A review of the implications of artificial intelligence tools in higher education. Should we panic?

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Abstract

Recently, Artificial Intelligence (AI) tools are taking higher education or the education sector in general by storm. Artificial Intelligence is among the emerging tools in educational technology. Numerous Application Programming interfaces (APIs) exist. However, recent developments in AI have seen the emergence of tools such as ChatGPT, QuillBot, and CopyMatic in the higher education sector. However, it is unclear whether AI tools broadly have pedagogical advantages and how they will influence meaningful teaching and learning in higher education. The big question is, should the higher education sector panic? There are concerns about student autonomy and authentic learning. Or should we embrace this disruption, bring students to the conversation, and find new and creative ways of teaching, learning, and assessing in the wake of emerging AI? This review provides an overview of the recent emerging AI tools in the higher education setting and critiques their implications on the pedagogical landscape. The search retrieved sixty-three (63) journal articles for synthesis. The desktop search relied on Scopus and Web of Science databases. This review argues that AI use in the higher education sector could transform higher education through improved productivity, access, and affordability, enhancing student success, supporting research and stakeholder collaboration, identifying at-risk students, and personalised learning experiences employing tutoring systems with other opportunities if meaningfully integrated. However, on the other end of the spectrum are concerns and fears concerning the use of AI that include but are not limited to algorithmic bias and discrimination, ethics, transparency, data privacy and security, and student autonomy, including the potential for job losses for teachers. The review concludes and makes recommendations for the higher education sector or higher learning institutions on integrating AI responsibly and effectively by strengthening the connection with pedagogical perspectives.

Keywords: Artificial intelligence, benefits, challenges, effective teaching and learning, higher education.

1. Introduction

Haleem et al. [1] define Artificial Intelligence (AI) as a branch of computer science that enables computers to emulate and understand human behaviour, including communication. Artificial intelligence model-based computers or machines are trained based on data provided to create intelligent computers/ machines that can comprehend, respond, and perform certain functions as people. Typical examples include natural language models, robotics, speech and picture recognition, problem-solving models, and more. Rapid advances in AI have seen a massive development of computing and information processing techniques and applications, which perform tasks that simulate intelligent human behaviour [2] including making inferences, analysis, and decision-making. Artificial intelligence has demonstrated increasing power in

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processing where larger models are trained with machine learning algorithms; big data analytics and improvements in learning algorithms [3]. Soon, AI is predicted to perform increasingly complex tasks that rival human cognitive capabilities. Various economic sectors have made strides in AI development; these include transport (autonomous vehicles), healthcare (use of computer-aided medical diagnosis software), banking and insurance, retail, and science. Arguably, the future and today's world of work are significantly shaped by technology such as AI and machine learning, which are anticipated to impact economies, and society [4]. Cockburn, Henderson and Stern [5] indicate that the burst or advances in the field of AI have huge implications for economies and society at large as they directly influence innovation and production of a wide range of products and services. Therefore, this disruption has implications for productivity, employment, and competition.

With the exponential growth in AI advancement in society in general, the education sector and higher education are not exceptional. Verma [6] alludes to the fact that AI already contributes immensely to the education sector, for example, in educational and research technology and administrative/ management operations. Hwang et al. [2] citing O'Shea and Self indicate that the field of AI application in education has made progress for over 30 years, with numerous applications of AI in education. These include, for example, the use of classroom robotics to enhance learning, motivate and engage students, and create personalised learning experiences for specific students. Precision education emphasises prevention and intervention practices in line with students' learning preferences and personal attributes. Here, individual learners are analysed for their learning behaviours through intelligent tutor systems that allow teachers' knowledge and intelligence into the decision-making process.

Although the incorporation of AI systems in higher education has been postulated to positively enhance some educational attributes, such as improved productivity and the quality of communication, and personalised support and experiences for students, there are rising concerns about whether AI will erode the pedagogical value of higher education, student autonomy/ responsibility, agency, issues of algorithm bias, ethics and privacy among other concerns. If not addressed, these issues of AI systems have grave implications for the higher education sector and society. It is critical to ensure optimising the positive implications of AI systems in the higher education setting while minimising the negative results. This review article explores the implications of AI in higher education and makes suggestions or recommendations.

