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Abstract-- This comparative study analyzes advances in the knowledge and use of artificial intelligence (AI) tools among engineering students in Los Mochis, Sinaloa, Mexico, during the periods from December 2024 to December 2025. The research was conducted using structured questionnaires administered to two groups of students, assessing different areas of general AI knowledge, such as the use of educational platforms, virtual assistants, digital resources, online collaboration, educational simulations, and aspects of ethics and privacy. The results show a high level of familiarity with AI in both groups, with a significant increase in the adoption of advanced tools such as Gemini, Copilot, and Symbolab in 2025. Likewise, improvements are evident in the personalization of learning, student engagement, digital collaboration, and the use of simulations, reflecting a more strategic and autonomous integration of AI into educational processes (Pertusa, 2023). These advances enhance technical, analytical, and collaborative skills, strengthening students' creativity, efficiency, and preparedness to navigate complex and dynamic digital environments (Alvarado, 2015).

Keywords-- Digital collaboration, Artificial Intelligence tools, Artificial Intelligence,
Personalized learning, Educational simulations.

Abstract-- This comparative study analyzes the advances in knowledge and use of artificial intelligence (AI) tools among engineering students in Los Mochis, Sinaloa, Mexico, during the periods of December 2024 and December 2025. The research was conducted using structured questionnaires administered to two groups of students, assessing various areas of general AI knowledge, such as the use of educational platforms, virtual assistants, digital resources, online collaboration, educational simulations, and aspects of ethics and privacy. The results indicate a high level of familiarity with AI in both groups, with a significant increase in the adoption of advanced tools such as Gemini, Copilot, and Symbolab in 2025. Additionally, improvements are observed in personalized learning, student engagement, digital collaboration, and the use of simulations, reflecting a more strategic and autonomous integration of AI into the educational process (Pertusa, 2023). These advances enhance technical, analytical, and collaborative skills, strengthening creativity, efficiency, and students' readiness to face complex and dynamic digital environments (Alvarado, 2015).

Keywords: Artificial Intelligence, Artificial Intelligence Tools, Personalized Learning, Educational Simulations, Digital Collaboration.

INTRODUCTION

Over the past decade, artificial intelligence has transformed higher education, particularly in engineering programs, by integrating into learning platforms, educational simulations, and collaborative tools that enhance both students' conceptual knowledge and practical skills (Pertusa, 2023). This process of gradually incorporating AI has altered the dynamics of teaching and learning, driving new methodologies centered on interaction with intelligent systems and specialized digital environments. Avila-Tomás et al. (2020) note that artificial intelligence is a field of computing that seeks to create systems capable of mimicking human abilities such as learning, reasoning, and decision-making, and that today it is already part of our daily lives in all areas.

As a result of this technological transition, engineering education has undergone profound changes that require academic programs to integrate competencies related to the use of advanced technologies, data analysis, and AI applications to respond to an increasingly complex and digitized professional environment (Montúfar, 2025). These transformations have enabled not only the automation and personalization of learning but also the strengthening of practical, analytical, and collaborative skills that are essential for academic training.

Complementing this picture, a recent study conducted in Mexico with engineering students reported a high level of acceptance and appreciation for the use of artificial intelligence tools in university education. These students, especially those in advanced semesters, expressed greater familiarity, satisfaction, and a perception of positive impact on their learning process, recognizing AI as a significant resource for improving their academic performance and autonomy in digital environments. (Niebla et al., 2025).

With the aim of deepening the understanding of the knowledge and use of artificial intelligence technologies among engineering students, a comparative study was conducted with two groups of upper-level students in Los Mochis, Sinaloa, Mexico. The research consisted of the in-person administration of a structured questionnaire to identify the percentage of students who are familiar with and use AI tools in their professional training, as well as variations in their technological adoption between 2024 and 2025. Based on the quantitative and qualitative analysis of the data obtained, the study seeks not only to determine the level of familiarity with these technologies but also to identify advances, differences, and

emerging patterns in their adoption. In this way, the research provides relevant evidence for understanding the evolution of AI use in engineering education, contributing to the strengthening of academic programs and the training of more competent, critical professionals who are prepared to face the technological and productive challenges of the current environment.

This comparative study is based on previous research conducted with students in the same engineering program at the same institution (corresponding to Group 1 and serving as the basis for the comparative analysis in this study), which showed that, although a considerable proportion of students recognized basic concepts and initial tools of artificial intelligence, such knowledge did not necessarily translate into applicable competencies that would strengthen their professional training. The results showed that the use of these technologies was still limited by a lack of specific training, as well as by the need to promote more inclusive and personalized educational environments that cater to the diversity of profiles, skills, and needs present in the classroom. This background underscores the importance of analyzing the evolution between the two periods and assessing the progress made in the use and understanding of AI tools. (González, 2025).

