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Transforming university teaching with the use of artificial intelligence: opportunities and challenges

Transformando la docencia universitaria con el uso de la inteligencia artificial: oportunidades y retos

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ABSTRACT

This systematic review article addresses how artificial intelligence (AI) is transforming university teaching. It presents the multiple opportunities that AI offers with the purpose of enhancing and elevating the quality of university education, while also analyzing the challenges inherent to the integration of these technologies into university teaching environments. The results indicate that AI contributes significantly to the efficiency and accessibility of higher education; however, the review also identifies several challenges that must be carefully considered to ensure the successful implementation of AI in educational settings. One of the primary concerns is the lack of adequately trained personnel who are proficient in using AI, additionally, there is a pervasive fear among educators that AI could potentially lead to the replacement of teachers by machines, undermining the human element that is central to the teaching profession or that their privacy could be violated, these situations must be addressed to optimize its implementation and ensure its effectiveness.

Keywords: higher education, teaching transformation, artificial intelligence.

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RESUMEN

Este artículo de revisión sistemática aborda cómo la inteligencia artificial (IA) está transformando la docencia universitaria. Presenta las múltiples oportunidades que ofrece la IA con el propósito de mejorar y elevar la calidad de la educación universitaria, al tiempo que analiza los desafíos inherentes a la integración de estas tecnologías en los entornos docentes universitarios. Los resultados indican que la IA contribuye significativamente a la eficiencia y accesibilidad de la educación superior; sin embargo, la revisión también identifica varios desafíos que deben considerarse cuidadosamente para garantizar la implementación exitosa de la IA en entornos educativos. Una de las principales preocupaciones es la falta de personal adecuadamente capacitado que sea competente en el uso de la IA, además, existe un temor generalizado entre los educadores de que la IA pueda conducir a la sustitución de los maestros por máquinas, socavando el elemento humano que es fundamental para la profesión docente o que su privacidad pueda ser violada. Estas situaciones deben ser abordadas para optimizar su implementación y asegurar su efectividad.

Palabras clave: educación superior, transformación docente, inteligencia artificial.

INTRODUCTION

Digital transformation has left a profound mark on various areas of our society, notably in the educational sector, even more so during the pandemic period (Rangel-de Lázaro & Duart, 2023). Today, society is being altered by AI (Durso & Arruda, 2022). In particular, higher education has achieved significant change in the last few decades, largely driven by the advancement of artificial intelligence (AI) (Salas-Pilco & Yang, 2022). The incorporation of AI into higher education has created unprecedented opportunities to improve efficiency, accessibility, and personalized learning (Farrelly & Baker, 2023; Mairal, 2023).The field of Artificial Intelligence in Education (AIED) has begun to impact the application of technology to instruction and learning since the 1970s, in order to improve the learning process and promote student achievements (Southgate et al., 2019). With ongoing technological progress, it is essential to understand the impact of AI on the formulation and realization of academic programs, as well as on student learning experiences. While AI offers opportunities, it is necessary for educators to become more acquainted with this field as it is in its initial stage (Laupichler et al., 2022) and to thoroughly address the ethical, technical, and educational challenges associated with its implementation (Memarian & Doleck, 2023; R. Wang et al., 2022).

Three reviews were found for the use of AI online: one on applications for extended reality (Rangel-de Lázaro & Duart, 2023), one on its operation in empirical research (Ouyang et al., 2022), and another on the most discussed topics with AI, but only in Web of Science (Chu et al., 2022). One piece of research on AI for graduate programs in Brazil (Durso & Arruda, 2022) and another aimed at identifying concepts of ethics and transparency in AI in the higher education literature (Memarian & Doleck, 2023). Additionally, four studies on the effects of chatbot and / or GPT chat GPT on student learning (Dempere et al., 2023; Imran & Almusharraf, 2023; Wu & Yu, 2023) and one special bibliometric analysis (Lin & Yu, 2023). Moreover, four specific studies on AI learning in higher education focused on: Saudi Arabia (Alotaibi & Alshehri, 2023), Latin America (Salas-Pilco & Yang, 2022), Ecuador (Ocaña-Fernández et al., 2019) and China (Kang, 2023).

Another on the implications of its use in academic research (Cárdenas, 2023), one on trends in AI literacy for higher education and adults (Laupichler et al., 2022), one on promise and challenges that explored the perspective and functions of teachers in AI-based research up to 2020 (Celik et al., 2022). A critical review on the definitions of AI in higher education (Bearman et al., 2023) and another on key technologies for smart classrooms discussing the role of AI (Dimitriadou & Lanitis, 2023). Finally, two studies on the use of AI in language teaching were found (McCallum, 2023; Sharadgah & Sa'di, 2022).

Literature Review

The university teacher, within the framework of changes brought about by the convergence toward the European Higher Education Area (EHEA), is tasked with developing new functions, tasks, and roles that extend beyond the traditional role of knowledge transmitter. In this emerging scenario, the teacher is expected to act as a facilitator, tutor, advisor, manager, and guide of the learning process (Mas-Torelló & Olmos-Rueda, 2016). The university teacher must focus on refining the structure, interaction, and teaching strategies, placing greater emphasis on the humanistic approach, teamwork, and promoting an innovative mindset among students (Macanchí Pico et al., 2020).