2. The rise of Artificial Intelligence in higher education

Globally, numerous AI tools or applications have been implemented in higher education. These include predictive modelling, AI computer-assisted content analysis, assistive technology (chatbots), intelligent analytics, image analytics (facial recognition), personalisation, and AI software tools and algorithms [7]. Artificial Intelligence educational predictive models use existing large datasets to estimate or provide insights that can guide decision-making that can

be time-saving and cost-effective [8]. For example, AI educational predictive models/ applications can predict students' attrition (dropout and pass) rates. Salas-Pilco and Yang [7] found AI computer-assisted content analysis as utilised by higher educational institutions to be adopting natural language processing (NLP) algorithms that extract information from university documents and datasets. The extracted dataset can generate useful insights, for example, teacher evaluations through student evaluations or curriculum analysis. Assistive AI technology (chatbots) consists of AI and natural language processing that allows interaction between a human (student) and computer technology through text or voice [9]. The Assistive AI technology (chatbots) acts as virtual assistants that can answer questions and provide real-time appropriate responses. Intelligent analytics are AI-based algorithms capable of processing and providing evidence from educational data through statistical analysis [7] citing Sun & Stranieri. Examples of intelligent analytics include identifying indicators of graduates' employability and analysis of academic research performance and productivity. The increasing service needs for students and college/ university management have given rise to image analytics (such as facial recognition). Traditional education management systems or models cannot meet the efficiency and safety of students and school management cannot be guaranteed [10]. Personalised education and AI [11] are achieved through big data and AI applications that can monitor and provide useful insight into a student's learning trajectory. From this, a student's educational experience can be enhanced by creating custom learning material for specific learning environments, custom tests, and evaluations; and providing instructors with information about possible learning hindrances for a particular student. Numerous AI tools, software, and algorithms are utilised in higher education systems, for example, open-source software packages that include, R and Python programming languages, Moodle Learning Management System (LMS), and other proprietary software such as Statistical Package for the Social Sciences (SPSS), Grammarly and Turnitin (writing and plagiarism packages) and automated grading and feedback mechanisms (tools). Recent developments in AI have seen the emergence of tools such as ChatGPT, QuillBot, and CopyMatic in the higher education sector.

3. Theoretical framework

A theoretical framework is a grounding base for an inquiry that informs literature, the methodological approach, and analysis [12]. A theoretical framework, according to Passey [13] "arises from outcomes beyond a single study, based on one or more theories." It is therefore important to have a theoretical framework in the research process, to select a topic, develop research questions, and conceptualise the literature review and the research design, including the analysis. In this review paper, we adopt the "Framework for the roles of Artificial Intelligence in Education (AIED)" by Hwang et al. [2]. This framework unpacks AI roles in education, which include intelligent tutoring, tutee roles, learning tools/ partners, or advisory for policymaking.

According to Hwang et al. [2], the intelligent tutor role is the principal component of AIED tools. This includes smart tutoring systems and customised learning systems with features of cognitive tutors to supplement tutoring. These are more common in mathematics and science education. Other tutoring intelligent tutor systems are dialogue-based, enhancing learning and critical thinking achieved from real-time student feedback. Besides, AI offers learners (AI tutees) opportunities to understand difficult and complex concepts by promoting deep learning competencies and knowledge creation through AI systems that can learn through their interaction with humans. These are AI chatbots based on natural language processing and artificial neural networks. Constructivism and student-centred learning are critical in higher education as strategies to promote student learning outcomes and ensure academic success [14]. From this pedagogical perspective, AI learning tools or partners gather and scrutinise student data more efficiently, invoking students' deeper learning and enquiry, such as making inferences and predicting outcomes [2]contrary to low-level tasks. Artificial intelligence tools can organise, analyse and compute data in "smart" ways such as providing hints, concept mapping, visualisations, and graphs that foster in-depth thinking by learners as they connect to underlying data and make inferences. Not only does AIED assist learners and teachers, but also the administration, governance, and management roles for the educational landscape. For example, by providing sound, accurate, and precise policymaking decisions. Artificial Intelligence tools or techniques can inform and guide policy development in education, for example, by understanding educational trends and problems from the micro (student/ teacher/ course/ programme) and macro (college/ university/ sector) levels.