DEVELOPMENT

Artificial intelligence was developed with the aim of expanding human capabilities by optimizing processes and streamlining tasks through systems capable of learning, analyzing information, and making decisions with greater speed and precision. Its applications span a wide range of fields, from the automation of smart environments and robotics to video games and advanced data processing using artificial neural networks. Given this context, it can be argued that so-called intelligent agents—equipped with sensors to perceive their environment and mechanisms to act upon it—perform specific functions in both digital and physical environments, integrating specialized software and hardware. Thus, AI not only mimics skills such as reasoning, planning, or problem-solving, but also incorporates capabilities for adaptation, self-correction, and environmental modeling, establishing itself as a strategic technology that redefines the way we interact with contemporary technological systems (Alvarado, 2015).

This remarkable technological advancement, which in recent years has become a natural part of daily life, has also had a significant impact on the field of education. Both teachers and students are now immersed in an environment marked by the growing use of

based on artificial intelligence, which facilitate, optimize, and transform multiple activities linked to the teaching and learning process, promoting more agile, interactive dynamics adapted to new educational demands.

Similarly, it is necessary to conceptually define the main categories that guide this study. Table 1 presents the definitions under investigation related to artificial intelligence in the educational field, including dimensions such as personalized learning, automated assessments, virtual assistants, data analysis, digital collaboration, and privacy protection. This systematization constitutes the theoretical foundation that guides the construction of the instrument and the analysis of the results.

Table 1. *Definitions relevant to this study on artificial intelligence in education.*

Concept	Definition
Artificial Intelligence	Field aimed at replicating human capabilities such as reasoning, problem-solving problem-solving and decision-making through computational systems that emulate intelligent behaviors (Alvarado, 2015).
Personalized Learning	An educational approach that adapts content, methodologies, sequences, and assessments to students' individual characteristics, supported by intelligent systems based on data and predictive algorithms (Torres et al., 2025).
AI-Powered Automated Assessments	Artificial intelligence-based tools that optimize the accuracy and efficiency of academic assessment through automated processes, reducing time and resources (Escobar et al., 2024).
Educational Virtual Assistants	AI-based software and natural language processing that interact with users to provide academic support and answer questions (Crespo & Benavides, 2024).
Personalized Learning (Adaptive Systems)	A process supported by adaptive hypermedia systems and intelligent tutoring systems that tailor content to the student's characteristics and needs (Leris & Sein-Echaluce, 2011).
Online Educational Resources (OER)	Digital materials accessible via ICT and the Internet (videos, documents, software, and multimedia) that support learning and accommodate different cognitive styles (Lozano et al., 2018).
Augmented Reality and Virtual Reality	Interactive technologies that integrate virtual environments or digital elements into reality to generate immersive experiences applied to learning and educational simulation (Abásolo et al., n.d.).
Data Analytics in Education	Application of artificial intelligence and data mining for the massive and automated processing of educational information for optimization and decision-making purposes (Martínez, 2015).
Online Collaboration Tools	Digital systems that support communication, coordination, and cooperation in virtual learning environments, facilitating collaborative work (Rosa et al., n.d.).
Privacy Protection in AI Environments	A set of ethical and regulatory principles aimed at ensuring confidentiality, informed consent, and the responsible use of personal data in AI-enabled educational systems (Amén-Mora et al., 2024).

Concept	Definition
AI-powered Educational Simulations	Computational modeling strategies that allow for experimentation in interactive virtual environments, strengthening critical thinking and problem-solving (Aleman et al., 2025).

Source: *Prepared by the authors based on the cited authors*.

Based on the definitions presented in Table 1, the conceptual framework guiding the methodological development of the study was established. These theoretical categories allow for the contextualization of the main applications and resources associated with artificial intelligence in the educational field, serving as a basis for the development of the instrument and for the comparative analysis of the use and knowledge of these tools among engineering students.

The research was conducted using a descriptive, comparative, longitudinal design aimed at analyzing the evolution in the use and knowledge of artificial intelligence tools among engineering students.

To this end, the results obtained from Group 1 (2024) and Group 2 (2025) were compared, with the aim of identifying changes, differences, and trends in the adoption of artificial intelligence technology between the two periods among engineering students in Los Mochis, Sinaloa, Mexico, based on a previous study conducted with Group 1 in December 2024.