Artificial Intelligence (AI) as a scientific discipline was formally established in 1956 in the United States by four distinguished researchers: McCarthy, Minsky, Rochester, and Shannon; these researchers in their initial statement expressed that the fundamental purpose of artificial intelligence was to emulate, through machines, the intelligence capabilities present in humans, animals, plants, as well as social and phylogenetic dimensions (UNESCO, 2018). Artificial intelligence focuses on creating systems that replicate human intelligence, enabling machines to learn, reason, and make autonomous decisions with the purpose of addressing a variety of problems. This approach seeks to increase the ability of computers to perform complex tasks and adapt to new environments (Russel & Norving, 2004). AI has the appropriate potential to transform teaching-learning methodologies, address the significant challenges present in contemporary education, and advance more rapidly toward quality education according to Sustainable Development Goal 4 (UNESCO, 2019). It is also described as computer systems that perform cognitive functions commonly attributed to human mental abilities, especially with regard to learning and

problem solving, and not as a specific technology (Baker & Smith, 2019). Artificial intelligence has been incorporated into the educational field with the goal of promoting skill development, exhibiting itself in specific applications that favor personalized, flexible, and diversified learning (Zheng, 2022). Although the term "artificial intelligence in education" was proposed in the 1970s, its use has become more frequent in recent times, evidencing the growing positive impact of AI in the education sector.

AI applications enhance design and personalized learning, allowing educators to reduce the time spent on assessment corrections, feedback, and corrections, which enables time to be used for direct interaction with students and working on challenging tasks such as synthesis and analysis of information. On the other hand, students can benefit from the use of AI when teaching staff is not available for various reasons, which is why the educational community highlights the importance of AI in teaching-learning; however, there is an ethical concern about how AI-based tools function and the excessive trust students might place in them, as well as the lack of internal standards (data policy) and the absence of practical improvements in the use of AI remains an obstacle (Pelletier et al., 2023).

Two authors also addressed AI educational tools from three perspectives: student-oriented, teacher-oriented, and system-oriented (Baker & Smith, 2019). Student-oriented tools include adaptive or personalized learning management systems and Intelligent Tutoring Systems (ITS). Teacher-oriented tools help reduce workload by automating tasks such as administration, assessment, feedback, and plagiarism detection. In addition, they provide data on students' learning progress, allowing teachers to offer proactive support and guidance. System-oriented tools provide institutional-level information, such as dropout patterns in faculties or schools. This article focused on teacher-oriented tools.

What remains to be researched is a systematic review that highlights the opportunities and challenges that university teachers face with the use of artificial intelligence after 2022. As opportunities, one can explore the personalization of student learning, support in repetitive tasks for the teacher, collaboration in research, and predictive analysis of performance. As challenges, although there is already an exclusive review of ethics and transparency, others such as training and adaptation can be explored, that is, skills and competencies, as well as evaluating gaps for access to education and technological dependency.

Given the described, this study sought to analyze the opportunities and challenges associated with artificial intelligence in transforming university teaching through a systematic review in the Scopus, WoS, and ERIC databases.

METHODOLOGY

This study is a systematic review of articles related to the transformation of university teaching and the use of artificial intelligence. It was carried out under the guidelines of the PRISMA 2020 method (Page et al., 2021), which consists of various steps that must be followed to perform a systematic review. A systematic method examines and comprehensively condenses all the accessible empirical evidence, provided it meets the eligibility criteria, with the purpose of addressing the research questions (Higgins & Green, 2008).

Research Questions

1. What are the databases with the most annual publications between 2022 and 2023?
2. What approaches, techniques/instruments for data collection have been used in the selected studies according to the authors, year of publication, and countries?
3. What are the main opportunities AI offers for improving quality in university teaching and how are these opportunities classified?
4. What are the most significant challenges associated with the integration of AI in university teaching?
5. What suggestions have been proposed in the academic literature to overcome the identified challenges and maximize the opportunities of AI?

Eligibility Criteria

The eligibility criteria are considered as follows:

Inclusion Criteria

a) Document types are original articles.
b) Thematic areas are Social Sciences or education.
c) The type of access is open.
d) Publications between the period of 2022 and 2023.
e) The language of the articles is English, Spanish, or Portuguese.
f) Articles are not duplicates.
g) The searched descriptors must appear in the title and/or abstract.
h) Articles must be applied to higher education (with respect to teaching work).

Exclusion Criteria

a) Articles are not from conferences, book chapters, journals, conference reviews, and notes.
b) Thematic areas other than social sciences.
c) Are not open access.
d) Publications before 2022.
e) Languages other than English, Spanish, or Portuguese.
f) Duplicate articles.
g) The descriptors do not appear in the title or abstract.
h) Articles could not be retrieved.
i) Articles are of a level different than higher education.
j) Articles were on topics not oriented towards teaching.
k) The content was not an original article.

Search Strategy

For the document search, the databases: Scopus, Web of Science, and ERIC were considered during 2022 and 2023. All articles consulted were carried out between December 2 and 8. The preliminary search string was ("artificial intelligence" OR "neural networks" OR AI) AND ("university teaching" OR "higher education"), which found a total of 4607 articles, with 2711 from Scopus, 755 from Web of Science, and 1141 from ERIC. Subsequently, search strings by database were generated where they were eliminated through filters and limits used before selection, as shown in Table 1.