4. Methods and materials

A systematic literature review was done concerning AI's implications in higher learning institutions. A systematic literature review is a rigorous standardised scientific method to collect and synthesise secondary data on a specific subject matter or topic based on existing research or studies. Specifically, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) were applied to this desktop search. Sixty-three (63) journal articles were retrieved using two common databases – Scopus and Web of Science (WoS). A desktop search using search terms, instructions, or search code “TITLE-ABS-KEY (artificial AND intelligence AND impact AND in AND higher AND education)” generated 419 and 660 journal results in Scopus and Web of Science platforms, respectively. Limiting or refining the Scopus search to articles, English language, and higher education search string or query “TITLE-ABS-KEY (artificial AND intelligence AND impact AND in AND higher AND education) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (EXACTKEYWORD , "Higher Education")) AND (LIMIT-TO (LANGUAGE , "English"))” resulted in 43 journal results. Limiting or refining the Web of Science search to open access, articles, English language, and higher education “Refined By: Open Access. Document Types: Article. Languages: English. Web of Science Categories: Education Educational Research” resulted in 38 journal results. From the Scopus and WoS databases, seven (7) duplicate results were excluded resulting in the final review synthesis of 63 journal articles. Fig. 1 outlines the PRISMA processes.

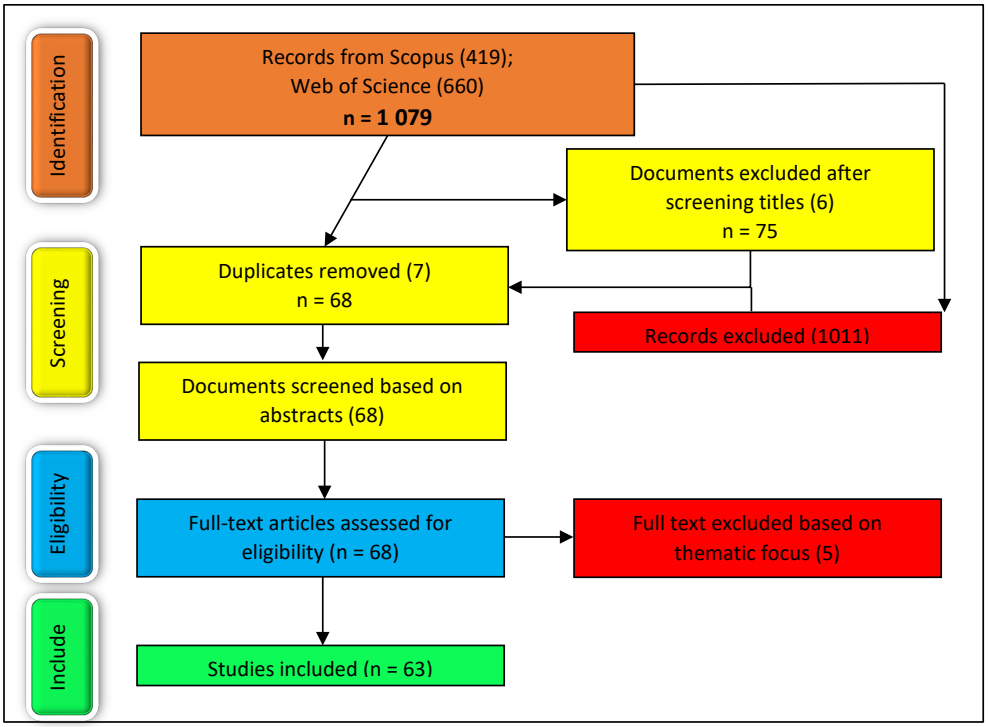

Fig. 1. The PRISMA systematic literature review selection process Source: Authors (2022)

Table 1 details the inclusion or exclusion criteria used. All articles used in the final review analysis were from academic journals, published in English, and indexed with reputable platforms (Scopus and WoS), which are commonly recognised databases, implying the sources were credible and of academic integrity. The retrieved papers or articles focused on the implications or impacts of AI in higher education (university or college) settings.

