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Uso de inteligencia artificial en estudiantes de pregrado: aprendizaje basado en preguntas

Use of artificial intelligence in undergraduate students: question-based learning

Uso de inteligência artificial em alunos de graduação: aprendizagem baseada em investigação

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Resumen

Este estudio examina el uso de la inteligencia artificial entre estudiantes universitarios, centrándose en los beneficios, los desafíos y las preferencias tecnológicas. Utilizando un enfoque cuantitativo, revisión de la literatura y una encuesta a 127 estudiantes de una universidad privada en Guadalajara, Jalisco, México, el análisis encontró que el 99% de los estudiantes la utiliza, principalmente dos a tres veces por semana. Las motivaciones incluyen el fácil acceso, el ahorro de tiempo, la rápida recuperación de información y una mejor comprensión. Los ordenadores portátiles (79%) y los teléfonos celulares (58%) son los dispositivos preferidos, siendo *ChatGPT, Copilot y Gemini* las herramientas más populares. Los beneficios incluyen aprendizaje personalizado, retroalimentación inmediata y adaptabilidad. Sin embargo, los desafíos incluyen información poco confiable, explicaciones complejas, problemas de precisión, fallas lógicas, falta de personalización y citas faltantes. A pesar de estos desafíos, el estudio concluye que mejora el aprendizaje de pregrado y recomienda su incorporación como herramienta educativa

complementaria. Posibles implicaciones prácticas ¿cómo incorporar la inteligencia artificial como herramienta en las planeaciones didácticas?

Palabras clave: Inteligencia artificial, aprendizaje basado en preguntas, pregrado, estudiantes, Tecnologías de la Información y la Comunicación.

Abstract

This study examines the use of artificial intelligence among college students, focusing on benefits, challenges, and technological preferences. Using a quantitative approach, literature review, and a survey of 127 students at a private university in Guadalajara, Jalisco, Mexico, the study found that 99% of students use it, primarily two to three times a week. Motivation includes easy access, time savings, rapid information retrieval, and better understanding. Laptop computers (79%) and mobile phones (58%) are the preferred devices, with ChatGPT, Copilot, and Gemini being the most popular tools. Benefits include personalized learning, immediate feedback, and adaptability. However, challenges include unreliable information, complex explanations, accuracy issues, logical flaws, lack of customization, and missing citations. Despite these challenges, the study concludes that it improves undergraduate learning and recommends its incorporation as a complementary educational tool to enhance undergraduate learning outcomes. Possible practical implications: how to incorporate artificial intelligence as a tool in teaching plans?

Keywords: Artificial intelligence, question-based learning, undergraduate, students, Information and Communication Technologies.

Resumo

Este estudo examina o uso de inteligência artificial entre estudantes universitários, com foco em benefícios, desafios e preferências tecnológicas. Usando uma abordagem quantitativa, revisão de literatura e uma pesquisa com 127 alunos de uma universidade privada em Guadalajara, Jalisco, México, a análise descobriu que 99% dos alunos usam o aplicativo, principalmente de duas a três vezes por semana. As motivações incluem fácil acesso, economia de tempo, rápida recuperação de informações e melhor compreensão. Laptops (79%) e celulares (58%) são os dispositivos preferidos, com ChatGPT, Copilot e Gemini sendo as ferramentas mais populares. Os benefícios incluem aprendizagem personalizada, feedback imediato e adaptabilidade. No entanto, os desafios incluem informações não confiáveis, explicações complexas, problemas de precisão, falhas lógicas, falta de personalização e citações ausentes. Apesar desses desafios, o estudo

conclui que ele melhora o aprendizado de graduação e recomenda sua incorporação como uma ferramenta educacional complementar. Possíveis implicações práticas: como incorporar a inteligência artificial como ferramenta no planejamento de ensino?

Palavras-chave: Inteligência artificial, aprendizagem baseada em investigação, graduação, estudantes, Tecnologias de Informação e Comunicação.

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Introduction

Digital technologies have become an essential part of knowledge management in just a few years. Artificial intelligence (AI) has become a key element for the individualisation, adaptation and personalisation of learning. With the unstoppable advance of AI in higher education, there is a controversial acceptance among some teachers and managers.

AI has increased its use in all fields and higher education is no exception. Its impact favors teaching and learning. It is a motivator for students. However, like all technology, it has beneficial effects and disadvantages. Its detractors say that it does not help students think, that it does not make them reflect, since it does not require reading. Simple access to technology allows them to seek help and solve problems immediately. Another problem that arises is plagiarism, which consists of students assuming that the information they obtain from some AI is their own.

This undoubtedly represents a challenge for teachers, who must quickly acquire skills in the use of this technology to stay aligned with their students.

Universities are rapidly incorporating AI integration to improve the student experience, which is why it has become an area of interest (Neji et al., 2023) .

According to Chao and Rivera (2024) **,** 33% of students use AI tools in their schoolwork, with *ChatGPT being* the most widely used. Students consider that these tools facilitate their academic life and have a positive impact on their learning.

AI has the potential to revolutionize the way students learn and interact with course material (González et al., 2021) . By leveraging AI-powered tools and systems, educators can create personalized learning experiences that meet each student's unique needs and learning styles. One such approach is the implementation of Inquiry-Based Learning (PBL), where students are actively engaged in the learning process through a series of carefully crafted questions.

