Technological innovations in education: a scoping review on the impact of AI on academic integrity

Inovações tecnológicas na educação: uma revisão de escopo sobre o impacto da IA na integridade acadêmica

Innovaciones tecnológicas en la educación: una revisión del alcance del impacto de la IA en la integridad académica

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ABSTRACT
This study presents a systematic review on the impact of artificial intelligence (AI) on academic integrity in higher education. The main objective was to understand how technological innovations, particularly those related to AI, influence the teaching and learning process. Using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PAGE et al., 2021) guidelines, the methodology involved searching various databases, including IEEE, SAGE, Scopus, ERIC, ACM, Semantic Scholar, and Web of Science. Out of the 3,484 articles initially retrieved, 31 were considered for discussion. The results highlight a growing trend of research regarding the proposed theme with emphasis on ChatGPT and cheating behavior detection systems, demonstrating concern for ethical issues in the academic environment.

Keywords: Learning, Teaching, Academic Integrity, Artificial Intelligence.

RESUMO
Esse estudo apresenta uma revisão sistemática sobre o impacto da inteligência artificial (IA) na integridade acadêmica no ensino superior. O objetivo principal foi compreender como as inovações tecnológicas, particularmente aquelas relacionadas à IA, influenciam no processo de ensino e aprendizagem. Utilizando as diretrizes do Preferred Reporting Items for Systematic Reviews and Metanalyses1 - (PAGE et al., 2021), a metodologia abrangeu a busca em diversas bases de dados, incluindo IEEE, SAGE, Scopus, ERIC, ACM, Semantic Scholar e Web of Science. Dos 3.484 artigos inicialmente recuperados, 31 foram considerados para discussão. Os resultados destacam uma tendência crescente de pesquisas em relação a temática proposta com ênfase ao ChatGPT e em sistemas detectores de comportamento de trapaça, demonstrando a preocupação com as questões éticas em meio acadêmico.


RESUMEN
Este estudio presenta una revisión sistemática sobre el impacto de la inteligencia artificial (IA) en la integridad académica en la educación superior. El objetivo principal era comprender cómo las innovaciones tecnológicas, particularmente las relacionadas con la IA, influyen en el proceso de enseñanza y aprendizaje. Utilizando las pautas de Elementos de informes preferidos para revisiones sistemáticas y metanálisis (PAGE et al., 2021), la metodología incluyó la búsqueda en varias bases de datos, incluidas IEEE, SAGE, Scopus, ERIC, ACM, Semantic Scholar y Web of Science. De los 3.484 artículos recuperados inicialmente, 31 fueron considerados para discusión. Los resultados resaltan una tendencia creciente de investigación en relación con el tema propuesto con énfasis en ChatGPT y los sistemas de detección de conductas infieles, lo que demuestra preocupación por las cuestiones éticas en el mundo académico.

Palabras clave: Aprendizaje, Enseñando, Integridad Academica, Inteligencia Artificial.

1 Preferred Reporting Items for Systematic Reviews and Meta-Analysis
1 INTRODUCTION

Recent studies (Grigorkevich et al., 2022; Gulec et al., 2021; Lee et al., 2020; Pinho; Franco; Mendes, 2021) that analyzed the knowledge acquisition process in the face of constant technological evolutions, including artificial intelligence, robotics, and data analysis, have identified a significant change. The increased access to information for both educators and students in higher education, coupled with the emergence of new andragogical practices that increasingly incorporate existing technologies, is shaping educational environments different from those of the past. This transformation is characterized by a move away from traditional teaching methods, paving the way for innovative approaches that leverage technology to enhance the learning experience.

Technologies used in higher education can be understood as facilitative tools in the teaching-learning process since they require interrelationships. The absence of such interrelationships makes it impossible to adopt a dialectical stance in the process of building an academic and formative practice committed to current social aspirations.

Research on technologies used in higher education has indicated that these tools have the potential to bring about significant changes in the context of professional training. The diversity of technological resources incorporated by these tools enables innovations in educational practices, directly impacting andragogical models and contributing to the studies of educational psychology.

Various authors (Dawley; Dede, 2014; Ovtcharova, 2014; Amin et al., 2016; Passig; Tzuriel; Eshel-Kedmi, 2016; Dede; Jacobson; Richards, 2017; Ilhan et al., 2017; Häfner; Häfner; Hien et al., 2018;; Queiroz et al., 2018) on technologies used in higher education have shown that they are tools capable of bringing about significant changes in the context of professional training, through the myriad of technological resources they incorporate. These tools are capable of bringing innovations to educational practices and, consequently, to andragogical models, impacting studies in educational psychology.