TABLE 1
SEARCH STRINGS

Scopus Database
TITLE-ABS-KEY (("artificial intelligence" OR "neural networks" OR ia) AND ("university teaching" OR "higher education")) AND PUBYEAR > 2021 AND PUBYEAR < 2024 AND (LIMIT-TO (SUBJAREA , "SOCI")) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (LANGUAGE , "English") OR LIMIT-TO (LANGUAGE , "Spanish") OR LIMIT-TO (LANGUAGE , "Portuguese")) AND (LIMIT-TO (OA , "all")) AND (LIMIT-TO (EXACTKEYWORD , "Artificial Intelligence") OR LIMIT-TO (EXACTKEYWORD , "Higher Education"))
Web of Science Database (WoS)
("artificial intelligence" OR "neural networks" OR IA) AND ("university teaching" OR "higher education") (Topic) and English or Spanish or Portuguese (Languages) and English or Spanish or Portuguese (Languages) and Article (Document Types) and 2024 or 2023 or 2022 (Publication Years) and Education Educational Research (Research Areas) and All Open Access (Open Access)
ERIC Database
(("artificial intelligence" OR "neural networks" OR IA)) AND (("university teaching" OR "higher education"))

Selection Process

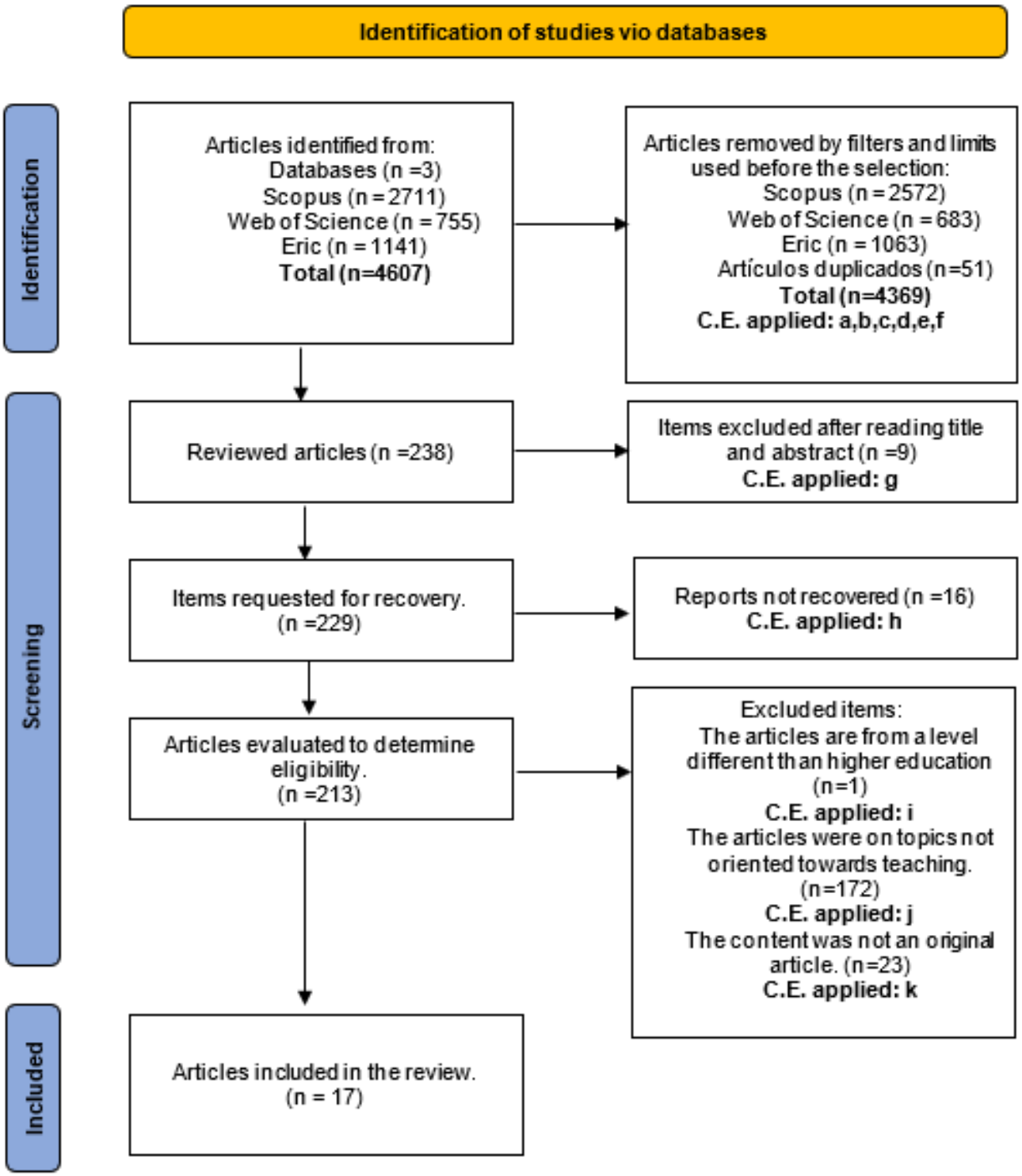
In all databases, the criteria a, b, c, d, e, f (which correspond to the search strings, see Table 1) were applied, and 2572 articles from Scopus, 683 from WoS (Web of Science), and 1063 from ERIC were removed, totaling 4318 articles eliminated. Subsequently, all databases were merged and 51 articles that were duplicated between databases were eliminated, resulting in 238 articles. Subsequently, additional inclusion and exclusion criteria were applied, leading to the selection of 17 articles, as illustrated in Figure 1.