PBL is an educational approach that highlights the importance of exploration and inquiry. This strategy motivates students to tackle complex, real-world problems, thereby

developing their critical thinking skills and taking responsibility for their own learning. (Wale & Bishaw, 2020)

According to Wale and Bogale (2021) , when students are actively engaged in the process of asking questions, gathering information, and constructing explanations, they are more able to effectively apply their critical thinking skills in their writing. Furthermore, the question-based approach has been shown to foster a sense of ownership and self-regulation in the learning process, as students take a more active role in shaping their own educational trajectories. Over time, students gain the ability to ask increasingly complex questions, influenced by their interests, assumptions, context, as well as the accumulation of knowledge and experience.

Integrating AI into PBL can provide numerous benefits, including the ability to generate personalized questions, offer intelligent feedback and guidance, and adapt the learning experience based on student performance and progress. This approach not only improves student engagement and understanding, but also enables educators to better identify and address knowledge gaps, ultimately leading to improved learning outcomes. (Aliabadi et al., 2023)

The potential of AI in education has been widely recognized, with studies highlighting its ability to facilitate personalized learning, intelligent tutoring, and automated assessment (Aliabadi et al., 2023; González et al., 2021; Luckin et al., 2016) . On the other hand, the implementation of AI in PBL not only improves student engagement but also enables teachers to identify knowledge gaps. It is crucial that the implementation of AI in the classroom is transdisciplinary, connected to the curriculum. This is precisely one of the challenges.

Incorporating AI into higher education is through a PBL model, which involves using AI-powered systems to generate and analyze questions, providing students with personalized feedback and adaptive learning experiences. By leveraging AI to create and assess questions, faculty can gain valuable insights into student understanding, identify knowledge gaps, and adapt their teaching strategies.

One of the problems people face when using AI is « How to formulate questions correctly? » How to structure a question? What characteristics should it have? How many characters should a question have on average?

It is well known that, as with any other question, you must be clear about what you expect as an answer, do so in a direct, straightforward and as simple manner as possible, including context to facilitate appropriate responses.

ChatGPT himself (2024) How to structure a question correctly? To structure a *prompt* as a correct question, it is important to follow these principles: 1) define the

purpose precisely and concisely, clearly specifying what you expect as an answer. 2) it must be direct, without ambiguities or overly complex sentences. 3) provide the relevant information that allows the AI to better understand the framework in which the question is asked. 4) the more detailed and specific you are, the more accurate the answer will be. Include details about the type of answer you are looking for (list, summary, analysis, etc.). 5) clearly indicate if the answer must follow a specific format, such as paragraphs, numbered lists, or quotes.

> A *prompt* is an instruction or set of instructions that you give to an artificial intelligence (AI) or language model to obtain a specific response. It can be a question, task, or request for text or image generation. Quality directly affects the accuracy and relevance of the response generated by the AI. (ChatGPT, 2024)

A *prompt* It is a request we make to AI, usually in the form of a question. Sigman and Bilinkis (2023) say that It allows us to rescue the Socratic perspective of the value of questioning and conversation, contributing to the development of higher-order capabilities, such as the explanation and justification of reasoning.

A good question is usually clear, meaning that its ideal length should be between 20 and 40 words. There is no exact number of characters or words, but the question should be short enough to maintain focus and detailed enough to capture the purpose of the research. It is recommended to avoid lengthy questions that include multiple variables, as they can complicate the analysis and interpretation of the results.

In this research we start from the following question: What are the main reasons for the use of AI in undergraduate students' learning? Our objective is to analyze the use of AI in undergraduate students' learning, identifying their benefits, challenges and technological preferences in the post-pandemic context. As a hypothesis: we believe that the use of AI as an educational tool improves the learning of undergraduate students and consequently can be incorporated as a complementary tool in teaching.

This study analyzes how the integration of AI in higher education can improve learning through the inquiry-based learning (PBL) approach.

Literature review

The implementation of AI in PBL not only improves student engagement but also enables teachers to identify knowledge gaps. It provides personalized feedback and adaptive learning experiences, tailored to each student’s individual needs and abilities (Aliabadi et al., 2023; Fahimirad and Kotamjani, 2018; Idroes et al., 2023) . This personalized approach can improve student engagement, motivation, and overall

academic performance. Furthermore, AI-based assessment tools assist in the grading process, allowing for frequent and immediate feedback, which can positively impact student progress (Abbas et al., 2023) . It fosters the development of critical thinking skills, encouraging students to interact with the material in a more active and interactive way. This of course with the guidance and supervision of the teacher as a subject matter specialist.

The emergence of AI-powered inquiry-based learning has revolutionized the educational landscape, offering personalized learning experiences (Kamalov et al., 2023) . However, despite the numerous benefits, there are potential risks associated with it. For example, absence of peer interaction could lead to social isolation and impaired socio-emotional development, which could lead to reduced engagement and enthusiasm.