For Queiroz et al., (2018), technologies used in higher education can be understood as tools that facilitate the teaching-learning process, as they need to interrelate; without this interaction, it would be impossible to achieve a dialectical stance
in the process of building an academic and formative practice committed to the current social aspirations. A significant advantage of using technology in higher education is its ability to facilitate knowledge construction outside the university setting, making it a ally in the knowledge acquisition process across various disciplines. The need for the integration of technologies in this context is undeniable, and in this scenario, studies in artificial intelligence (AI) are significant (Crompton; Burke, 2023).

Academic integrity refers to honesty and ethical responsibility in the academic environment. In the context of academic research, integrity involves conducting studies ethically, reporting results accurately, and avoiding data fabrication or falsification (Alnaqbi; Fouda, 2023). However, the question arises as to how technological innovations provided by AI can impact academic integrity. This article aims to present a systematic review on the impacts of AI on academic integrity and to discuss the contribution of technologies to the teaching and learning process, as well as to demonstrate what research indicates about the new roles of universities and teachers.

After the introduction, the study continues to explore the theme with a theoretical foundation. Next, we present the adopted methodology, detailing the experimental or methodological procedures used to collect data. The results obtained are analyzed in the following section. The final section of the article highlights the main conclusions and suggests possible directions for future research.

2 THEORETICAL FOUNDATION

Integrity is essential to ensure that students produce original work, properly attribute their sources, and adhere to established ethical standards. However, the rapid expansion of online learning environments and the sophistication of cheating technologies present new challenges, requiring innovative strategies to maintain the integrity of the educational process (Divayana et al., 2017).

The introduction of AI advancements such as personal profiles and facial recognition highlights the need to address issues of potential bias, privacy concerns, and other negative impacts that may arise. The added complexity when such cheat detection
systems are outsourced to external developers introduces opacity regarding the functioning of these technologies, raising questions about transparency and accountability (Oravec, 2022).

Cultural differences or past experiences with institutional administrations and law enforcement may affect students' interpretations of cheating detection practices and related surveillance, especially those involving facial and manual gestures (Hoffmann, 2019). Online monitoring contexts often introduce complications and special challenges for certain students. For example, students who face external distractions in their home environments or who are ill may be classified as suspects. Unfortunately, as students are often not given the opportunity to explain what occurred in their specific home environments, data portraying them as potential cheaters may still be part of various organizational databases, regardless of the outcomes of a specific accusation against them (Hooda et al., 2022).

The "digital divide" itself can be a factor, with students lacking equitable access to and training in technological use, which may result in problematic use of educational systems. The prospects are concerning for lists of "potential cheaters" being compiled and made available for future unspecified use; this stigma-associated data could be utilized in future contexts of employment and civic decision-making (Hoffmann, 2019).

At the turn of the 21st century, many experts and researchers believed that cognitive computing was the hope for the near future. Unlike programmable systems based on deterministic rules, cognitive systems are designed to evaluate information and ideas from multiple sources to reason and then offer hypotheses for consideration (Saraiva; Argimon, 2007).

Some authors refer to Cognitive Computing (CC) as another variant of Artificial Intelligence. It consists of systems that undertake specific tasks or make decisions as assistants or substitutes for people, as they can handle ambiguity and imprecision and possess a high degree of autonomy within their area of knowledge (Santos, 2018). In other terms, cognitive computing differs from artificial intelligence as it aims to simulate human thinking processes through the use of self-learning algorithms that utilize data mining, pattern recognition, and natural language processing to mimic human thought.
processes. Cognitive computing will lead to the creation of personal cognitive assistants for students, teachers, and support staff. A cognitive assistant can also act as a personal tutor, guiding students through coursework, explaining problematic sections. Cognitive computing will make it possible to contextualize and personalize course materials to meet each student's needs (Fagundes, 2021).

Cognitive computing will make possible the automation of many key processes in schools and tertiary institutions. Yearbooks, financial statements, student reports, and other regular documentation will all be handled automatically by cognitive computing platforms. Many tedious fillings of charts and tables as part of the reports will be automated (Connor, 2019).

It is anticipated that cognitive computing will help tertiary institutions solve one of their most enduring problems: student retention and completion rates. One reason for this is how cognitive computing can improve the role of career counselors on campus. These facilities often lack staff and are not in a position to provide comprehensive service to all students who knock on their doors seeking help (Hien et al., 2018).

AI technologies have steadily progressed and become more visible in different aspects of our lives. A recent phenomenon is ChatGPT, which appears in the reviewed literature, with a conversational artificial intelligence interface developed by OpenAI.