The study population consisted of students enrolled in December 2024 (Group 1, n = 41) and December 2025 (Group 2, n = 29), selected through convenience sampling, with the aim of identifying differences and progress in the adoption of AI tools over the course of a year.

A structured questionnaire consisting of 12 items was developed, based on recent literature on artificial intelligence in higher education and related previous studies, incorporating closed-ended and multiple-choice questions.

This instrument allowed for a comprehensive assessment of general knowledge, the use of learning platforms, assessment tools, virtual assistants, digital educational resources, online collaboration, personalized learning, educational simulations, as well as aspects of ethics and privacy protection.

Data collection was conducted by administering the questionnaire in person to both groups, ensuring understanding of the items and the reliability of the responses. For the analysis, absolute frequencies and percentages were calculated, establishing comparisons between the two periods to highlight the evolution in the use and knowledge of the various applications of artificial intelligence.

This approach allowed us to identify trends, significant differences, and advances in the integration of AI-mediated educational technologies, providing key information on the development of digital learning in higher education.

The results presented below show, in a comparative manner, how students in Groups 1 (Dec. 2024) and 2 (Dec. 2025) recognize and apply advanced artificial intelligence tools, revealing significant changes in their adoption and contributing to an understanding of the evolution of technological mastery in academic training.

Artificial intelligence is conceived as a field aimed at replicating human capabilities, such as thinking, acting, adapting, and self-correcting, integrating processes such as knowledge acquisition, problem-solving, logical reasoning, planning, evaluation of alternatives, the generation and generalization of concepts, as well as the symbolic representation of the world; in this way, AI is also understood as a software technique applied to the development of systems capable of offering optimal solutions, emulating intelligent behaviors observed in nature and specifically in humans.

Table 2 presents the operationalization matrix for the questionnaire on artificial intelligence in education, showing how each dimension, variable, and indicator relates to the formulated items. It includes aspects of general knowledge, the use of educational technologies, digital assessment, collaboration, and ethics. The instrument combines binary and multiple-choice items to facilitate the measurement of students' level of knowledge and application of artificial intelligence tools.

Table 2. *Operationalization matrix for the diagnostic questionnaire on artificial intelligence in education.*

Dimension	Variable	Indicator	Item / Question	Measurement Scale
Knowledge overview of AI	Knowledge of the Level artificial intelligence	Level of recognition of concept of artificial intelligence (Yes/No) by the student	1.- Do you know what is the artificial intelligence?	Binary
Use of learning educational	Use of platforms with AI intelligence	Frequency of use of educational online incorporate artificial	2.- Do you use online technology that learning with artificial intelligence?	Binary (Yes/No)
Digital educational assessment	Assessment knowledge automatic	Identification of tools for assessment tools used in courses	3.- Do you know of any automated Automatic used in your courses?	Binary (Yes/No)
Academic support digital	Use of virtual assistants	Use of virtual assistants such as to get help academic	4.- Have you used virtual assistants academic?	Binary (Yes/No)

Dimension	Variable	Indicator	Item / Question	Measurement scale
Personalization of learning	Knowledge of personalization using AI	Level of understanding regarding personalized learning using artificial intelligence	5. Do you know what is personalized learning with artificial intelligence?	Binary (Yes/No)
Educational resources digital	Use of educational resources with AI	Use of materials and resources that integrate artificial intelligence	6. Have you used educational onlineonline that incorporate the artificial ?	Binary (Yes/No)
Educational innovation	Use of augmented reality and virtual	Participation in experiences online reality-mediated augmented or virtual	7.- Have you participated in training courses that use augmented or virtual?	(Yes/No)
Educational Data Management	Knowledge of the education	Level of knowledge regarding Higher education	8.- Do you know how data analysis works in data analysis applied to data analysis in education higher education?	Binary (Yes/No)
Collaboration digital	Use of collaborative tools with AI	Use of digital tools online collaboration intelligence with artificial	9.- Have you used collaborative tools based on artificial intelligence?	Binary (Yes/No)
Ethics and security digital	Data protection privacy	Knowledge of personal data protection in educational environments with AI	10.- Do you know how to protect your privacy in environments learning with artificial intelligence?	Binary (Yes/No)
Experiential learning	Use of educational simulations with AI	Use of educational simulations for learning	11.- Have you used AI-based simulations for educational purposes with artificial intelligence?	Binary (Yes/No)
Tools for support for learning	Use of AI tools for learning	Recognition and use of tools of intelligence artificial intelligence tools that support the process of learning	12.- Which of these tools improve artificial intelligence do you know or have you used to help you learn more as a student?	Multiple choice

Source: Author's *own work.*

The questionnaire's operationalization matrix (see Table 2) allows for the systematic measurement of knowledge and use of artificial intelligence in education; the items, primarily on a binary scale, facilitate the identification of trends in the recognition and use of artificial intelligence tools, while the multiple-choice item expands the analysis to specific resources. Together, the matrix ensures the conceptual validity and relevance of the instrument for evaluating the integration of artificial intelligence in higher education.