Another identified risk is the introduction of bias into the data and algorithms used by AI-powered systems. Existing systemic biases and discrimination can be perpetuated, leading to unfair treatment of students from disadvantaged or marginalized groups. This issue of bias and equity needs to be addressed through rigorous testing and the implementation of ethical frameworks within the design and implementation of these tools. (Akgun and Greenhow, 2022)

Automated assessment capabilities, while potentially reducing teacher workload, may not fully capture the nuances and complexities of student learning. Reliance on automated grading and feedback could undermine teachers' role in providing personalized guidance and support, potentially leading to a decrease in the quality of education.

To address these risks, it is essential to take advantage of the benefits offered by AI and to recover the traditional elements related to human interaction, so that we take advantage of technology and at the same time address the social and educational needs of the student . Consequently, promoting interaction between peers and taking advantage of automated assessment.

One of the most used AI according to Puertas (2024) is *ChatGPT* , the author recognizes its potential for various educational tasks, such as text generation, translation, answering questions, and programming assistance. This opens up possibilities for its use in the creation of teaching materials, student assessment, and personalized feedback.

For Sigman and Bilinkis (2023), the disruption that AI generates in education demands a re-evaluation of the roles of educators and students, promoting adaptation to new methodologies and tools, because AI not only modifies *what* we learn, but *how* we do it, opening doors to personalization. They speak of cognitive stagnation, referring to

the incorporation of digital tools that we have done during these years to make our lives easier. This has also translated into the loss of skills such as memorization.

AI has expanded knowledge in education and medicine. Collecchia and De Gobbi (2024) mention that it can help doctors make more informed decisions, improve diagnostic accuracy and personalize treatments. In this field, as in education, the doctor as a specialist has to review the information provided and be very careful with the personal data that could identify the patient (in our case, the student).

The recommendation is not to mention names of people, but only to provide data and request diagnoses, to ensure the necessary treatments and care.

In this sense, one of the conclusions of the congress of the Instituto Tecnológico de Estudios Superiores de Monterrey (I TESM, 2024) was that learning and curriculum must be flexible; rigid educational systems have no place in these new educational trends with the use of AI. The problem that education is going through will not be solved with technology, however, we cannot be oblivious to it, otherwise we will make the problem worse.

Pérez (2024) invites us to reflect on the uses of AI and its impact on education. He mentions that as we conceive it today, it is based on the identification of patterns from large volumes of data. He adds that we have too much confidence in it, which can lead to serious errors since it does not understand the context in the same way as a human being; its operation is based on correlations and associations. This means that it can fail to interpret situations that require contextual or causal understanding. Instead of allowing students to depend on it to build knowledge, an environment should be fostered where they can develop their own critical thinking.

AI can be a useful tool, but it should not replace students' ability to understand and reason for themselves. Interacting can be beneficial if done in a mindful way. Educators should ask questions that help students reflect on their use of technology. For example, How can AI help us better understand the world, and what are its limitations?

One of his main critiques of Perez (2024) is that education should not be a process of domestication, but one that promotes transformation and the development of critical skills. It is essential that students are able to construct their knowledge rather than simply consume information provided by AI.

Bauman and Leoncini (2018) examine the dynamics of contemporary societies through the prism of globalization and rapid technological evolution, focusing on the concept of “liquidity.” This metaphor represents instability and lack of certainty in various areas of human life, such as personal relationships, work, and identity. The authors mention that technology transforms social interactions, creating new forms of

communication, but it can also increase the feeling of alienation, referring to the disconnection of an individual from their environment and from themselves. This is where we find meaning in what happens with AI in the lives of students.

Bauman (2005) mentioned earlier how the rapid integration of technology into education presents both opportunities and challenges. While it can facilitate access to knowledge, it can also lead to information overload and an emotional disconnect between students and educators. It is crucial to find a balance in the use of technology to enhance, rather than hinder, the educational process.

AI is transforming higher education by offering personalized learning experiences. It analyzes learning styles and performance, adapts materials and methodologies to individual student needs, and improves their engagement and understanding. However, its successful implementation in education requires careful consideration of several factors, including effective integration strategies, teacher training, and ethical considerations. (Abbas et al., 2023)

Methodology

A quantitative method is used, starting from a literature review to delve into and understand how AI has been used and incorporated in higher education, what its impacts have been on student learning and how it is perceived.

We now know that AI can mitigate creative block, as people often lack ideas or do not know how to start writing . So it is a very useful tool. However, it should not be overused or the writing process completely delegated .

A non-probabilistic convenience sampling was used, since according to Hernández and Escobar (2019), this method is applied until the sample is complete according to the established criteria. This choice was due to its easy access and low cost.

A questionnaire was developed based on the research question, which was reviewed by two peer researchers in the area of Information and Communication Technologies (ICT) . It was then applied to 10 students to verify their understanding and response frequency. The final questionnaire was sent to Economic and Administrative Sciences (CEA) students at a private university in the Metropolitan Area of Guadalajara, Jalisco, Mexico. It was sent through Google forms during the month of October 2024 and answered by 127 students, representing 27% of the total higher education students in the CEA school system .