Based on his experience at American universities, Shome (2021) observed a significant number of students in business and management courses reluctant to read academic content and remain engaged in the classroom. Thus, for the author, the use of ChatGPT and other similar tools can help improve student engagement and performance.

The results of a review (Chinonso; Theresa; Aduke, 2023) indicate that ChatGPT provides quick and instant responses to research queries, besides automatically producing text that resembles conversational responses. However, some difficulties are highlighted, such as the absence of citations and references in the responses generated by ChatGPT.

The article makes recommendations, emphasizing the importance of ensuring citation and reference in the responses provided by AI to ensure the reliability and integrity of the information.
3 METHODOLOGY

In pursuit of developing a systematic review, it was decided to adhere to the standards set by the Methodological Guidelines for the Systematic Review and Meta-Analysis of Randomized Clinical Trials as per the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (Page et al., 2021), as demonstrated in the following Figure 1.

![Figure 1 - PRISMA FLOW diagram](source: Page et al., 2021)

In conducting the research, databases such as the Institute of Electrical and Electronics Engineers (IEEE), SAGE, Scopus, the Educational Resources Information Center (ERIC), ACM Digital Library, Semantic Scholar, and the Web of Science were considered. Descriptors included terms like "Chat GPT" combined with "Education" and "Artificial Intelligence" to explore the intersection between education and artificial intelligence technology. Additionally, the research addressed themes like "academic integrity", "Learning Intelligent System," "Customization," and "Instructional Process"
in various combinations with "Artificial Intelligence" and "Higher Education." These descriptors aimed to deepen the understanding of the applications of artificial intelligence in the educational process, especially in higher education contexts, as well as the customization of learning and intelligent teaching systems. This diverse set of descriptors provided a solid foundation for the search and selection of studies relevant to the research topic.

After the articles were identified, they were analyzed, and those that met the study's objectives were selected, as demonstrated in the following Table 1.

<table>
<thead>
<tr>
<th>Steps</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>Identification of the topic and the guiding hypothesis of the research</td>
</tr>
<tr>
<td>Second</td>
<td>Selection of the inclusion and exclusion criteria for sampling</td>
</tr>
<tr>
<td>Third</td>
<td>Definition of the information that will be used in the selected study</td>
</tr>
<tr>
<td>Fourth</td>
<td>Evaluation of the studies and their inclusion in the review</td>
</tr>
<tr>
<td>Fifth</td>
<td>Interpretation of the results</td>
</tr>
<tr>
<td>Sixth</td>
<td>Presentation of the review and synthesis of the findings</td>
</tr>
</tbody>
</table>

Source: the author themselves

After identifying the articles from the mentioned search sources, their titles and abstracts were evaluated to select them. Articles that are part of the sample were listed, and recorded on a specific form containing data from the author of the original article, year, and data that respond to the study's objective.

The selected articles were also evaluated using the Lens platform to generate the number of academic papers in the results set that are cited by other academic works, and the total number of citations of academic papers for all the academic works cited in the results set.

Moreover, for efficient and collaborative organization of the research, the articles were indexed in Zotero, a bibliographic reference management tool. This facilitated the cataloging, organization, and citation of the articles throughout the research process.

To visually represent the trends and recurring themes in the articles, a word cloud was created, highlighting the most frequent terms in the titles and abstracts. This word cloud provided a quick and intuitive view of the key concepts addressed in the sample. Additionally, graphic tools and Excel spreadsheets were used to visualize relevant
statistical data, such as the temporal distribution of publications, the number of citations, and other indicators that aided in understanding and interpreting the research results.

Inclusion criteria considered all articles published in the specified databases, in the time frame from 2020 to 2023 with full text available, published in scientific journals, and in English (Table 1). The choice of the time period between 2018 and 2023 is based on the need to cover the most recent academic production, considering the rapid advancement of artificial intelligence technologies and their increasing impact on education. This time frame allows for an updated and relevant analysis of artificial intelligence applications in higher education, considering potential developments and innovations in recent years.

Exclusion criteria included: exclusion of articles not related to higher education; opinion pieces; review articles, reports, and editorials. Moreover, duplicate articles in the databases were considered a single version for analysis, articles published outside the established time frame and/or that do not contain the full text were also excluded.