Table 3 presents the results of the questionnaire administered to participants in Groups 1 and 2, with the aim of analyzing and comparing the level of knowledge, use, and perception of artificial intelligence in

the context of higher education learning. It shows the most frequent response, the absolute frequency, and the percentage corresponding to each group, allowing for the identification of trends, similarities, and differences in the integration of AI-based tools and resources within educational processes.

Table 3. *Results of the questionnaire responses, Group 1 vs. Group 2.*

Question Response	Most Frequent frequent	Frequency G1	% G1	Frequency G2	% G2
1. Do you know what artificial intelligence is?	Yes	40	97.6%	29	100%
2. Do you use AI-powered online learning platforms?	Yes	28	68.3%	24	82.8%
3. Are you familiar with automated assessment tools?	Yes	18	43.9%	17	58.6%
4. Have you used virtual assistants for academic help?	Yes	36	87.8%	27	93.1%
5. Are you familiar with AI-powered personalized learning?	Yes	14	34.1%	20	69.0%
6. Have you used online educational resources with AI?	Yes	21	51.2%	23	79.3%
7. Have you participated in courses using AR or VR?	No	5	12.2%	10	34.5%
8. Do you know how data analysis works in higher education?	No	8	19.5%	15	51.7%
9. Have you used AI-powered collaboration tools?	Yes	13	31.7%	22	75.9%
10. Do you know how to protect your privacy in AI environments?	No	9	22.0%	18	62.1%
11. Have you used educational simulations with AI?	No	7	17.1%	21	72.4%

Source: *Compiled by the author.*

The questionnaire results show significant differences between Group 1 and Group 2 regarding the knowledge, use, and application of artificial intelligence in the educational setting. Although both groups demonstrate a high level of general awareness of artificial intelligence and frequent use of virtual assistants for academic purposes, Group 2 shows higher percentages in the use of AI-powered learning platforms, smart educational resources, and collaboration tools, as well as in understanding data analysis and privacy protection in digital environments.

In contrast, Group 1 demonstrates less experience in using more advanced educational applications, such as AI-powered simulations and courses incorporating augmented or virtual reality.

These findings suggest that, while there is a common conceptual knowledge base regarding artificial intelligence in both groups, the level of integration and utilization of these technologies in learning processes is higher in Group 2, which could be associated with greater access, training, or exposure to educational environments mediated by digital technologies.

The demographic data of the students included in the study are presented below:

Table 4. *Percentage distribution of participants by gender in Groups 1 and 2.*

Gender	Group 1 (n = 41)	Percentage	Group 2 (n = 29)	Percentage
Women	13	31.7%	11	37.9%

Gender	Group 1 (n = 41)	Percentage	Group 2 (n = 29)	Percentage
Men	28	68.3%	18	62.1%
Total	**41**	**100%**	**29**	**100%**

Source: Author's *own work*.

The sample consisted of two groups of students assessed in different periods. Group 1, corresponding to December 2024, consisted of 41 participants, of whom 68.3% were men and 31.7% were women. Group 2, assessed in December 2025, consisted of 29 students, with a gender distribution of 62.1% men and 37.9% women.

In both groups, male participation was higher; however, Group 2 shows a more balanced distribution between men and women, which contributes to greater heterogeneity in the sample and strengthens the comparison between periods. (See Table 4).

Table 5. *Distribution of participants by age in Groups 1 and 2.*

Age (years)	Group 1 (n = 41)	% Group 1	Group 2 (n = 29)	% Group 2
17	–	–	5	17.2%
18	6	14.6%	21	72.4%
19	25	61.0%	3	10.4%
20	4	9.8%	–	–
21	3	7.3%	–	–
22	1	2.4%	–	–
24	1	2.4%	–	–
26	1	2.4%	–	–
Total	**41**	**100%**	**29**	**100%**

Source: Author's *own work*.

Table 5 shows differences in age distribution among the groups. Group 1 exhibits a wide range of ages, with a predominance of 19-year-old students, while Group 2 shows a more homogeneous population, concentrated mainly among 18-year-olds.