Table 1: Questions included in the questionnaire applied to CEA students

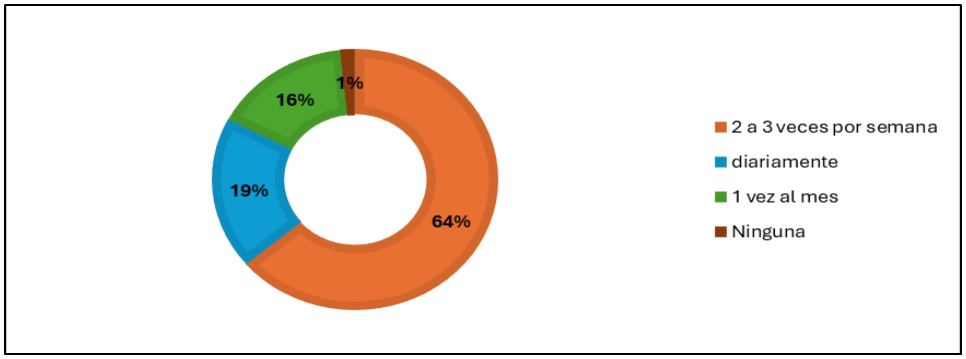
Question/Prompt/Inquiry	Variable
How often do you use AI?	Frequency of use of AI
What are the reasons for using AI as a learning medium instead of other technological means?	Reasons for use
What technological devices do they use to power AI?	Type of device
What do they use AI for?	Uses of AI
What are the reasons for using a type of AI?	Reasons for using specific AI
What AI do you use most frequently?	Most used type of AI
How often do you use AI for jobs and tasks?	Frequency of use for jobs and tasks
What are the reasons for using AI?	General reasons for using AI
What are the main problems you face when using AI?	Usage problems

Source: own elaboration

Results

42% of the sample is female and 58% is male . The average age was 21.3 years. The frequency of AI use among undergraduate students has increased significantly in the post-pandemic context, at which time it has become an essential tool for personalized learning and education . 99% of students use AI; 64% use it two to three times a week, 19% daily, and 16% once a month (see figure 1).

Figure 1. Frequency of AI use among undergraduate students



Source: Prepared by the authors using survey data

Although students are more frequently using AI in the academic field, they also recognize its lack of precision and the presence of inconsistencies in the information provided . In this sense, García (2023) found that 75% of students consider the use of *ChatGPT* in their academic activities to be inappropriate . This indicates that students adopt a more critical stance regarding technology and its applications .

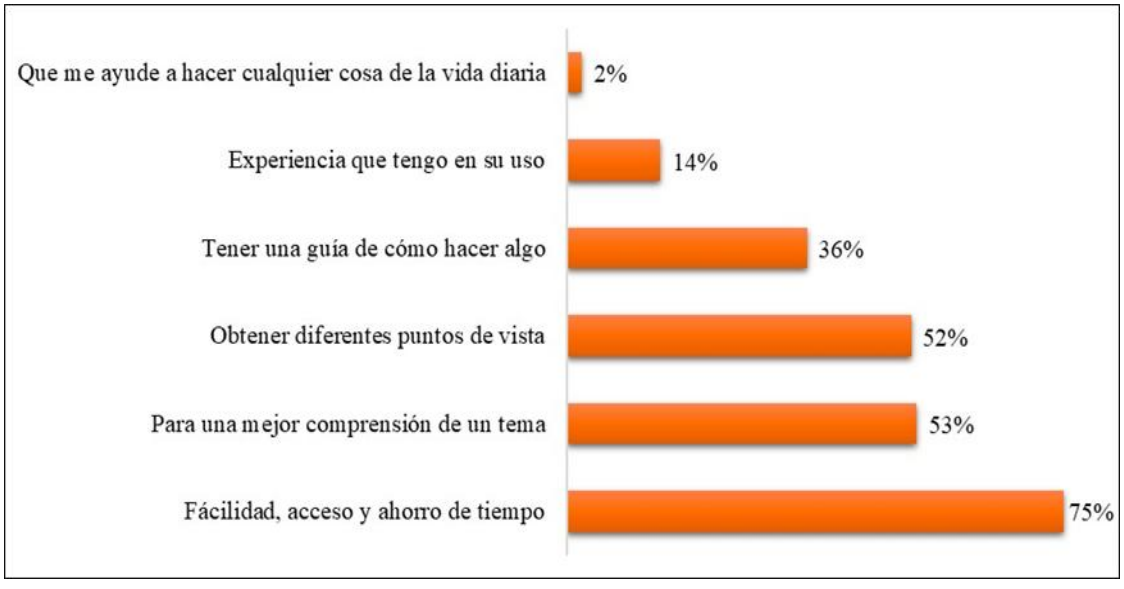
The reasons for using AI include personalization of learning, immediate feedback, and the ability to adapt to individual student needs, which improves the quality of learning.

In figure two, the main reasons for use can be seen, which include ease of access and saving time (75%), quick search for information and better understanding of a topic (53%), verification of information from different perspectives (52%) and obtaining quick guides for carrying out tasks (36%).

According to Alpizar and Martínez (2024), students highlight the ease and accessibility of learning resources (31%), efficiency in searching for information (27%) and innovative presentation of information (21%).

Students have developed the ability to refine their questions and consequently obtain better information.

Figure 2. What are the reasons for using AI as a learning medium?



