391523.2020.1747757.

Walter, Y. 2024. "Embracing the Future of Artificial Intelligence in the Classroom: The Relevance of AI Literacy, Prompt Engineering, and Critical Thinking in Modern Education." *International Journal of Educational Technology in Higher Education* 21: 15. https://doi.org/10.1186/s41239-024-00448-3.

Xie, H., H.-C. Chu, G.-J. Hwang and C.-C. Wang. 2019. "Trends and Development in Technology-Enhanced Adaptive/Personalized Learning: A Systematic Review of Journal Publications from 2007 to 2017." *Computers & Education* 140: 103599. https://doi.org/10.1016/j.compedu.2019.103599.

Xiong, Y., Y. Shi, Q. Pu and N. Liu. 2023. "More Trust or More Risk? User Acceptance of Artificial Intelligence Virtual Assistant." *Human Factors and Ergonomics in Manufacturing & Service Industries* 34 (3): 190–205. https://doi.org/10.1002/hfm.21020.

Yilmaz, A. 2021. "The Effect of Technology Integration in Education on Prospective Teachers' Critical and Creative Thinking, Multidimensional 21st Century Skills and Academic Achievements." *Participatory Educational Research* 8 (2): 163–99. https://doi.org/10.17275/per.21.35.8.2.

Yusuf, A., N. Pervin and M. Roman-Gonzalez. 2024. “Generative AI and the Future of Higher Education: A Threat to Academic Integrity or Reformation? Evidence from Multicultural Perspectives.” *International Journal of Educational Technology in Higher Education* 21: 21. https://doi.org/10.1186/s41239-024-00453-6.

Zawacki-Richter, O., V. I. Marín, M. Bond and F. Gouverneur. 2019. “Systematic Review of Research on Artificial Intelligence Applications in Higher Education – Where Are the Educators?” *International Journal of Educational Technology in Higher Education* 16 (1): 1–27. https://doi.org/10.1186/s41239-019-0171-0.

Zhang, C., Y. Meng and X. Ma. 2024. “Artificial Intelligence in EFL Speaking: Impact on Enjoyment, Anxiety, and Willingness to Communicate.” *System* 121. https://doi.org/10.1016/j.system.2024.103259.

Zheng, X., Y. Le, A. P. C. Chan, Y. Hu and Y. Li. 2016. “Review of the Application of Social Network Analysis (SNA) in Construction Project Management Research.” *International Journal of Project Management* 34 (7): 1214–25. https://doi.org/10.1016/j.ijproman.2016.06.005.

Zheng, L., L. Zhong, J. Niu, M. Long and J. Zhao. 2021. “Effects of Personalized Intervention on Collaborative Knowledge Building, Group Performance, Socially Shared Metacognitive Regulation, and Cognitive Load in Computer-Supported Collaborative Learning.” *Educational Technology & Society* 24 (3): 174–93.