These characteristics allow us to contextualize the study's results based on the participants' ages. The greater age diversity and more balanced gender distribution in Group 2 are associated with more dynamic learning and faster adoption of advanced AI tools. This heterogeneity is reflected in the results in Table 6 and Figure 1, where Group 2 showed notable increases in the use of augmented/virtual reality courses, educational simulations, and collaborative tools, suggesting that a more diverse sample enhances the effective integration

of AI technologies into academic learning. The comparison between the two periods revealed substantial progress in the second year.

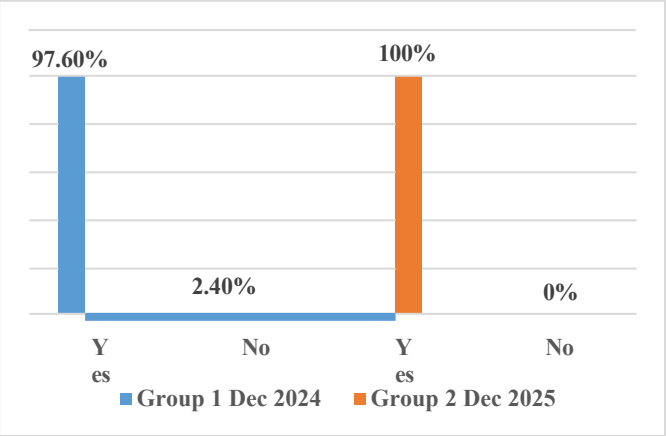

Figure 1. *Awareness and use of AI.*

Source: Author's *own work*.

The results in Figure 1 reflect a high level of general awareness of artificial intelligence in both groups. In December 2024, 97.6% of Group 1 stated they were familiar with the concept, while in December 2025, the entire Group 2 (100%) reported familiarity with it. According to Alvarado (2015), artificial intelligence seeks to replicate human capabilities such as thinking, acting, and adapting, enabling the development of systems that emulate intelligent behaviors.

The slight improvement observed in Group 2 may be related to the increased dissemination and use of these technologies in educational settings, consolidating a solid foundation for adopting more advanced applications in higher education.

Table 6. *Comparison of the use and knowledge of advanced AI applications in Groups 1 and 2.*

AI Application / Awareness	Group 1 Dec. 2024 Yes (n=41)	Group 1 Dec. 2024 No (n=41)	Group 2 Dec. 2025 Yes (n=29)	Group 2 Dec. 2025 No (n=29)
AI-powered online learning platforms	31 (75.6%)	10 (24.4%)	26 (89.7%)	3 (10.3%)
Automated assessment tools	14 (34.1%)	27 (65.9%)	13 (44.8%)	16 (55.2%)
Virtual assistants	40 (97.6%)	1 (2.4%)	26 (89.7%)	3 (10.3%)
AI-powered personalized learning	15 (36.6%)	26 (63.4%)	14 (48.3%)	15 (51.7%)

AI Application / Knowledge	Group 1 Dec. 2024 Yes (n=41)	Group 1 Dec. 2024 No (n=41)	Group 2 Dec. 2025 Yes (n=29)	Group 2 Dec. 2025 No (n=29)
Online educational resources with AI	26 (63.4%)	15 (36.6%)	20 (69.0%)	9 (31.0%)
AR/VR courses	5 (12.2%)	36 (87.8%)	21 (72.4%)	8 (27.6%)
Data analysis in higher education	8 (19.5%)	33 (80.5%)	10 (34.5%)	19 (65.5%)
AI collaboration tools	17 (41.5%)	24 (58.5%)	23 (79.3%)	6 (20.7%)
Privacy protection in AI environments	13 (31.7%)	28 (68.3%)	15 (51.7%)	14 (48.3%)
Educational simulations with AI	11 (26.8%)	30 (73.2%)	17 (58.6%)	12 (41.4%)

Source: Author's *own work*.

Between December 2024 and December 2025, students in Group 2 showed significant progress in the use of artificial intelligence (AI) applications in their learning (see Figure 2).

Participation in courses using augmented or virtual reality rose from 12.2% to 72.4%, while the use of AI-powered educational simulations doubled from 26.8% to 58.6% (see Table 6). Likewise, the use of digital collaboration tools grew from 41.5% to 79.3%, and online educational resources reached 100%.

According to Torres et al. (2025) and Leris & Sein-Echaluce (2011), these technologies enable personalized learning by adapting content and educational pathways to each student. Virtual assistants (Crespo & Benavides, 2024), automated assessments (Escobar et al., 2024), augmented and virtual reality (Abásolo et al., n.d.), data analysis (Martínez, 2015), and online collaboration (Rosa et al., n.d.) enhance participation, autonomy, and interaction.