Table 1. Inclusion or exclusion criteria

Include article if	**Exclude article if**
Published in English	The publication is not in English
Journal article	Not a journal source
The focus is on AI in higher education (university or college) setting	The focus is not on AI in higher education (university or college) setting

Source: Authors

5. Results and discussion

Tables 2 and 3 summarise the results of the systematic review of the implications of AI in higher education. Tables 2 and 3 detail the advantages and concerns of AI systems in higher education settings, respectively.

5.1 Advantages and opportunities of artificial intelligence in higher education

Our review analysis shows that AI use in higher education has prospects to improve efficiency and reduce administrative burdens (Table 2). For example, Elkhodr, Gide, Wu and Darwish [15] in their findings reveal that most students who used the Generative Artificial Intelligence (GenAI) tool ChatGPT improved their performance such as user functionality, workflow, and command of the content, contrary to students that used the traditional search engines. Again, Breines and Gallagher [16] demonstrate that the AI Teacherbot (a chatbot) alleviated teachers' workload by handling routine queries and providing real-time student support. Therefore, AI use in higher education helps teachers succeed in their professional activity and is also time-saving concerning planning for the teaching content [17]. This attribute of AI is also supported by Tavares et al. [18] that the advantage of Neural Machine Translation (NMT) tools in technical translation includes improved efficiency and speed that assist students' work and productivity streamlines the translation process.

In Table 2, our review analysis suggests that AI use in higher education could enhance personalised learning experiences for students. Breines and Gallagher [16] found that an AI Teacherbot (a chatbot) offers personalised and interactive learning experiences for students, therefore enhancing student engagement and understanding of the course materials. This implies the innovative and transformative power of AIED in promoting inclusive learning. Similarly, Molontay et al. [19] present a novel data-reliant probabilistic student flow framework that portrays prerequisite combinations or features of courses in line with their impact on programme completion time. This AI-based student flow model is suitable for evaluating paramount curricula reforms and educational transformation.

Again, Williams [20] reveals that AI and blockchain integration in competency-based education can revolutionise educational institutions by creating personalised learning trajectories for students informed by individual students' potential and weaknesses. Here, Blockchain is used in tracking and verifying students' competencies through a secure and transparent credentials and recognition system.

Table 2. Results on the advantages of Artificial Intelligence in higher education environments

Advantages and opportunities of AI use in HE	**Sources**
Prospects for improving efficiency, communication and reducing administrative burden (time-saving)	For example, Wu and Darwish [15]; Breines and Gallagher [16]; Bucea-Manea-Ţoniş et al [17]; Tavares et al. [18]; Álvarez-Álvarez and Falcon [21]; Archibald et al. [22]; Chaka [23]; Cui [24]; Elkhodr, Gide, Escotet [25]; Kumar and Boulanger [26]; Page and Gehlbach [27]; Popenici and Kerr [28]; Razia, Awwad and Taqi [29]; Shenkoya and Kim [30]; Vinichenko, Melnichuk and Karácsony [31]; Yang and Chang [32]
Enhanced personalised learning experiences for students, thus improving academic performance	For example, Essel et al. [9]; Breines and Gallagher [16]; Molontay et al. [19]; Williams [20]; Chaka [23]; Escotet [25]; Page and Gehlbach [27]; Yang and Chang [32]; Ahmad [33]; Chaudhry et al. [34]; Langenfeld, Burstein and von Davier [35]; Muniasamy and Alasiry [36]; Seo et al. [37]; Wang et al. [38]; Yang, Lian and Zhao [39]