4 RESULTS

An initial search resulted in the retrieval of a total of 3,484 articles (Figure 2). However, upon screening, 2,417 articles were excluded after analyzing the titles, aiming to focus the research on more relevant studies. Subsequently, a more rigorous screening was conducted, involving reading the abstracts of the remaining articles. This resulted in the exclusion of 686 articles that did not meet the eligibility criteria defined for the research. In the eligibility phase, the remaining articles were subjected to a full reading to assess their relevance to the research topic. From this analysis, 318 articles were excluded, leaving a total of 31 articles that were deemed suitable and relevant for the review (Table 2).
Figure 2 – Research Results

<table>
<thead>
<tr>
<th>Identification</th>
<th>Articles retrieved from databases: 3484</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Articles excluded by title: 2417</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Screening</td>
<td>Article excluded after abstract reading: 686</td>
</tr>
<tr>
<td></td>
<td>IEEE = 7</td>
</tr>
<tr>
<td></td>
<td>SAGE = 8</td>
</tr>
<tr>
<td>Eligibility</td>
<td>Articles excluded after full reading: 318</td>
</tr>
<tr>
<td></td>
<td>Scopus = 5</td>
</tr>
<tr>
<td></td>
<td>ERIC = 3</td>
</tr>
<tr>
<td>Included</td>
<td>31 articles</td>
</tr>
<tr>
<td></td>
<td>ACM = 5</td>
</tr>
<tr>
<td></td>
<td>Semantic = 2</td>
</tr>
<tr>
<td></td>
<td>Web Of Science = 1</td>
</tr>
</tbody>
</table>