Furthermore, the ethical and secure implementation of AI (Amén-Mora et al., 2024) ensures privacy and equity, while educational simulations (Aleman et al., 2025) strengthen critical thinking and preparation for real-world scenarios.

Taken together, these results show that students moved from a conceptual understanding of AI to active and immersive use, integrating these technologies into their learning in practical and meaningful ways.

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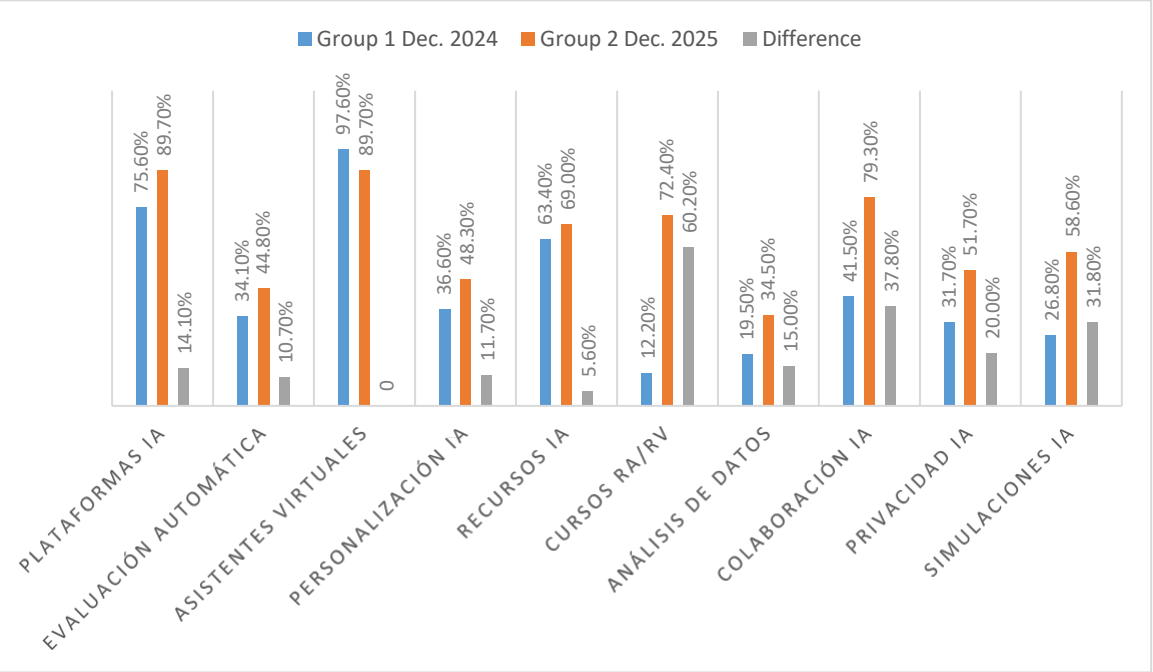

Figure 2. *Differences in progress regarding the use and knowledge of advanced AI applications.*

Source: Author's own work

Figure 2 shows significant growth in the use and knowledge of advanced artificial intelligence applications among engineering students. For example, participation in courses using augmented and virtual reality increased from 12.2% in 2024 to 72.4% in 2025, while the use of AI-powered educational simulations rose from 26.8% to 58.6%, and digital collaboration tools increased from 41.5% to 79.3%.

These advances show that students began to integrate these technologies more actively into their learning, contrasting with Torres et al.'s (2025) notion of personalized learning, which emphasizes the adaptation of content and methodologies to individual needs—something that was previously limited to conceptual understanding. Likewise, Escobar et al. (2024) highlight that automated assessments require both ethical and technical understanding to be effective, underscoring the importance of guiding students in the responsible use of these tools.

Furthermore, Aleman et al. (2025) note that educational simulations enable active learning and the transfer of knowledge to practical contexts, demonstrating that the incorporation of these technologies enhances not only familiarity with AI but also the ability to apply concepts in real-world and collaborative situations, bridging the gap between theoretical knowledge and educational practice.