Search Results

During the identification phase, two databases were used: Scopus, Web of Science, and ERIC. Using specific combinations of English words, a total of 4607 articles were identified: 2711 from Scopus, 755 from Web of Science and 1141 from ERIC. Those that did not meet the defined exclusion criteria (a, b, c, d, e, f) and duplicates both within each database and between them were then eliminated. This resulted in the removal of 4369 articles.

In the screening stage, 238 articles remained for examination after previous eliminations. The titles and abstracts of these articles were reviewed, eliminating those that did not match criterion g, leading to the exclusion of 9 more articles. The retrieval of 229 articles was then requested, of which 16 could not be recovered for eligibility assessment. Of the retrieved articles, 196 were excluded based on criteria i, j, k. Finally, in the inclusion stage, 17 articles were selected for a more detailed review.

FIGURE 1
PRISMA 2020 FLOW DIAGRAM



RESULTS

What are the databases with the most annual publications between 2022 and 2023?

As shown below (Table 2), the majority of the published articles are from the Scopus and ERIC databases in equal percentages. The year with the highest publication in all journals was 2023, with 76%.

TABLE 2
DISTRIBUTION OF ANNUAL PUBLICATIONS BETWEEN 2022 AND 2023

Year	Scopus	%	Web of Science	%	ERIC	%	TOTAL	%
2022	2	29%	1	33%	1	14%	4	24%
2023	5	71%	2	67%	6	86%	13	76%
TOTAL	**7**	41%	**3**	18%	**7**	41%	**17**	100%

What approaches, techniques/data collection instruments have been used in the selected studies according to the authors, publication year, and countries?

Table 3 shows the 17 articles, more than half indicate that they applied surveys as a technique (Alnasib, 2023; Bucea-Manea-ţoniş et al., 2022; Chan & Hu, 2023; Heugh et al., 2022; Holmes et al., 2023; Kiryakova & Angelova, 2023; Martín-Ramallal et al., 2022; McGrath et al., 2023; Slimi, 2023; Y. Wang, 2023); one indicates the application of the questionnaire and interview as instruments (Yong et al., 2022); three mention structured interviews (Kohnke et al., 2023; Pisica et al., 2023; Yong et al., 2022), and another tests (Sichterman et al., 2023). There are two articles that indicate having applied as an instrument chat GPT and another the Python program (van den Berg & du Plessis, 2023; Yang, 2023). Most of the articles come from Europe (Bucea-Manea-ţoniş et al., 2022; Holmes et al., 2023; Kiryakova & Angelova, 2023; Martín-Ramallal et al., 2022; McGrath et al., 2023; Pisica et al., 2023; Sailer et al., 2023; Sichterman et al., 2023; Slimi, 2023) or Asia (Alnasib, 2023; Chan & Hu, 2023; Kohnke et al., 2023; Y. Wang, 2023; Yang, 2023; Yong et al., 2022). For articles where the country of study was not found, the country of study of the first author was listed.

TABLE 3
APPROACH, TECHNIQUE, AND INSTRUMENTS ACCORDING TO AUTHORS, PUBLICATION YEAR, AND COUNTRIES

ID	Authors	Year	Country	Approach/Design	Technical/Instrument
1	Alnasib B.N.M.	2023	Saudi Arabia	Availability sampling	Survey/questionnaire
2	Bucea-Manea-ţoniş R.; Kuleto V.; Gudei S.C.D.; Lianu C.; Lianu C.; Ilić M.P.; Păun D.	2022	Romania and Serbia	Qualitative	Exploratory survey
3	Chan, Cecilia Ka Yuk; Hu, Wenjie	2023	Hong Kong	NE	Online survey
4	Heugh, Kathleen; French, Mei; Arya, Vandana; Pham, Min; Tudini, Vincenza; Billinghurst, Necia; Tippett, Neil; Chang, Li-Ching; Nichols, Julie; Viljoen, Jeanne-Marie	2022	Australia	NE	Online survey
5	Holmes W.; Iniesto F.; Anastopoulou S.; Boticario J.G.	2023	United Kingdom	NE	Online survey
6	Kiryakova, Gabriela; Angelova, Nadezhda	2023	Bulgaria	Qualitative	Questionnaires, Surveys
7	Kohnke L.; Moorhouse B.L.; Zou D.	2023	Hong Kong	Interpretive qualitative	Semi-structured interviews
8	Martin-Ramallal, Pablo; Merchan-Murillo, Antonio; Ruiz-Mondaza, Mercedes	2022	Spain	Exploratory. Descriptive	Survey
9	McGrath C.; Cerratto Pargman T.; Juth N.; Palmgren P.J.	2023	Sweden	Experimental philosophy	Electronic survey
10	Pisica A.I.; Edu T.; Zaharia R.M.; Zaharia R.	2023	Romania	Exploratory qualitative	Semi-structured interviews
11	Sailer M.; Bauer E.; Hofmann R.; Kiesewetter J.; Glas J.; Gurevych I.; Fischer F.	2023	Germany	Experimental	NLP adaptive feedback algorithm
12	Sichterman, Bo; van Ginkel, Stan; van Halteren, Melanie; van Tilborg, Richard; Noroozi, Omid	2023	Netherlands	Pretest-posttest	Tests to assess professional outcomes
13	Slimi, Zouhaier	2023	Spain	Qualitative	Survey
14	van den Berg G.; du Plessis E.	2023	South Africa	Qualitative and documentary analysis	Chat GPT-generated choice plan
15	Wang Y.	2023	China	NE	Survey
16	Yang, Tzu-Chi	2023	Taiwán	The AI method	Python program