Source: Prepared by the authors using survey data

Students use computers, tablets and smartphones to access AI-based educational platforms, facilitating interactive and accessible learning.

According to the results of our survey, students use AI on laptops or desktop computers at 79%, followed by mobile phones at 58%. Therefore, mobile applications have been developed that support the continuous use of AI in various environments.

Figure 3 indicates that students primarily use AI to support homework and schoolwork, at 87%. This is followed by the use of AI for counselling and mental health (31%), learning about the use and development of *hardware* and *software* (28%), and language study (23%).

The main uses include the creation of personalized educational content, monitoring academic progress and facilitating tutoring tailored to individual needs.

Zamora and Stynze (2024) conclude that AI is a significant tool if used responsibly and ethically in the classroom, therefore, it should not be seen as a threat, but as an ally that contributes significantly to the teaching-learning process.

Figure 3. Main uses of AI in educational environments

Source: Prepared by the authors using survey data

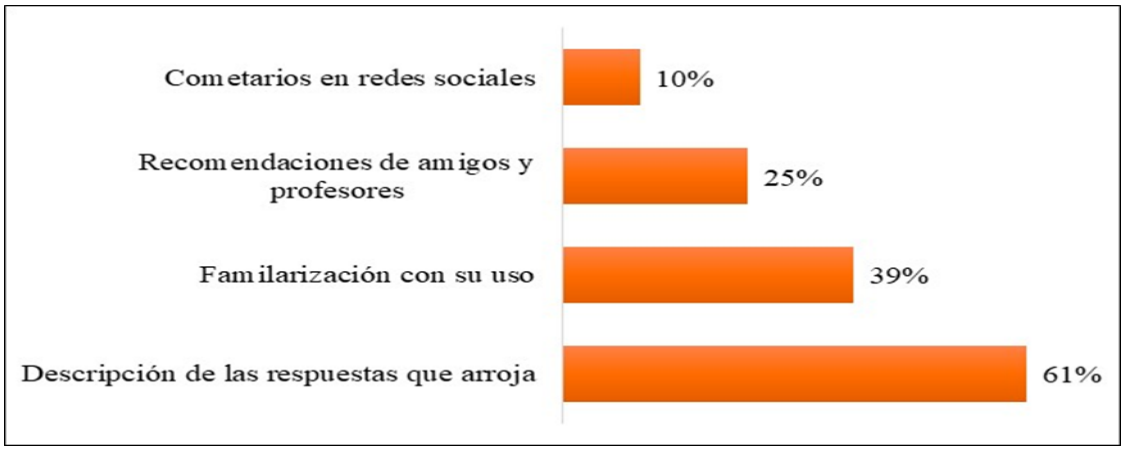
According to Chao and Rivera (2024), students use AI mainly to support the development of school tasks (17%), to search for information (15%) and as a starting point for academic activities (17%). They use AI tools at least once a week or more. In addition, these resources are also used for the generation of ideas (12%), the search for inspiration (brainstorming) (11%), or as support for the understanding of class content (10%). To a lesser extent, they are used for leisure or gaming activities (8%), and only a very low proportion of the student population claims to use these tools to avoid doing school activities themselves (2%). Chao and Rivera (2024) He mentions that, of the existing applications that they know and use, *ChatGPT stands out* , followed by *Dall-E2* and *MidJourney* .

Reasons for choosing a specific type of AI may include its effectiveness in improving academic performance, its ability to provide instant feedback, and its ease of use in educational settings.

Students use different types of AI (figure 4), depending on the description of the responses obtained (61%), as well as their familiarity with some of them (38%). In

addition, recommendations from friends (24%) and comments on social networks (10%) also influence their choice.

Figure 4. What are the reasons why you use a type of AI?

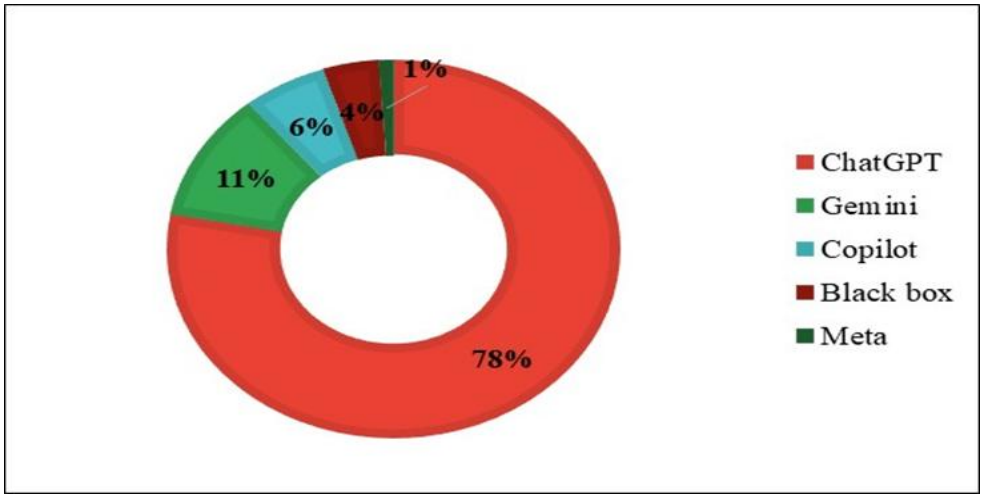


Source: Prepared by the authors using survey data

Alpizar and Martínez (2024) mention the advantages of using AI versus using traditional methods: 30% consider that it improves the quality of teaching and learning, the same value for those who appreciate the accessibility and convenience that AI tools provide. 21% value the speed they obtain in their information search work.