Source: the author themselves

Table 2. Article Selection

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Study Objectives</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alnaqbi, N. M.; Fouda, W.</td>
<td>Explorar o papel do ChatGPT e das redes sociais na melhoria da avaliação do estilo de ensino de professores no ensino superior usando conjuntos neutroféricos.</td>
<td>2023</td>
</tr>
<tr>
<td>Baralt, M. <em>et al.</em></td>
<td>Criar uma comunidade de aprendizado de idiomas por meio de realidade virtual.</td>
<td>2022</td>
</tr>
<tr>
<td>Beg, A.; Alhemeiri, M.; Beg, A.</td>
<td>Facilitar a avaliação automatizada de cursos de engenharia/ciência.</td>
<td>2020</td>
</tr>
<tr>
<td>Bervell, B. <em>et al.</em></td>
<td>Desenvolver e validar uma Escala de Aceitação de Aprendizado Misto (BLAS) no ensino superior a distância.</td>
<td>2021</td>
</tr>
<tr>
<td>Cakir, O.</td>
<td>Aplicar sistemas de aprendizado adaptativo personalizado no curso de Cálculo I.</td>
<td>2022</td>
</tr>
<tr>
<td>Celik, I.</td>
<td>Realizar um estudo empírico sobre o conhecimento profissional dos professores para integrar ética no ensino com ferramentas baseadas em inteligência artificial.</td>
<td>2023</td>
</tr>
<tr>
<td>Nome</td>
<td>Título</td>
<td>Ano</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>------------------------------------------------------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>Chatterjee, S.; Bhattacharjee, K. K.</td>
<td>Analisar quantitativamente a adoção de inteligência artificial no ensino superior usando modelagem de equações estruturais.</td>
<td>2020</td>
</tr>
<tr>
<td>Chinonso, O. E.; Theresia, A. M.-E.; Aduke, T. C.</td>
<td>Investigar as perspectivas e desafios do uso do ChatGPT para ensino, aprendizagem e pesquisa.</td>
<td>2023</td>
</tr>
<tr>
<td>Crompton, H.; Burke, D.</td>
<td>Revisar o estado atual do uso de inteligência artificial no ensino superior.</td>
<td>2023</td>
</tr>
<tr>
<td>Ejaz, H. et al.</td>
<td>Investigar as perspectivas dos estudantes de medicina sobre inteligência artificial e educação médica.</td>
<td>2022</td>
</tr>
<tr>
<td>Essel, H. B. et al.</td>
<td>Avaliar o impacto de um assistente de ensino virtual (chatbot) no aprendizado dos alunos no ensino superior de Gana.</td>
<td>2022</td>
</tr>
<tr>
<td>Geerling, W. et al.</td>
<td>Avaliar o desempenho do ChatGPT na compreensão da economia universitária.</td>
<td>2023</td>
</tr>
<tr>
<td>Gilson, A. et al.</td>
<td>Analisar o desempenho do ChatGPT no Exame de Licenciamento Médico dos Estados Unidos.</td>
<td>2023</td>
</tr>
<tr>
<td>Guerrero, D. T. et al.</td>
<td>Explorar o uso da inteligência artificial no treinamento cirúrgico.</td>
<td>2022</td>
</tr>
<tr>
<td>Haderer, B.; Ciocacu, M.</td>
<td>Desenvolver um sistema de planejamento de tarefas e horários assistido por inteligência artificial para a Educação 4.0.</td>
<td>2022</td>
</tr>
<tr>
<td>Ilie, M. et al.</td>
<td>Analisar as necessidades e o desempenho para mudanças no ensino superior e a implementação de inteligência artificial, aprendizado de máquina e realidade estendida.</td>
<td>2021</td>
</tr>
<tr>
<td>Jantakun, T.; Jantakun, K.; Jantakoon, T.</td>
<td>Propor um modelo comum para a inteligência artificial no ensino superior.</td>
<td>2021</td>
</tr>
<tr>
<td>Jiang, Y. et al.</td>
<td>Investigar o papel emergente da inteligência artificial baseada em aprendizado profundo na patologia tumoral.</td>
<td>2020</td>
</tr>
<tr>
<td>Juma, H.</td>
<td>Investigar o conhecimento e a compreensão dos estudantes de ensino superior sobre inteligência artificial.</td>
<td>2021</td>
</tr>
<tr>
<td>Lu, K.</td>
<td>Analisar se o ChatGPT pode ajudar os instrutores universitários a gerar questões de teste de alta qualidade.</td>
<td>2023</td>
</tr>
<tr>
<td>Neo, M.</td>
<td>Estudar a aceitação de um chatbot pelos estudantes malaios em seu processo de aprendizado.</td>
<td>2022</td>
</tr>
<tr>
<td>Oravec, J. A.</td>
<td>Discutir os sistemas de detecção de trapace baseados em análise biométrica e inteligência artificial.</td>
<td>2022</td>
</tr>
<tr>
<td>Southworth, J. et al.</td>
<td>Desenvolver um modelo para a IA em todo o currículo para melhorar a alfabetização em IA no ensino superior.</td>
<td>2023</td>
</tr>
<tr>
<td>Stojanov, A.</td>
<td>Realizar um estudo autoetnográfico sobre o aprendizado com o ChatGPT 3.5.</td>
<td>2023</td>
</tr>
<tr>
<td>Tili, A. et al.</td>
<td>Investigar o uso de chatbots na educação, usando o ChatGPT como estudo de caso.</td>
<td>2023</td>
</tr>
<tr>
<td>Tsai, M.-L.; Ong, C. W.; Chen, C.-L.</td>
<td>Explorar o uso de grandes modelos de linguagem (LLMs) no ensino de engenharia química.</td>
<td>2023</td>
</tr>
<tr>
<td>Wood, E.; Ange, B.; Miller, D. D.</td>
<td>Avaliar a prontidão para integrar a alfabetização em inteligência artificial no currículo da faculdade de medicina: pesquisa com alunos e docentes.</td>
<td>2021</td>
</tr>
<tr>
<td>Xie, H.</td>
<td>Discutir o futuro promissor da ciência cognitiva e da inteligência artificial.</td>
<td>2023</td>
</tr>
<tr>
<td>Yilmaz, R.; Yilmaz, F. G. K.</td>
<td>Analisar o efeito do uso de ferramentas baseadas em inteligência artificial na capacidade de pensamento computacional, autoeficácia em programação e motivação dos alunos.</td>
<td>2023</td>
</tr>
<tr>
<td>Yü, H.; Guo, Y.</td>
<td>Investigar como a inteligência artificial generativa pode capacitar a reforma educacional.</td>
<td>2023</td>
</tr>
</tbody>
</table>

Source: the author themselves
The descriptors related to "Chat GPT" and "Education" have a moderate presence, being more prominent in Scopus with 11 occurrences. On the other hand, descriptors involving "academic integrity" and "Artificial Intelligence" vary considerably in their representation, with ACM leading with 492 occurrences, while "Instructional Process" and "Higher Education" are predominant in ERIC, with 275 and 63 occurrences, respectively.

The distribution by year of publication of the 63 listed articles is as follows: 10 articles in 2020, 18 articles in 2021, 16 articles in 2022, and 19 articles in 2023. There is a significant concentration of publications in the most recent years. This trend can be correlated with the release and continuous advancement of artificial intelligence-based language models, such as Chat GPT and similar technologies, which have gained prominence and strongly influenced the intersection between education and technology.

Starting from 2020, Chat GPT and similar technologies have been increasingly incorporated into educational environments, impacting research and innovations in the field of education. Although the difference between the last two years and the first half of the time interval is relatively small, with just seven more publications in the last two years, it is plausible to attribute part of this increase to the growing interest in exploring the potential applications and educational implications of these advanced technologies.