17	Yong, Yoo Ji; Lee, Jee Hyun; Kim, Yeon Soo	2022	Korea and the Philippines, Peru, Turkey, among others	Descriptive analysis	Structured questionnaires and interviews

Note: The acronym NE stands for not specified.

What are the most significant challenges associated with the integration of AI in university teaching?

Regarding the challenges described in Table 4, the ethical use of AI is highlighted due to the questions raised by teachers about its use (Alnasib, 2023; Kiryakova & Angelova, 2023; Pisica et al., 2023; Sichterman et al., 2023; Slimi, 2023). It is pointed out that there is still no training for teachers or staff with knowledge (Bucea-Manea-ţoniş et al., 2022; Kohnke et al., 2023; Sichterman et al., 2023; Y. Wang, 2023; Yong et al., 2022), as well as a lack of technical support for its implementation (Heugh et al., 2022; McGrath et al., 2023). Three reports mention concerns about bias and misinformation (Kiryakova & Angelova, 2023; Slimi, 2023; Yang, 2023), while another two mention that its use is still limited in handling mass information (Sailer et al., 2023; van den Berg & du Plessis, 2023). Five articles indicate that the biggest challenge is teachers' concerns about being replaced (Chan & Hu, 2023; Kiryakova & Angelova, 2023; Pisica et al., 2023; Sichterman et al., 2023; Slimi, 2023). Three point out concerns regarding data privacy (Holmes et al., 2023; Pisica et al., 2023; Slimi, 2023). Two reports mention legal issues (Holmes et al., 2023; Pisica et al., 2023) and, finally, only one indicates concerns about social effects (Pisica et al., 2023).

TABLE 4
CHALLENGES OF AI FOR IMPROVING QUALITY IN UNIVERSITY TEACHING

Challenges	ID
It is believed to be harmful or addictive, its use is questioned (Ethical use)	1, 6, 10, 12, 13
Teachers are not yet trained	2, 7, 12, 15, 17
Bias and misinformation in its use	6, 13, 16
Lack of technical support for its application or technology capacity	4, 9
It is believed to replace the teacher (Robots)	3, 6, 10, 12, 13
Still limited for its use of massive information	11, 14
Concerns about privacy, cybersecurity	5, 10, 13
Legal issues	5, 10
Psychosocial effect	10

What suggestions have been proposed in the academic literature to overcome the identified challenges and maximize the opportunities of AI?

Table 5 shows the suggestions, most of which mention the importance of creating guidelines for good use (Chan & Hu, 2023; Holmes et al., 2023; Pisica et al., 2023; Slimi, 2023), three highlight the importance of training staff or teachers (Alnasib, 2023; Pisica et al., 2023; Slimi, 2023). On the other hand, two suggest that it is important to have technological resources (Alnasib, 2023; Sichterman et al., 2023). And they recommend using Chat GPT for teacher planning (Kohnke et al., 2023; van den Berg & du Plessis, 2023).

TABLE 5
SUGGESTIONS TO ADDRESS AI CHALLENGES FOR IMPROVING QUALITY IN UNIVERSITY TEACHING

Suggestions	**ID**
Increase teacher knowledge, train staff according to experience	1, 10, 13
First evaluate the perception of applying AI	2, 9
Ensure the availability of resources	1, 12
Create guidelines for proper use	3, 5, 10, 13
Apply Chat GPT in planning and teaching	7, 14

DISCUSSION

In 2023, AI has established itself as a valuable resource for university teachers, significantly improving their work. AI has enabled educators to tailor educational content to the specific needs of each student, thus enhancing teaching effectiveness. Furthermore, it provides tools for more efficient evaluation and monitoring of student performance, giving teachers more opportunities to focus on meaningful interactions and foster essential skills in their students.

AI has also enriched teaching with a diversity of updated pedagogical resources. Ultimately, artificial intelligence has become fundamental in improving the personalization, efficiency, and quality of university education. Therefore, a series of articles have been researched that demonstrate how university teaching has been transformed with the use of AI. After applying selection criteria, 17 relevant articles were identified between 2022 and 2023, with a higher concentration of publications in the last year in databases such as Scopus and ERIC. Although not all articles specify their methodology, many mention the instruments used, with two of them highlighting AI itself. Most of the publications come from Europe and Asia, highlighting a lack of studies in America.