Figure five shows that the most used AI by students are *ChatGPT* , *Copilot* , *Gemini*, *Meta and Black box* .

Figure 5. What AI do you use frequently?



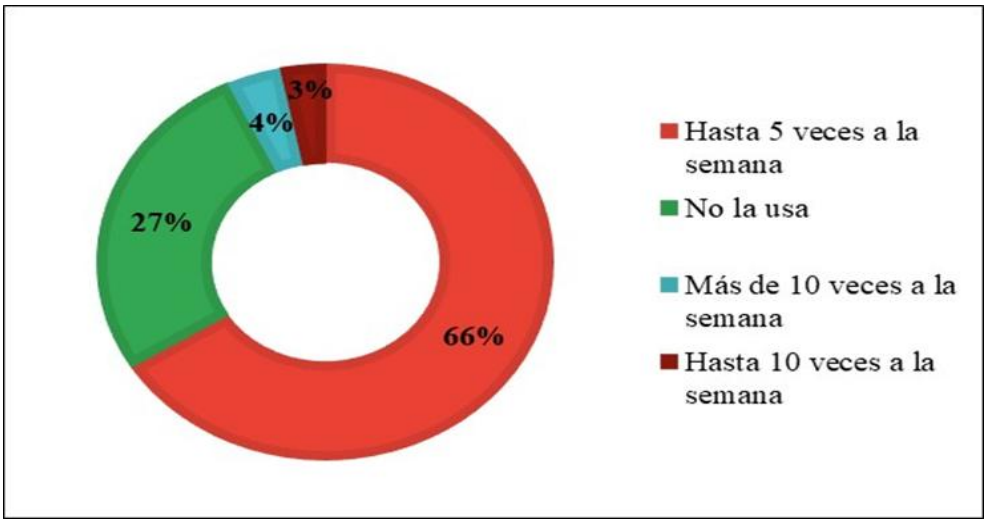
Source: Prepared by the authors using survey data

Although the frequency of AI use for work and assignments has increased, 73% of students say they do not use it specifically in the school environment. 85 % of students who have worked with an AI tool mention that the existing applications they know and use are *ChatGPT* , followed by *Gemini*, *CoPilot* , *Microsoft* 's *BingChat* and *Google* 's

Bard , among others. In terms of language, most of them have the advantage of having their version in Spanish and otherwise they use the English version, using their knowledge or being guided intuitively. (Hernández et al., 2024)

As for the frequency of use for school work, figure six shows that students use it up to five times a week (66%). 27% do not use it, 4% use it more than 10 times a week and 3% use it up to 10 times a week.

Figure 6. How often do you use artificial intelligence to perform classwork and assignments?



Source: Prepared by the authors using survey data

The main reasons for using AI in education include personalizing learning, facilitating remote assessments, and optimizing educational management through data analysis.

Reasons why students use AI: for ease, the ability to obtain information quickly and efficiently, for the accessibility and convenience it offers. The availability of information is also mentioned, which helps to understand complex topics, speed in resolving doubts or problems is crucial, as a support for tasks and projects because it serves as a guide and facilitates the completion of tasks and projects. Helps correct texts, improves ideas and offers a variety of sources of reference in a single response.

Common issues include lack of familiarity with technological tools, concerns about data privacy, and over-reliance on these technologies, which can impact autonomous learning .

According to the responses of the surveyed students, the main problems that students face when using AI have to do with: 1) the information is often not reliable, truthful or complete, which underlines the importance of verifying sources and corroborating data before using them. The answers are sometimes difficult to understand,

and the way of explaining concepts can be very technical or redundant. This suggests the need to simplify the information and adapt it to the user's context. 2) There is concern about the accuracy of the answers, indicating that they may not always be correct or relevant to what is being asked. 3) it can have logical flaws and does not always understand the context or specificity of the questions. This highlights the importance of formulating clear and concise questions. 4) the answers are sometimes very mechanical and there is a lack of personalization or empathy in the interactions. 5) The lack of clear citations and references of where the information comes from is a critical point, especially in academic or research contexts.

Discussion

We have identified differences in the use of AI, related to institutional regulations and the greater flexibility of some Higher Education Institutions (HEIs) and teachers regarding the use of technologies in the classroom . We found that 63% of students use AI between two and three times a week, while Ulloa et al. (2024) indicate that 50% of respondents use it occasionally .

Our findings reveal a concern about the quality of information obtained through AI, which is in line with what has been pointed out by Abbas et al. (2023), Chan and Tsi (2023) and Fahimirad and Kotamjani (2018), who warn about the lack of reliability, accuracy and integrity of the data provided by these systems. In this regard, we agree with Idroes et al. (2023) on the need for students to verify sources and corroborate data.