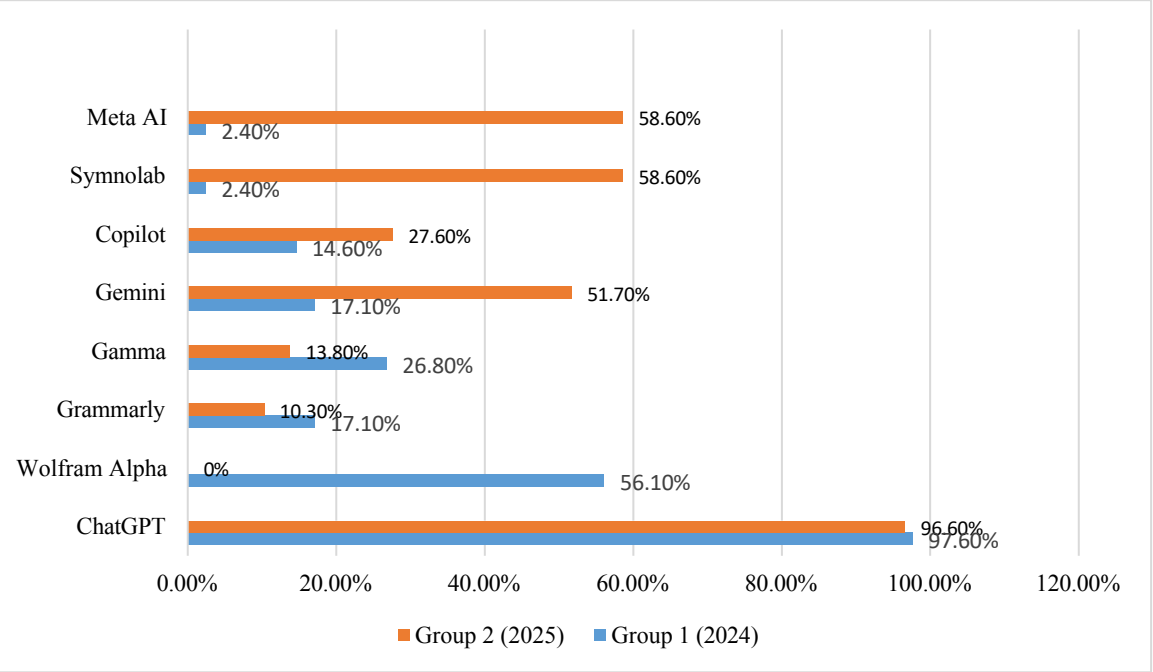

Figure 3. *Comparative analysis of AI tool usage (2024–2025).*

Source: Author's *own work*.

Figure 3 shows how the use of artificial intelligence tools evolved between Group 1 (Dec 2024) and Group 2 (Dec 2025). Engineering students' preferences show a clear dominance of ChatGPT, along with notable growth in specialized platforms that enhance learning, productivity, and digital skills.

ChatGPT, according to Morales-Chan (n.d.), drawing on the work of Brown et al. (2020), is an AI-based language model developed by OpenAI. It employs modern natural language processing techniques and is trained on large volumes of textual data, enabling it to generate coherent and context-aware responses.

Its use remains predominant, at 97.60% in 2024 and 96.60% in 2025, confirming its position as a central resource in students' academic experience.

Morales-Chan (n.d.), drawing on Brown et al. (2020) and Hernández et al. (2021), highlights its ability to synthesize information, translate, generate creative content, write scripts, produce code, and construct linguistically coherent discourse.

Wolfram Alpha, according to Sarmiento et al. (2025), is an artificial intelligence platform designed to solve mathematical problems, generate graphs, and explain step-by-step procedures. It functions as a computational search engine with advanced algorithms and an extensive database.

Its use shows the most significant decline, from 56.10% in 2024 to 0% in 2025, indicating an almost total abandonment, possibly due to a preference for more versatile platforms.

Sarmiento et al. (2025) note that Wolfram Alpha promotes logical thinking, problem-solving, and conceptual understanding, fostering autonomy and active exploration of concepts.

Grammarly, according to Frapolli (2025), is a platform for English grammar and style correction.

Its adoption drops from 17.10% in 2024 to 10.30% in 2025, reflecting a preference for assistants that integrate correction and writing features.

Ortega & Salgado (2025), citing Hederson (2023), highlight that Grammarly facilitates text editing, preventing errors, offering lexical alternatives, and improving the clarity and precision of writing.

Gamma, according to González et al. (2024), is a generative artificial intelligence tool that simplifies the creation of presentations, web pages, and documents by automating design, image generation, and graphics.

Its adoption grows from 15.80% in 2024 to 26.80% in 2025.

Arana & Muñoz (2024) note that this tool facilitates the understanding of complex concepts, promotes collaborative learning, and allows students to explore topics in a more interactive and personalized way.

Gemini, according to Mata & Jara (2024) and citing Iglesia (2023), is a multimodal AI from Google capable of processing text, images, audio, and video.

Its use increases from 17.10% in 2024 to 51.70% in 2025, showing accelerated adoption.

Mata & Jara (2024) highlight that it enables the generation of high-quality, SEO-optimized content and facilitates the customization and management of resources in educational settings.