Identifying students at risk and offering timely interventions	For example, Bucea-Manea-Țoniș et al [17]; Archibald et al. [22]; Hinojo-Lucena et al. [40]
AI can enhance writing and facilitate research, science, and data mining and analysis processes, including opportunities for research in the AI area	For example, Popenici and Kerr [28]; Vinichenko, Melnichuk and Karácsony [31]; Arteaga, Gravini-Donado and Riva [41]; Bauer et al. [42]; Dergaa et al. [43]; Rohlfshagen et al. [44]; Villaseñor, Arencibia-Jorge & Carrillo-Calvet [45]
Enhancing teaching, learning and assessment methods/ practices (removing difficulties in learning), enhancing pedagogical perspectives	For example, Bucea-Manea-Țoniș et al. [17]; Álvarez-Álvarez and Falcon [21]; Chaka [23]; Kumar and Boulanger [26]; Popenici and Kerr [28]; Shenkoya and Kim [30]; Chaudhry et al. [34]; Wang et al. [38]; de Vries [46]; Gudiño Paredes, Jasso Peña and de La Fuente Alcazar [47]; Killian et al. [48]; Leoste et al. [49]; Lin et al. [50]; Montalvo, Palomo and de la Orden [51]; Ramírez et al. [52]; Shardlow, Sellar and Rousell [53]; Sullivan, Kelly and McLaughlan [54]; Sun, Zhang and Lei [55]; Tsai et al. [56]
AI can offer a platform to prepare students for the future world of work	For example, Williams [20]; Chaka [23]; Yang and Chang [32]; Ahmad [33]; Yang, Lian and Zhao [39]; Al-Maskari, Sullivan, Kelly and McLaughlan [54]; Tsai et al. [56]; Al Riyami and Ghnimi [57]
AI provides a platform to improve student motivation and engagement, including enriching the classroom) and student satisfaction	For example, Essel et al. [9]; Bucea-Manea-Țoniș et al [17]; Lin et al. [50]; Montalvo, Palomo and de la Orden [51]; Ramírez et al. [52]; Tsai et al. [56]; Bhavana and Vijayalakshmi [58]; Fratto, Sava and Krivacek [59]; Liu et al. [60]; Molinillo, Aguilar-Illescas, Anaya-Sánchez and Vallespín-Arán [61]; Pospíšilová and Rohlíková [62]; Tautz, Sprenger and Schwaninger [63]; Zhang et al. [64]
Boosts collaborative work/ learning	For example, Chaka [23]; Melnichuk and Karácsony [31]; Ahmad [33]; Tsai et al. [56]; Vinichenko, Zhang et al. [64]; Bucea-Manea-Țoniș et al. [65]
Enhancing feedback and supporting peer-feedback	For example, Álvarez-Álvarez and Falcon [21]; Escotet [25]; Kumar and Boulanger [26]; Chaudhry et al. [34]; Langenfeld, Burstein and von Davier [35]; Bauer et al. [42]; Molinillo, Aguilar-Illescas, Anaya-Sánchez and Vallespín-Arán [61]; Pospíšilová and Rohlíková [62]; Tautz, Sprenger and Schwaninger [63]; Lee et al. [66]; Malik et al. [67]
Enhances creativity, innovation, critical thinking, problem-solving, knowledge construction and deep learning for a sustainable curriculum	For example, Shenkoya and Kim [30]; Melnichuk and Karácsony [31]; Muniasamy and Alasiry [36]; Yang, Lian and Zhao [39]; de Vries [46]; Leoste et al. [49]; Liu et al. [60]; Pospíšilová and Rohlíková [62]; Vinichenko, Zhang et al. [64]; Lee et al. [66];

Source: PRISMA review outcome and analysis by authors

Not all students are at the same cognitive levels and others struggle with various aspects. Artificial intelligence platforms present tools that efficiently identify struggling (at-risk students) students and offer timely interventions (Table 2). In their bibliometric analysis, Hinojo-Lucena et al. [40] found that several studies demonstrated that virtual tutoring was among the primary systems to improve student success by employing intelligent systems that predict students' moods through neural network-based algorithms capable of detecting individual learning styles. This is also substantiated by Bucea-Manea-Țoniș et al. [17] who validate AI usage to help teachers gain insight into student performance. By so doing, this helps teachers identify students at risk and suggest interventions such as additional instruction or warnings for students' risky behaviours.