We consider it essential to emphasize the importance of formulating clear and concise questions. It is recommended to use specialized AI tools depending on the topic of interest. To this end, some platforms offer thematic spaces or specific sections depending on the subject matter.

Chao and Rivera (2024) found that 20% of teachers use AI tools in their educational practice, while 33% of students use them to perform academic tasks. Although our study does not address the case of teachers, we found that 66% of students use AI to perform school tasks and activities. However, we agree that students have a more positive view regarding the benefits of AI in their learning process. Therefore, teachers must be trained in the use of AI tools for pedagogical purposes.

The lack of adequate infrastructure, as well as the lack of teacher training, represent a significant obstacle to the adoption of AI in education. It is recommended to increase investment in ICT to provide educational institutions with the necessary resources for an effective implementation of AI. It is essential to implement continuous

training programs that train educators in the pedagogical and ethical use of these tools. (Uribe, 2024) .

Conclusions

The use of AI as an educational resource improves the learning of undergraduate students and, consequently, can be integrated as a complementary support in teaching. However, its use in higher education presents a significant challenge for HEIs. AI has captured the attention of universities, which seek to innovate and remain competitive. The wide availability of electronic devices and quick access to information have transformed the way students learn.

AI has established itself as an innovative resource for learning. The PBL approach allows students to manage their knowledge effectively. By asking well-structured questions and seeking answers with the guidance of their teachers, students can improve their performance, motivation and academic progress. For this to work, it is essential that teachers train and become experts in the use of AI. Its incorporation into the classroom must be transdisciplinary, aligned with a curriculum that offers personalized support to students, considering their diverse learning styles. Such integration includes the provision of intelligent feedback, which can significantly improve the assessment process.

However, it is equally important to foster socialization and develop cognitive skills, such as reading comprehension and critical analysis skills. The combination of AI and teaching experience can create better opportunities for mentoring and support.

Responsible use of AI offers numerous benefits, such as mitigating learning gaps and implementing more effective teaching strategies, which in turn increases motivation and academic performance.

These findings suggest that AI can be a valuable tool for improving the quality of university learning.

Future Lines of Research

Although the use of AI can be useful as a complementary tool in student learning, we do not have enough evidence to claim that it can be generalised to other HEIs. Therefore, it is recommended that each institution carry out its own diagnosis. Even so, it should be considered a complementary element, since its use in education is irreversible. It is recommended to carry out studies with random samples that offer greater representativeness. It would also be beneficial to carry out specific studies for other areas to identify possible differences.

It is essential that it is used responsibly and above all for educational purposes, since it is easy to be enchanted by AI.

There is a need to examine the use of AI among teachers to maximize its pedagogical potential. In this context, a key question arises: how to integrate AI into teaching planning? How would current teaching methodologies be transformed if teachers used AI to personalize the educational experience of each student in real time?

Gratitude

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References

Abbas, N., Ali, I., Manzoor, R., Hussain, T. y Hussaini, M. H. A. (2023). Role of Artificial Intelligence Tools in Enhancing Students' Educational Performance at Higher Levels. *Journal of Artificial Intelligence,Machine Learning and Neural Network*, *3*(05). https://doi.org/10.55529/jaimlnn.35.36.49

Akgun, S. y Greenhow, C. (2022). Artificial intelligence in education: Addressing ethical challenges in K-12 settings. *AI and Ethics*, *2*(3), 431-440. https://doi.org/10.1007/s43681-021-00096-7

Aliabadi, R., Singh, A. y Wilson, E. (2023). Transdisciplinary AI Education: The Confluence of Curricular and Community Needs in the Instruction of Artificial Intelligence. En T. Schlippe, E. C. K. Cheng, y T. Wang (Eds.), *Artificial Intelligence in Education Technologies: New Development and Innovative Practices* (pp. 137-151). Springer Nature. https://doi.org/10.1007/978-981-99-7947-9_11

Alpizar, G. L. O. y Martínez, R. H. (2024). Perspectiva de estudiantes de nivel medio superior respecto al uso de la inteligencia artificial generativa en su aprendizaje. *RIDE Revista Iberoamericana para la Investigación y el Desarrollo Educativo*, *14*(28). https://doi.org/10.23913/ride.v14i28.1830

Bauman, Z. y Leoncini, T. (2018). *Generación liquida: Transformaciones en la era 3.0* (Primera). Paidós.

Bauman, Z. (2005). *Los retos de la educación en la modernidad liquida* (Primera). Gedisa. https://www.uv.mx/mie/files/2012/10/retos-educacion-modernidad.pdf

Chan, C. K. y Tsi, L. H. Y. (2023). *The AI Revolution in Education: Will AI Replace or Assist Teachers in Higher Education?* (arXiv:2305.01185). arXiv. https://doi.org/10.48550/arXiv.2305.01185

Chao, R. C. y Rivera, N. M. A. (2024). Usos y percepciones de herramientas de inteligencia artificial en la educación superior en México. *Revista Iberoamericana de Educación*, *95*(1). https://doi.org/10.35362/rie9516259

ChatGPT. (2024, octubre 26). *¿Cómo estructurar una pregunta correctamente?* https://chatgpt.com