Figure 3. Publications Over Time

Source: Created by the author from data extracted from the Lens platform.

The academic articles analyzed show a diverse distribution by countries, reflecting the global reach of research related to artificial intelligence and education. The United
States leads the group with 23%, demonstrating its prominent role at the forefront of these studies. Following closely are Australia, China, England, India, and Japan.

A literature review (CROMPTON; BURKE, 2023) conducted an analysis on the use of AI in higher education from 2016 to 2022, following the PRISMA protocol (Figure 3). A total of 138 articles were analyzed, and the results highlight a significant increase in publications related to AI in higher education in 2021 and 2022, indicating a rapid growth of interest in this topic. Furthermore, there is a noted shift in the leadership of this research field from the United States to China, which has become the country with the highest number of publications, a result similar to that of this dissertation (Figure 4).

Figure 4 - Academic articles on the use of AI in higher education.

Among the 63 academic articles selected, 47 of them emerge as the most cited and influential in subsequent research, according to data analysis from the Lens.org platform. This strong presence in subsequent research demonstrates the relevance of these articles in the academic landscape and their contribution to the advancement of the field of artificial intelligence and education. The frequent citations attest to the quality and value of these contributions, as well as their ongoing influence in shaping new ideas and
approaches within the academic community, totaling 569 academic citations as distributed according to Figure 5.

![Figure 5 - Type of Publication](image)

Source: by the author from data extracted from the Lens platform.

The analysis of the word cloud reveals a wide range of topics covered in the academic articles, highlighting the prominent presence of "Psychology" and "Mathematical Education." Additionally, the inclusion of Social Sciences disciplines such as "Political Science," "Sociology," and "Philosophy" indicates an interdisciplinary approach. The terms "Educational Technology" and "Multimedia" suggest an interest in innovative teaching and learning approaches. The emphasis on "Adaptive Learning" and "Machine Learning" reflects the adoption of emerging technologies to personalize education. Furthermore, the presence of terms like "Engineering," "Medicine," "Neuroscience," "Data Science," and "Linguistics" indicates a diversity of disciplines explored in the articles (Figure 6).
The data revealed that the studies are more focused on analyzing students' learning and adaptation rather than teaching practices, highlighting studies related to the exact sciences and health fields. No specific studies were found on other sciences, such as humanities or social sciences.

In the context of the evaluative process, automatic assessment has been applied to support various students in higher education. Besides reducing the time dedicated by teachers to evaluation, automatic grading has shown benefits for students with different needs.

Feedback was a tool widely employed in the studies, providing students with formative assessments through text and/or images. Another trend that emerged from the studies was the use of AI to manage students' big data to support learning, as will be examined in the next section.

5 DISCUSSION

Artificial intelligence (AI) technologies have seen significant advancements and are increasingly present in various academic and professional fields. In this context, ChatGPT has stood out, becoming the subject of research since 2022 (Alnaqbi; Fouda,
Academic integrity has been widely discussed by researchers, such as Alnaqbi and Fouda (2023), who emphasize the importance of credibility in establishing a quality relationship between individuals and online information sources. They highlight the need to discern between authentic and misleading content, especially in the face of the vast amount of information available on the internet.

This concern about academic integrity is also addressed by Oravec (2022), who investigated the so-called "dishonest behavior" in the context of AI. The author emphasizes the importance of developing and enhancing tools to detect and prevent dishonest practices, such as plagiarism and academic fraud, which can be amplified by the use of technology.

Furthermore, Celik (2023) examined the level of knowledge of teachers about the use of AI in education, highlighting the importance of empowering educators to effectively integrate technology into their pedagogical practices. The personalization capability of learning offered by ChatGPT has been pointed out as one of the most relevant aspects of its application in education (Jiang et al., 2020). This technology allows educators to develop teaching materials tailored to the individual needs of students, promoting a more effective and inclusive learning environment.

Both teachers and students can significantly benefit from the use of ChatGPT in the classroom. Educators save time on various administrative tasks, allowing them to focus more on teaching. In the future, according to Jiang et al., (2020) ChatGPT has the potential to become a tool to enhance the teaching and learning experience for students and teachers. The integration of AI in education offers promising opportunities to improve the quality and personalization of education.