Research is one of the critical aspects of knowledge production and innovation in institutions of higher learning. Table 2 review analysis also shows that AI can facilitate research and data analysis. Bauer et al. [42] demonstrate the efficacy of, for example, the integration of natural language processing (NLP) that offers a peer-feedback mechanism for a collaborative and cross-disciplinary framework for research and development. Therefore, AI can revolutionise knowledge systems and research processes.

Numerous concerns in higher education include the quality of the teaching and learning unintentionally brought about by traditional teaching and learning practices. Fortunately, AI use in higher education can enhance teaching and learning methods (Table 2). Sun, Zhang and Lei [55] highlight the role-playing teaching method supported by mobile Internet, AI, and other technologies. In their study, they found AI to effectively improve the uptake of learning resources, teachers' professionalism, and the regulation of teaching methods such as role-playing. Therefore, AI significantly improves the efficient usage of learning resources; and self-planning, monitoring, regulation, and evaluation by learners. This implies a teacher-led but student-centred model. Indeed, Bucea-Manea-Ţoniş et al [17] portray that better ways to teach such as audio, video, and e-books, emanating from personalised learning experiences (discussed earlier) achieved through AI significantly contribute to the quality of teaching and learning process. Sullivan, Kelly and McLaughlan [54] contend that the use of AI enhances student learning, for example, ChatGPT allows simple language extrapolations for complex concepts, recommends a well-structured outline for assignment writing or tasks, and provides grammatical feedback, including demo or practice quiz questions for test preparation which all improve learning. Further, Tsai et al. [56] show that incorporating Artificial Intelligence of Things (AIOT) enhances students' comprehension of cutting-edge concepts and practical applications in AI and the Internet of Things. Again, hands-on experiences and project-based learning, sharpen students' critical problem-solving skills.

de Vries [46] found that AI provides creativity and innovative problem-solving to complex engineering problems, for example, for engineering students, thus improving students' learning experiences that prepare them for a technology-driven workforce (Table 2). Arguably, AI prepares students for the future. Al-Maskari, Al Riyami and Ghnimi's [57] findings suggest that students' knowledge of the fourth industrial revolution (4IR) technologies impact their future preparedness. The implication is to adopt 4IR technologies, academic programmes, training, and other factors vital for enculturating students for the future. For example, Sullivan, Kelly and McLaughlan [54] suggest that students' use of AI such as ChatGPT improves their employability, as these AI tools are revolutionising business. Again, Williams [20] postulates that shifting towards AI and blockchain competency-based education enhances the employability outcomes of students by bridging the academia/ industry demands gap. In an

increasingly changing society's digital transformation, integrating AIOT education can help prepare students for future careers in technology-driven industries [56].

The higher education sector, without a doubt, is struggling with student motivation and engagement issues. This review demonstrates that AI use in higher education can improve student motivation and engagement (Table 2). For example, Bhavana and Vijayalakshmi [58] examined the use of augmented reality through a smartphone application on the learning motive of students. Their findings show that "attention, relevance, confidence, and satisfaction" were positively influenced by augmented reality. The finding implies that using augmented reality smartphone application/s motivates and assists students in learning. This aligns with Bucea-Manea-Țoniș et al. [17] that AI improves student performance and engagement. Artificial Intelligence of Things boosts students' motivation and engagement, likely to improve academic performance [56].

In the world of emerging global complex challenges, collaboration and interdisciplinary are increasingly being emphasised. Artificial Intelligence use in higher education can boost collaborative work and learning (Table 2). For example, Bucea-Manea-Țoniș et al. [65] demonstrate that blockchain-based tools in higher education boost student collaboration. There is evidence to corroborate that student collaboration supports students' motivation and increased engagement level in learning and, thus, academic success (learning outcomes). Again, Tsai et al. [56] reveal that AIOT offers opportunities for creativity through teamwork, thus enabling students to adapt to an increasingly evolving technological landscape.