Collecchia, G. y De Gobbi, R. (2024). *AI in Clinical Practice: A Guide to Artificial Intelligence and Digital Medicine* (Primera). Elselvier. https://shop.elsevier.com/books/ai-in-clinical-practice/collecchia/978-0-443-14054-9

Fahimirad, M. y Kotamjani, S. S. (2018). A Review on Application of Artificial Intelligence in Teaching and Learning in Educational Contexts. *International Journal of Learning and Development*, *8*(4). https://doi.org/10.5296/ijld.v8i4.14057

García, S. O. V. (2023). Uso y percepción de ChatGPT en la educación superior. *Revista de Investigación en Tecnologías de la Información*, *11*(23). https://doi.org/10.36825/RITI.11.23.009

González, C. V., Prendes, E. P. y Roig, V. R. (2021). Artificial Intelligence for Student Assessment: A Systematic Review. *Applied Sciences*, *11*(12). https://doi.org/10.3390/app11125467

Hernández, G. M. H., Ramos, Q. J. M., Chávez, M. F. J. y Trejo, C. M. del C. (2024). Ventajas y riesgos de la Inteligencia Artificial Generativa desde la percepción de los estudiantes de educación superior en México. *European Public y Social Innovation Review*, *9*, 1-19. https://doi.org/10.31637/epsir-2024-495

Hernández, Á. C. E.y Escobar, N. A. C. (2019). Introducción a los tipos de muestreo. *Alerta, Revista científica del Instituto Nacional de Salud*, *2*(1). https://doi.org/10.5377/alerta.v2i1.7535

Idroes, G. M., Noviandy, T. R., Maulana, A., Irvanizam, I., Jalil, Z., Lensoni, L., Lala, A., Abas, A. H., Tallei, T. E. y Idroes, R. (2023). Student Perspectives on the Role of Artificial Intelligence in Education: A Survey-Based Analysis | Journal of Educational Management and Learning. *Journal of Educational Management and Learning*, *1*(1). https://doi.org/10.60084/jeml.v1i1.58

Instituto Tecnológico de Estudios Superiores de Monterrey (2024, enero). *IFE Conference*. IFE Conferece. https://ciie.itesm.mx/es/

Kamalov, F., Santandreu, C. D. y Gurrib, I. (2023). New Era of Artificial Intelligence in Education: Towards a Sustainable Multifaceted Revolution. *Sustainability*, *15*(16), Article 16. https://doi.org/10.3390/su151612451

Luckin, R., Holmes, W., Griffiths, M. y Forcier, L. B. (2016). *Intelligence Unleashed: An argument for AI in Education*. Pearson Education. https://www.pearson.com/corporate/about-pearson/what-we-do/innovation/smarter-digital-tools/intelligence-unleashed.html

Neji, W., Boughattas, N. y Ziadi, F. (2023). Exploring New AI-Based Technologies to Enhance Students' Motivation. *Issues in Informing Science and Information Technology*, *20*, 095-110. https://doi.org/10.28945/5149

Pérez, Á. M. A. (2024). *Crítica de la razón artificial*. Simposio internacional SOMECE 2024: Benemérita Universidad Autónoma de Puebla. https://www.facebook.com/SOMECE/videos/914414176743525

Puertas, E. (2024). Indicaciones prácticas para usar ChatGPT. En *ChatGPT y educación universitaria: Posibilidades y límites de ChatGPT como herramienta docente* (Primera). Octaedro. https://octaedro.com/libro/chatgpt-y-educacion-universitaria/

Sigman, M. y Bilinkis, S. (2023). *Artificial: La nueva inteligencia y el contorno de lo humano* (Primera). Debate. https://www.amazon.com.mx/Artificial-nueva-inteligencia-contorno-humano-ebook/dp/B0CHHL4667/?tag=wkss20-20

Ulloa, M. J. L. U., Sólorzano, M. C. M., Díaz, C. E. G., Quiñonez, B. N. M. y Baque Mite, L. A. (2024). Usos de la inteligencia artificial en los estudiantes universitarios. *Polo del Conocimiento*, *9*(8). https://doi.org/10.23857/pc.v9i8.7899

Uribe, F. (2024). Los Retos de la Inteligencia Artificial (IA) en la Educación de México. *Ciencia Latina Revista Científica Multidisciplinar*, *8*, 2607-2626. https://doi.org/10.37811/cl_rcm.v8i5.13723

Wale, B. D. y Bishaw, K. S. (2020). Effects of using inquiry-based learning on EFL students' critical thinking skills. *Asian-Pacific Journal of Second and Foreign Language Education*, *5*(1), 9. https://doi.org/10.1186/s40862-020-00090-2

Wale, B. D. y Bogale, Y. N. (2021). Using inquiry-based writing instruction to develop students' academic writing skills. *Asian-Pacific Journal of Second and Foreign Language Education*, *6*(1), 4. https://doi.org/10.1186/s40862-020-00108-9

Zamora, Ú. Z. C. y Stynze, G. H. O. (2024). Conocimiento, uso y percepción de la inteligencia artificial en la enseñanza superior. *Revista Científica Estelí*, *49*. https://doi.org/10.5377/esteli.v13i49.17889

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