In the context of engineering courses, a study (Tsai; Ong; Chen, 2023) highlighted the potential benefits of integrating Large Language Models (LLMs) in chemical engineering education. In the study, ChatGPT is used as a problem-solving tool. For the authors, this approach promotes critical thinking, enhances problem-solving skills, and facilitates a deeper understanding of core subjects. During an experimental lecture, a
simple example of building a model to calculate the efficiency of a steam turbine cycle was introduced, and students were assigned projects to explore the potential use of LLMs in solving various aspects of chemical engineering problems. Although it received mixed feedback from students, it was found to be an accessible and practical tool for improving efficiency in problem-solving.

Another study (Haderer; Ciolacu, 2022) proposes an AI-assisted task and planning system for students, with a special emphasis on adapting to new work environments, characterized by social distancing and mobile collaboration. The article presents the analysis, the concept for mobile operating systems, and the graphical interface for smartphones. It provides an overview of the current state of technology, followed by a detailed description of the system development process using the task planner as an example. The document explains the procedure, from the design draft to the programming phase, with integrated testing techniques.

Also within exact sciences courses, another study (Yilmaz; Yilmaz, 2023) examined the impact of using ChatGPT in programming education, focusing on learning processes and outcomes. The research investigated the effect of using ChatGPT in programming education on students' computational thinking skills, programming self-efficacy, and motivation regarding the subject. The study involved 45 university students enrolled in a university-level programming course. The research results revealed that students in the experimental group exhibited significantly better computational thinking skills, programming self-efficacy, and motivation compared to students in the control group.

Also in the exact sciences area, another study (Beg; Alhemeiri; Beg, 2020) presents a tool called QAgen that allows the automatic creation of a large number of questions and answers related to different topics in computer/electrical engineering (ECE), computer science, physics, etc. Specifically, the tool is related to courses in digital logic design, computer architecture, etc. The generated questions are in a format suitable for both Learning Management System (LMS)-based and/or non-LMS-based assessment in conventional courses or MOOCs (Massive Online Open Courses). The proposed tool is based on open-source software, eliminating the need for any commercial software
packages. The underlying principles of QAgen are also applicable to other engineering/science courses if assessment methods require the creation of some diagrams, tables, and equations of connected objects.

To assess the utility of QAgen, sets of practice questions were created for three different courses. Surveys with students from these courses indicated that the questions helped the students prepare for real tests/exams. Especially favored by the students was the availability of correct answers at the end of each practice test/exam. In the medical field, the integration of AI improves the way healthcare professionals acquire knowledge and skills, being used to develop personalized learning systems that adapt to the individual needs of students, providing tailored content and study recommendations. Additionally, AI is used in advanced medical simulations, allowing students to practice complex procedures in safe virtual environments (Guerrero et al., 2022).

Collaborating with this finding, other studies (Ejaz et al., 2022; Wood; Ange; Miller, 2021) with medical students. The authors argue that AI should be part of their curriculum to develop skills and knowledge to ensure a patient-centered digital future in medicine. This teaching should focus on the applications of artificial intelligence in clinical medicine. Students should also have the opportunity to engage in algorithm development. Finally, addressing the issue of university exchanges, with the use of AI was studied by Essel et al., (2022) and Baralt et al. (2022) who described an innovative project carried out by various academic institutions in collaboration to create the "Virtual Tabadul". This is a virtual exchange program designed to promote foreign language learning, particularly English and Arabic, and foster intercultural understanding among about 1,200 young university students from the United States and the Middle East and North Africa (MENA). Four educational institutions participated in this project: Florida International University and the University of Michigan-Dearborn, both from the USA, along with Oum El-Bouaghi University in Algeria and Ibn Tofail University in Morocco. This initiative was made possible thanks to funding provided by the Stevens Initiative. The "Virtual Tabadul" is an example of how technology can be leveraged to create enriching educational opportunities that transcend borders and bring students from different parts of the world closer together, promoting intercultural dialogue and mutual
understanding. This study highlights the importance of such initiatives in promoting international education and building intercultural communities.

The challenges presented by the studies (Alnaqbi; Fouda, 2023; Bervell et al., 2021; Chatterjee; Bhattacharjee, 2020; Essel et al., 2022; Geerling et al., 2023; Ilić et al., 2021; Juma, 2021; Lu, 2023; Neo, 2022; Stojanov, 2023; Xie, 2023; Yu; Guo, 2023) include the need to redesign the curriculum and the evaluative process. This may involve reintroducing supervised and face-to-face assessments to ensure the integrity of the assessment process. Additionally, exploring AI robots as a form of complementary learning may be beneficial to provide immediate and personalized feedback to students.

The analysis of the use of AI in higher education in a review (Crompton; Burke, 2023) revealed five main areas of use: assessment, prediction, AI assistant, intelligent tutoring system (ITS), and student learning management.