Table 2 shows that higher education institutions could also benefit from AI use to support peer feedback. Peer feedback is also an acclaimed strategy for student success. Bauer et al. [42] show that the use of natural language processing supports peer feedback by enabling automatic analysis and understanding of textual feedback among peers. Therefore, NLP demonstrates enhanced efficiency and accuracy in processing and providing timely and constructive feedback.

de Vries [46] shows that AI-powered systems, for example, for engineering students, bring creativity, critical thinking, and problem-solving skills. Artificial Intelligence, in this case, allows engineering students to partake in hands-on experiences through enhanced design and its application on projects (Table 2). Therefore, AI use in higher education could enhance creativity, innovation, and critical thinking, all attributes of academic success.

5.2 Concerns and challenges of Artificial Intelligence in higher education

Despite AI's vast opportunities or prospects in higher education, various concerns and challenges have emerged (Table 3). Among these concerns is the threat to employment for teachers and support staff (that is the potential for human skills loss) (Table 3). For example,

Tavares, et al. [18] highlight the concern of Neural Machine Translation (NMT) tools in technical translation and the possibility of skills loss, drawing attention to the need for a balanced adaptive approach (that is, leveraging AI benefits while preserving the human translation expertise).

Table 3. Results on the concerns and challenges of Artificial Intelligence in higher education

Concerns and challenges of AI use in HE	**Sources**
Threat to employment for teachers and support staff (potential for human skills loss) and changing roles of instructors	For example, Tavares et al. [18]; Popenici and Kerr [28]; Ahmad [33]; Cox [68];
Ethical consideration issues - data privacy, surveillance and algorithmic biases	For example, Bucea-Manea-Ţoniş et al. [17]; Williams [20]; Álvarez-Álvarez and Falcon [21]; Kumar and Boulanger [26]; Popenici and Kerr [28]; Chaudhry et al. [34]; Seo et al. [37]; de Vries [46]; Gudiño Paredes, Jasso Peña and de La Fuente Alcazar [47]; Killian et al. [48]; Cox [68]; Garay Gallastegui and Reier Forradellas [69]
The need for training by teachers and students (teachers are not experts in AI – technical challenges)	For example, Essel et al. [9]; Bucea-Manea-Ţoniş et al. [17]; Chaka [23]; Killian et al. [48]; Leoste et al. [49]; Malik et al. [67] Almaraz-López, Almaraz-Menéndez, and López-Esteban [70]
Overreliance on AI – implications on critical thinking and creativity	For example, Popenici and Kerr [28]; Garay Gallastegui and Reier Forradellas [69]
Unequal access to AI resources among institutions and students	For example, Bucea-Manea-Ţoniş et al. [17]; Chaka [23]; Razia, Awwad and Taqi [29]; Leoste et al. [49]; Fratto, Sava and Krivacek [59]; Cox [68]; Crittenden, Biel and Lovely III [71]; Usher and Hershkovitz [72]
Considerations for academic authenticity, integrity, student autonomy and trust	For example, Razia, Awwad and Taqi [29]; Dergaa et al. [43]; Gudiño Paredes, Jasso Peña and de La Fuente Alcazar [47]; Leoste et al. [49]; Rudolph, Sullivan, Kelly and McLaughlan [54]; Chen et al. [73]; Tan and Tan [74]
Beliefs, attitudes and complexity of technology and institutional factors as impediments to AI adoption	For example, Razia, Awwad and Taqi [29]; Crittenden, Biel and Lovely III [71]; Gupta and Bhaskar [75]

Source: PRISMA review outcome and analysis by authors

Ethical consideration issues, data privacy, and algorithmic biases are also gaining traction. Garay Gallastegui and Reier Forradellas [69], in their article on the application of predictive machine learning models, outline the challenges of AI in education as presenting complex issues such as privacy and data protection concerns through the collection and utilisation of student and teachers' data that may need strong ethical considerations for confidentiality and consent (Table 3). Another observed concern of AI is its accuracy and fairness, as some models are biased or make flawed predictions that require a balanced approach with human intuition/integration. Bucea-Manea-Ţoniş et al [17] analysis cautions privacy issues as a significant challenge of AI integration in higher education for cognitive projects. Although AI and blockchain integration in competency-based education revolutionises education, Williams [20] also presents difficulties in guaranteeing data privacy, and AI algorithms biases necessitating human and technological interaction balance. Similarly, de Vries [46] found that AI use in engineering students' settings raises critical ethical questions about data privacy.