Copilot, according to Fuentes et al. (2024) and Medina (2024), is a Microsoft search assistant that uses GPT-4 and allows users to supplement information with online sources.

Its use grows from 14.60% to 27.60%, indicating greater integration into programming and technical support.

Castrillón & Mata (2025) highlight that Copilot automates writing, summarization, and content creation tasks within the Microsoft 365 ecosystem, without requiring advanced technical knowledge.

Symbolab, according to Chicaiza et al. (2024), citing Martínez & Herranz (2022) and Escobar (2023), is a platform for solving mathematical, physics, and chemistry problems step by step, also available in a mobile version.

Its usage increases from 2.40% in 2024 to 58.60%, reflecting rapid adoption and effectiveness in technical engineering education.

This tool facilitates accurate calculations, understanding of the problem-solving process, and offers a user-friendly interface for novice users.

Meta AI, according to Cabrera & López (2025), is an assistant integrated into apps such as Instagram, WhatsApp, Messenger, and Facebook, which enables automatic responses and facilitates everyday tasks. Its adoption also grows from 2.40% to 58.60%, demonstrating that students are increasingly incorporating AI to personalize and automate their learning.

Cabrera & López (2025) highlight that it improves human-AI interaction, fosters innovation, and enables content creation through the LLaMA natural language model.

Overall, the results show that, although ChatGPT remains the central platform, there are notable increases in specialized tools such as Symnolab, Gemini, Copilot, and Meta AI, while the use of Wolfram Alpha and Grammarly is declining. This demonstrates not only greater technological proficiency but also a more strategic and autonomous integration of artificial intelligence into learning, enhancing productivity, creativity, and adaptation to complex digital environments.

DISCUSSION AND ANALYSIS OF THE RESULTS

The results show more than just a simple increase in percentages; they reveal a shift in the way learners engage with technology. In 2024, artificial intelligence was, for many, a concept still largely unknown and perceived as distant; by 2025, it had rapidly become an everyday tool for solving problems, designing projects, and learning more actively—a trend consistent with Pertusa's (2023) observations on the transformation of educational dynamics driven by AI integration. This advancement reflects greater confidence, curiosity, and digital autonomy, but it also invites reflection on the fact that using more AI tools does not necessarily mean understanding them better. The real challenge is not just incorporating new platforms, but learning to

question them, validate them, and use them with ethical and professional judgment. If university education can guide students through this technological frenzy with critical thinking and responsibility, AI will cease to be an occasional aid and become a strategic ally in the construction of knowledge, strengthening their holistic development and solidifying their profile as ethical, competent engineers prepared to face the challenges of their personal and professional lives with discernment.

CONCLUSIONS

The study's results reflect notable progress in the adoption of artificial intelligence among engineering students, showing how initial theoretical knowledge progressively translates into active and strategic use of advanced tools.

While in 2024 most students had a basic understanding of AI, its practical application was limited, especially in educational simulations, augmented reality, and digital collaboration.

This initial gap indicates that learning was more focused on conceptual understanding than on actual interaction with immersive technologies, which aligns with Alvarado's (2015) observation regarding the importance of moving from theory to practice to strengthen analytical and collaborative skills.

Furthermore, Torres (2025) highlights that the use of advanced tools promotes autonomy and active participation, while Leris (2011) emphasizes how personalized learning enhances each student's educational experience.

Complementarily, the adoption of specific platforms demonstrates how students diversify their tools to enhance their learning. ChatGPT has established itself as the central resource for academic support, while Gemini has seen significant growth by offering multimodal experiences and task automation, promoting efficiency in content management (Mata & Jara, 2024). Symbolab has also shown notable growth, facilitating the resolution of complex problems and reinforcing technical understanding.

According to Abásolo et al. (n.d.), the incorporation of immersive and collaborative experiences transforms the way students learn, promoting deeper, more interactive, and personalized learning capable of preparing future engineers to face increasingly complex challenges. **FUTURE WORK**

In this study, the focus was solely on determining the level of use and knowledge of artificial intelligence tools among engineering students; however, for future research, a more comprehensive design could be implemented in which students receive specific training on the ethical and responsible use of these technologies.

This would allow for an evaluation of how training in AI best practices enhances their academic and professional performance, while simultaneously strengthening skills such as creativity, collaboration, and problem-solving.

Furthermore, it would be valuable to analyze the impact of different platforms on practical projects, as well as to study the effectiveness of pedagogical strategies that integrate artificial intelligence in a more personalized, dynamic, and inclusive manner, preparing students to address the challenges of today's workplace with ethics and efficiency.

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