Among the opportunities that AI offers university teachers, there are studies that highlight its positive effect on learning (Southgate et al., 2019), emphasizing the role of personalized learning and accessibility (Farrelly & Baker, 2023; Mairal, 2023), which is valuable for students with disabilities. On the other hand, it is noted how AI fosters an innovative mindset and critical thinking (Macanchí Pico et al., 2020). However, one of the greatest opportunities is that AI serves as a support for teachers, saving time and effort in the development of educational materials.

The challenges include the lack of personnel trained for the use of AI, such as (Laupichler et al., 2022), and the fear of teachers being replaced by machines or having their privacy violated (Memarian & Doleck, 2023; R. Wang et al., 2022). Moreover, it is crucial to examine the information provided by artificial intelligence, since it is still in an early stage of development (Laupichler et al., 2022).

These studies evidence the digital transformation in education (Rangel-de Lázaro & Duart, 2023)and suggest the need for training, resources, and clear guidelines for the effective use of AI. Despite these recommendations, it is important to recognize the limitations of the analysis, such as the possibility that relevant articles exist in other databases that were not included, since the study was based on only three sources and 16 articles were inaccessible. Regarding limitations, there may be articles in other databases that were not analyzed, since the work was only with 3 databases, 16 of them being inaccessible.

CONCLUSION

In the vast majority of studies examined, the broad opportunities that artificial intelligence (AI) offers teachers to improve and enriching the educational process are consistently highlighted. AI not only opens doors to more personalized and efficient teaching methods, but also allows for more accurate evaluation and monitoring of student performance. However, the effectiveness of incorporating artificial intelligence into the educational field depends largely on several critical factors, such as teacher training and access to the necessary technological resources. Universities must ensure that both teachers and students have access to the necessary AI technology for a successful implementation. Given the increasing adoption of AI tools by teachers in the last year, it is evident that ongoing research in this field is essential. The year 2023 has witnessed how the adoption of AI by teachers has fostered development and innovation in the education sector. As these tools begin to incorporate these tools into their pedagogical practices, new avenues are opened to enhance educational content and personalize the learning experience for their students, signaling a promising future for AI-driven education.

REFERENCES

Alnasib, B. N. M. (2023). Factors Affecting Faculty Members' Readiness to Integrate Artificial Intelligence into Their Teaching Practices: A Study from the Saudi Higher Education Context. *International Journal of Learning, Teaching and Educational Research*, *22*(8), 465-491. Scopus. https://doi.org/10.26803/ijlter.22.8.24

Alotaibi, N. S., & Alshehri, A. H. (2023). Prospers and Obstacles in Using Artificial Intelligence in Saudi Arabia Higher Education Institutions—The Potential of AI-Based Learning Outcomes. *Sustainability (Switzerland)*, *15*(13). Scopus. https://doi.org/10.3390/su151310723

Baker, T., & Smith, L. (2019). *Educ-AI-tion Rebooted? Exploring the future of artificial intelligence in schools and colleges*. https://media.nesta.org.uk/documents/Future_of_AI_and_education_v5_WEB.pdf

Bearman, M., Ryan, J., & Ajjawi, R. (2023). Discourses of artificial intelligence in higher education: A critical literature review. *Higher Education*, *86*(2), 369-385. Scopus. https://doi.org/10.1007/s10734-022-00937-2

Bucea-Manea-ţoniş, R., Kuleto, V., Gudei, S. C. D., Lianu, C., Lianu, C., Ilić, M. P., & Păun, D. (2022). Artificial Intelligence Potential in Higher Education Institutions Enhanced Learning Environment in Romania and Serbia. *Sustainability (Switzerland)*, *14*(10). Scopus. https://doi.org/10.3390/su14105842

Cárdenas, J. (2023). Artificial intelligence, research and peer-review: Future scenarios and action strategies. *Revista Espanola de Sociologia*, *32*(4). Scopus. https://doi.org/10.22325/fes/res.2023.184

Celik, I., Dindar, M., Muukkonen, H., & Jarvela, S. (2022). The Promises and Challenges of Artificial Intelligence for Teachers: A Systematic Review of Research. *Techtrends*, *66*(4), 616-630. https://doi.org/10.1007/s11528-022-00715-y

Chan, C. K. Y., & Hu, W. (2023). Students' voices on generative AI: Perceptions, benefits, and challenges in higher education. *International Journal of Educational Technology in Higher Education*, *20*(1), 43. https://doi.org/10.1186/s41239-023-00411-8

Chu, H.-C., Hwang, G.-H., Tu, Y.-F., & Yang, K.-H. (2022). Roles and research trends of artificial intelligence in higher education: A systematic review of the top 50 most-cited articles. *Australasian Journal of Educational Technology*, *38*(3), 22-42. https://doi.org/10.14742/ajet.7526

Dempere, J., Modugu, K., Hesham, A., & Ramasamy, L. K. (2023). The impact of ChatGPT on higher education. *Frontiers in Education*, *8*. Scopus. https://doi.org/10.3389/feduc.2023.1206936