For AI use to be implemented effectively in higher education would also require skills and capabilities in AI (Table 3). Most teachers are not AI experts. Therefore, a need for training teachers and students on various AI systems and attributes arises. Bucea-Manea-Țoniș et al. [17] show that teachers are not adequately trained concerning AI and digital education, thus the need for AI technology experts to support teachers with unexpected challenges. Similarly, Almaraz-López, Almaraz-Menéndez, and López-Esteban [70] noticed that although students recognise AI, their study observed that students' knowledge of AI is limited, thus the need for more training on AI.

Another concern is the fear of overreliance on AI (Table 3). Critiques imply that overreliance on AI will erode critical thinking and creativity. For example, Garay Gallastegui and Reier Forradellas [69] state that ensuring transparency and ethical responsibility is critical to harnessing trust between teachers, students, and stakeholders for effective and authentic learning environments.

Just like every other technology, Technology can include or exclude. Unequal access to AI resources among institutions and students is a commonly cited concern (Table 3). For example, Bucea-Manea-Țoniș et al. [17] highlight that teachers or institutions may not be privy or concerned about the cost implications of AI technology by students. Also, Crittenden, Biel and Lovely III [71] show that institutional budgets often are inadequate to match current technological advancements of digital learning and the required support. Therefore, AI use in higher education could also provoke the digital divide.

Sullivan, Kelly and McLaughlan [54] raise concerns about academic integrity and student autonomy (Table 3). These concerns include cheating and academic dishonesty as students use AI-powered tools that can easily present or facilitate student cheating. This is not different from academic dishonesty and misconduct, for example, plagiarism and data fabrication. Crittenden, Biel and Lovely III [71] hint that beliefs and attitudes toward AI could impede its adoption (Table 3). In their study, they emphasise how beliefs and attitudes on how it fits into the curriculum are impediments to the adoption of technology into educational settings by teachers and students.

6. Implications of artificial intelligence in higher education

It is clear from this review that AI can revolutionize higher education. Artificial intelligence in higher education implies opportunities for enhancing administrative tasks, student learning experiences, and teaching and research proficiency among other prospects. Besides, AI raises serious concerns about job displacement, data privacy, ethics and questions about authentic

learning. This calls for a balanced AI use in higher education that is ethical, of equitable access, and without eroding the pedagogical value and humanistic outlook in higher education.

7. Conclusion and recommendations

In this review paper, we systematically examined the implications of AI tools in higher education. A pertinent question or concern must be addressed. Should institutions of higher learning panic? It is evident from the review findings that there are numerous promising opportunities or benefits from AI integration in the higher education sector. Equally so, the presence of negative aspects or concerns about AI use in higher education cannot be over-emphasised. Given the current knowledge systems and society's rapid technological revolution, there is no way to avoid AI in higher education and society in general, including the future world of work. It is, therefore, imperative that the higher education institutions, teachers, students, and relevant stakeholders alike are appraised of these developments (both positive and negative) to make informed decisions if the AIED tools are to be used optimally and minimise the negative implications. We propose that institutions of higher learning should develop a nuanced approach to integrating AI into the curriculum, including guidelines, regulations, and policies for AI use, ensure transparency and promote digital literacy (AI education and training for students and teachers – reskilling); develop and guarantee cyber and privacy security on AI use, emphasise ethics education on AI responsible use and balance AI technological advancements with human integration in education. Our answer to the critical question, should we panic? is in the pudding. We encourage contextual discussions among higher education institutions, including students' voices for constructive engagement with AI in education while being mindful of its impact on the pedagogical perspective.

8. Limitations of the review and future direction

The limitation of this review includes that the authors limited the systematic search to two databases (Scopus and WoS) and mainly open-access articles. Other possible research (studies) may not have been included in this review analysis. Again, our review focus was based on the broader spectrum of AI tools, not necessarily on specific AI technologies. Specific AI tools may have specific roles, benefits and challenges, thus differing implications. Future research direction may be context-specific and directed to specific AI tools, as some universities or college settings may not be at the same technological endowment level and the socio-cultural dynamics that may be at play.

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