Another suggested approach (Javaid et al., 2023) is to increase the emphasis on experiential learning projects, in which AI is still unable to replicate human interaction and the practical application of concepts. This would not only increase student engagement but also better prepare students to face real-world situations.

The curricular issue of university courses was analyzed in a study (Southworth et al., 2023) on the integration of AI across the curriculum at the University of Florida (USA), creating interdisciplinary opportunities for student engagement and ensuring that they are prepared for their careers.

Another study (Jantakun; Jantakun; Jantakoon, 2021) proposes an AAI-HE (Artificial Intelligence in Higher Education) model composed of seven main components. These components include interactive elements between users and AI technology, AI technology and components, roles for artificial intelligence in education, machine learning and deep learning, decision support system (DSS) modules, AI applications in education, and the use of AI to enhance efficiencies on campus. The evaluation of the model by experts indicates that the composition of the AAI-HE is considered absolutely appropriate. The study suggests that this model can guide researchers and instructors interested in studying and implementing effective AI practices in higher education, contributing to more efficient management.
Cakir (2022) addressed the issue of personalized instruction in education and its ability to increase motivation, interest, performance, and students' attitude. The research aimed to develop an instructional management system that could be adapted to each individual, considering each student's level of prior knowledge, which would allow for the personalization of all instructional materials. The project itself involved an interdisciplinary study of systems and product development, covering areas of educational technology and computer engineering. The methodology used follows action research principles, which imply a practical approach focused on developing concrete solutions.

5.1 APPLICATIONS IN EDUCATION

The application of AI, including ChatGPT, spans various academic areas. Studies such as Celik (2023) emphasize the need to prepare educators to efficiently integrate AI-based tools into education. The personalization capability of learning offered by ChatGPT is crucial (JIANG et al., 2020), allowing educators to design specific lessons to meet the individual needs of students.

5.2 IMPACT ON ENGINEERING AND EXACT SCIENCES

In engineering courses, the integration of Large Language Models (LLMs), specifically ChatGPT, can enhance problem-solving skills (Tsai et al., 2023). However, challenges such as mixed feedback from students highlight the need for adjustments in implementation.

5.3 AI IN MEDICINE

The medical field benefits from AI not only in the development of personalized learning systems but also in advanced simulations (Guerrero et al., 2022). Medical
students should be equipped with AI knowledge to ensure patient-centered practice (Wood et al., 2021).

5.4 INNOVATIONS IN UNIVERSITY EXCHANGES

Innovative projects such as "Virtual Tabadul" explore the potential of virtual reality to promote foreign language learning and intercultural understanding (Essel et al., 2022; Baralt et al., 2022). These initiatives highlight how technology can enrich educational opportunities, transcending borders.

5.5 CHALLENGES AND PROPOSED SOLUTIONS

Studies identify challenges, including the need to redesign curricula and assessment processes. Proposed solutions include reintroducing supervised assessments and using AI robots to provide personalized feedback (Crompton; Burke, 2023).

The integration of AI into university curricula is discussed by Southworth et al. (2023), emphasizing interdisciplinary opportunities and career preparation. Models like the AAI-HE by Jantakun et al. (2021) offer a framework for implementing effective AI practices in higher education.

Personalized instruction is highlighted (Cakir, 2022), showing how adjustable learning management systems can personalize instructional material, taking into account students' prior knowledge.

6 CONCLUSION

With technological advancement, the impact of AI on academic integrity becomes a topic of discussion in all countries. This systematic review sought to understand how these innovations are influencing the educational landscape by examining their role in higher education and the ethical and social challenges associated with addressing issues involving the integrity of academic research.
The studies reviewed highlight the transformative role of technologies, pointing out that they bring positive changes to educational practices; however, the implementation of these technologies does not occur without challenges. The issue of academic integrity is addressed in the research, especially with the introduction of automated cheating detection systems that are still not reliable and require significant improvements, namely, learning how the machine writes. Additionally, trust, credibility, and honesty become fundamental to maintaining integrity in an increasingly technology-driven educational environment.

We see that academic integrity is impacted by Artificial Intelligence (AI) in various ways. The ease of access to information provided by AI can be beneficial for academic research, but it also increases the risk of plagiarism. Automated writing tools can streamline the creation of documents, but there is the challenge of ensuring the authenticity of academic work. Intelligent tutoring systems offer personalized support, but their misuse can compromise genuine learning. The spread of technologies like ChatGPT in education highlights the need to rethink assessment practices to preserve academic integrity. In summary, AI offers opportunities and challenges, requiring an ethical approach to ensure integrity in the academic environment.
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