Dimitriadou, E., & Lanitis, A. (2023). A Critical Evaluation, Challenges, and Future Perspectives of Using Artificial Intelligence and Emerging Technologies in Smart Classrooms. *Smart Learning Environments*, *10*. https://doi.org/10.1186/s40561-023-00231-3

Durso, S. de O., & Arruda, E. P. (2022). Artificial Intelligence in Distance Education: A Systematic Literature Review of Brazilian Studies. *Problems of Education in the 21st Century*, *80*(5), 679-692. https://doi.org/10.33225/pec/22.80.679

Farrelly, T., & Baker, N. (2023). Generative Artificial Intelligence: Implications and Considerations for Higher Education Practice. *Education Sciences*, *13*(11), 1109. https://doi.org/10.3390/educsci13111109

Heugh, K., French, M., Arya, V., Pham, M., Tudini, V., Billinghurst, N., Tippett, N., Chang, L.-C., Nichols, J., & Viljoen, J.-M. (2022). Multilingualism, Translanguaging and Transknowledging: Translation Technology in EMI Higher Education. *AILA Review*, *35*(1), 89-127. https://doi.org/10.1075/aila.22011.heu

Higgins, J. P., & Green, S. (Eds.). (2008). *Cochrane Handbook for Systematic Reviews of Interventions: Cochrane Book Series*. https://doi.org/10.1002/9780470712184

Holmes, W., Iniesto, F., Anastopoulou, S., & Boticario, J. G. (2023). Stakeholder Perspectives on the Ethics of AI in Distance-Based Higher Education. *International Review of Research in Open and Distance Learning*, *24*(2), 96-117. Scopus. https://doi.org/10.19173/irrodl.v24i2.6089

Imran, M., & Almusharraf, N. (2023). Analyzing the role of ChatGPT as a writing assistant at higher education level: A systematic review of the literature. *Contemporary Educational Technology*, *15*(4). Scopus. https://doi.org/10.30935/cedtech/13605

Kang, H. (2023). Artificial intelligence and its influence in adult learning in China. *Higher Education Skills and Work-Based Learning*, *13*(3), 450-464. https://doi.org/10.1108/HESWBL-01-2023-0017

Kiryakova, G., & Angelova, N. (2023). ChatGPT—A Challenging Tool for the University Professors in Their Teaching Practice. *Education Sciences*, *13*(10), Article 10. https://doi.org/10.3390/educsci13101056

Kohnke, L., Moorhouse, B. L., & Zou, D. (2023). Exploring generative artificial intelligence preparedness among university language instructors: A case study. *Computers and Education: Artificial Intelligence*, *5*, 100156. https://doi.org/10.1016/j.caeai.2023.100156

Laupichler, M. C., Aster, A., Schirch, J., & Raupach, T. (2022). Artificial intelligence literacy in higher and adult education: A scoping literature review. *Computers and Education: Artificial Intelligence*, *3*. Scopus. https://doi.org/10.1016/j.caeai.2022.100101

Lin, Y., & Yu, Z. (2023). A bibliometric analysis of artificial intelligence chatbots in educational contexts. *Interactive Technology and Smart Education*. https://doi.org/10.1108/ITSE-12-2022-0165

Macanchí Pico, M. L., Orozco Castillo, B. M., Campoverde Encalada, M. A., Macanchí Pico, M. L., Orozco Castillo, B. M., & Campoverde Encalada, M. A. (2020). Innovación educativa, pedagógica y didáctica. Concepciones para la práctica en la educación superior. *Revista Universidad y Sociedad*, *12*(1), 396-403.

Mairal, R. (2023). What should the university of the future look like? *On the Horizon*, *31*(1), 62-70. Scopus. https://doi.org/10.1108/OTH-08-2022-0050

Martín-Ramallal, P., Merchán-Murillo, A., & Ruiz-Mondaza, M. (2022). Formadores virtuales con inteligencia artificial: Grado de aceptación entre estudiantes universitarios. *Educar*, *58*(2), Article 2. https://doi.org/10.5565/rev/educar.1482

Mas-Torelló, Ó., & Olmos-Rueda, P. (2016). *El profesor universitario en el espacio europeo de educación superior*.

McCallum, L. (2023). New takes on developing intercultural communicative competence: Using AI tools in telecollaboration task design and task completion. *Journal for Multicultural Education*. https://doi.org/10.1108/JME-06-2023-0043

McGrath, C., Cerratto Pargman, T., Juth, N., & Palmgren, P. J. (2023). University teachers' perceptions of responsibility and artificial intelligence in higher education—An experimental philosophical study. *Computers and Education: Artificial Intelligence*, *4*. Scopus. https://doi.org/10.1016/j.caeai.2023.100139

Memarian, B., & Doleck, T. (2023). Fairness, Accountability, Transparency, and Ethics (FATE) in Artificial Intelligence (AI) and higher education: A systematic review. *Computers and Education: Artificial Intelligence*, *5*. Scopus. https://doi.org/10.1016/j.caeai.2023.100152

Ocaña-Fernández, Y., Valenzuela-Fernández, L. A., & Garro-Aburto, L. L. (2019). Inteligencia artificial y sus implicaciones en la educación superior. *Propósitos y Representaciones*, *7*(2), 536-568. https://doi.org/10.20511/pyr2019.v7n2.274

Ouyang, F., Zheng, L., & Jiao, P. (2022). Artificial Intelligence in Online Higher Education: A Systematic Review of Empirical Research from 2011 to 2020. *Education and Information Technologies*, *27*(6), 7893-7925. https://doi.org/10.1007/s10639-022-10925-9

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., … Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, *372*, n71. https://doi.org/10.1136/bmj.n71

Pelletier, K., Robert, J., Muscanell, N., McCormack, M., Reeves, J., Arbino, N., & Grajek, S. (2023). *2023 EDUCAUSE Horizon Report, Teaching and Learning Edition*.

Pisica, A. I., Edu, T., Zaharia, R. M., & Zaharia, R. (2023). Implementing Artificial Intelligence in Higher Education: Pros and Cons from the Perspectives of Academics. *Societies*, *13*(5). Scopus. https://doi.org/10.3390/soc13050118

Rangel-de Lázaro, G., & Duart, J. M. (2023). You Can Handle, You Can Teach It: Systematic Review on the Use of Extended Reality and Artificial Intelligence Technologies for Online Higher Education. *Sustainability (Switzerland)*, *15*(4). Scopus. https://doi.org/10.3390/su15043507

Russel, S., & Norving, P. (2004). *Inteligencia artificial, un enfoque moderno*. https://luismejias21.files.wordpress.com/2017/09/inteligencia-artificial-un-enfoque-moderno-stuart-j-russell.pdf

Sailer, M., Bauer, E., Hofmann, R., Kiesewetter, J., Glas, J., Gurevych, I., & Fischer, F. (2023). Adaptive feedback from artificial neural networks facilitates pre-service teachers' diagnostic reasoning in simulation-based learning. *Learning and Instruction*, *83*. Scopus. https://doi.org/10.1016/j.learninstruc.2022.101620

Salas-Pilco, S. Z., & Yang, Y. (2022). Artificial intelligence applications in Latin American higher education: A systematic review. *International Journal of Educational Technology in Higher Education*, *19*(1). Scopus. https://doi.org/10.1186/s41239-022-00326-w

Sharadgah, T. A., & Sa'di, R. A. (2022). A Systematic Review of Research on the Use of Artificial Intelligence in English Language Teaching and Learning (2015-2021): What Are the Current Effects? *Journal of Information Technology Education-Research*, *21*, 337-377. https://doi.org/10.28945/4999

Sichterman, B., Ginkel, S. van, Halteren, M. van, Tilborg, R. van, & Noroozi, O. (2023). The Effects of a Constructively Aligned Virtual Reality Setting on Professionals' Knowledge, Motivation and Perceptions. *International Journal of Technology in Education*, *6*(4), Article 4. https://doi.org/10.46328/ijte.462

Slimi, Z. (2023). The Impact of Artificial Intelligence on Higher Education: An Empirical Study. *European Journal of Educational Sciences*, *10*(1), 17-33.

Southgate, E., Blackmore, K., Pieschl, S., Grimes, S., McGuire, J., & Smithers, K. (2019). *Artificial Intelligence and emerging technologies in schools: Research report* (Australia) [Report]. Department of Education and Training (Australia). https://apo.org.au/node/254301

UNESCO. (2018, septiembre). *Inteligencia artificial: Promesas y amenazas*. https://unesdoc.unesco.org/ark:/48223/pf0000265211_spa

UNESCO. (2019). *La inteligencia artificial en la educación*. https://www.unesco.org/es/digital-education/artificial-intelligence

van den Berg, G., & du Plessis, E. (2023). ChatGPT and Generative AI: Possibilities for Its Contribution to Lesson Planning, Critical Thinking and Openness in Teacher Education. *Education Sciences*, *13*(10). Scopus. https://doi.org/10.3390/educsci13100998

Wang, R., Cao, J., Xu, Y., & Li, Y. (2022). Learning engagement in massive open online courses: A systematic review. *Frontiers in Education*, *7*. Scopus. https://doi.org/10.3389/feduc.2022.1074435

Wang, Y. (2023). Artificial Intelligence Technologies in College English Translation Teaching. *Journal of Psycholinguistic Research*, *52*(5), 1525-1544. Scopus. https://doi.org/10.1007/s10936-023-09960-5

Wu, R., & Yu, Z. (2023). Do AI chatbots improve students learning outcomes? Evidence from a meta-analysis. *British Journal of Educational Technology*. Scopus. https://doi.org/10.1111/bjet.13334

Yang, T.-C. (2023). *Application of Artificial Intelligence Techniques in Analysis and Assessment of Digital Competence in University Courses*.

Yong, Y. J., Lee, J. H., & Kim, Y. S. (2022). A Study on the Possibility of a Change in Culture and Arts Education Curriculum by Shooting «METACLASSROOM» in the COVID19 Pandemic Era. *Cypriot Journal of Educational Sciences*, *17*(5), 1603-1621.

Zheng, F. (2022). Personalized Education Based on Hybrid Intelligent Recommendation System. *Journal of Mathematics*, *2022*, e1313711. https://doi.org/10.1155/2022/1313711