

Artificial intelligence in university education: a SWOT analysis from the students' perspective

La inteligencia artificial en la formación universitaria: un análisis DAFO desde la perspectiva del estudiantado

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ABSTRACT

Introduction: the emergence of artificial intelligence (AI) has transformed higher education, and the role of these tools in students' training remains contested. **Objective:** to describe university students' perceptions of the use of AI in their academic training. **Methodology:** descriptive qualitative study; 88 sixth-semester students at a public Ecuadorian university, trained in research methods and in the use of AI, answered an open-ended questionnaire structured around the four SWOT dimensions. Responses were categorized through AI-assisted content analysis reviewed by the researchers. **Results:** the most frequent strengths and opportunities were broader access to educational resources and the optimization of academic tasks; the most frequent weaknesses and threats were cost and accessibility, technological dependence, algorithmic bias and privacy risks. **Conclusion:** these perceptions invite a rethinking of the educational model and an ethical, critical and equitable integration of these tools.

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KEYWORDS

Artificial intelligence, higher education, perception, educational technology, university students

RESUMEN

La irrupción de la inteligencia artificial (IA) ha transformado la educación superior, y su papel en la formación del estudiantado es controvertido. El objetivo de este artículo es describir las percepciones del estudiantado sobre el uso de la IA en su formación universitaria. Para ello, se realizó un estudio cualitativo descriptivo, con 88 estudiantes de sexto semestre de una universidad pública ecuatoriana, formados en investigación y en IA, que respondieron un cuestionario abierto estructurado según las cuatro dimensiones DAFO. Las respuestas se categorizaron mediante análisis de contenido asistido por IA y revisado por los investigadores. Como resultado, se observó que las fortalezas y oportunidades más frecuentes fueron el acceso a recursos educativos y la optimización de tareas académicas; las debilidades y amenazas más frecuentes, el costo y la accesibilidad, la dependencia tecnológica, los sesgos algorítmicos y los riesgos para la privacidad. En conclusión, estas percepciones invitan a repensar el modelo educativo y a promover una integración ética, crítica y equitativa de la IA.

PALABRAS CLAVE

Inteligencia artificial, enseñanza superior, percepción, tecnología educacional, estudiante universitario

Introduction

In the past decade, the advent of artificial intelligence (AI) has profoundly altered the landscape of education, redefining the very nature of teaching and learning. The implementation of AI systems in education has enabled knowledge to be personalized and content adapted to the needs and pace of each student. Furthermore, it has facilitated advances in the automation of administrative tasks and assessments, in monitoring student progress, and in educational decision-making, among other tasks (Educación 3.0, 2024). In essence, these advances facilitate improvements in learning experience, performance, and quality (Chen et al., 2020). Conversely, AI also presents ethical and pedagogical challenges, such as ensuring equitable access to these technologies and safeguarding the privacy

and security of student data (Vera, 2023). In summary, the integration of AI in higher education has had a profound impact, which has not been without controversy and conflicting positions.

Considering the challenges currently facing higher education, the aim of this study is to describe how university students perceive the use of AI tools in their academic training. To this end, the opinions of 88 university students who have received explicit training in these resources were collected using the strengths, weaknesses, opportunities, and threats (SWOT) analysis method. The opinions were subjected to qualitative content analysis.

To achieve this objective, first, a literature review is presented on the impact of AI on education and associated challenges, especially at the university level. Then, the study methodology is outlined, including the research questions, participants, and procedures for data collection and analysis. Finally, the findings are presented and discussed, with particular attention paid to their implications in the context of higher education.

AI in university education

In recent years, research on the use of AI in education has proliferated, resulting in the emergence of a new field of study: artificial intelligence in education (AIED). Although this line of research dates to the 1970s (Woolf, 2007), the necessity to employ technology during the COVID-19 pandemic and the emergence of ChatGPT have highlighted the need to reassess the utilization of AI technologies and applications in educational settings. According to the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2019), AI should be regarded as a resource that is capable of mimicking certain functionalities of human intelligence, including features such as perception, learning, reasoning, problem-solving, language interaction, and even creative production (p. 24).

In the absence of further context, the concept of technology and AI naturally leads one to consider online education. The advent of intelligent tutoring systems, teaching robots, learning analytics dashboards, and adaptive learning systems has resulted in notable enhancements in the virtual teaching experience and performance (Chen et al., 2020). Nevertheless, AIED studies also concentrate on the way these tools are transforming conventional face-to-face educational environments. This revolution has impacted all agents involved in this ecosystem, including students, instructors, and administrations (Hwang et al., 2020).

From the student perspective, AI serves to reinforce learner centrality in the teaching process. The advent of AI has led to a greater degree of personalization in educational content, with learning materials being

more closely aligned with the specific needs of each learner. Furthermore, AI can assist students in developing autonomy and further enhancing their capacity to learn how to learn (Humble and Mozelius, 2022). Chiu et al. (2023) conducted a systematic review of studies on AI opportunities for students and identified four dimensions where AI has a positive effect: (i) motivation and engagement, (ii) academic performance, (iii) development of 21st-century skills, and (iv) other non-cognitive aspects. Nevertheless, the aforementioned effects will be more pronounced in students who are more proficient and motivated. These effects were established in designs incorporating objective outcome measures, a different question from how students themselves interpret these tools.

In addition to the advantages of AI at the individual level, it also contributes to enhanced teamwork. In the contemporary era, an ever-increasing number of learning platforms are emerging that facilitate real-time joint activities, thereby enhancing communication and the organization and planning of tasks. These resources identify roles and group dynamics, subsequently providing feedback on how to work more efficiently and effectively (Vera, 2023).

The advent of AI has also had an impact on the role of teachers in the classroom. The advent of new tools has the potential to play an important role in the process of accompanying and tutoring students in their learning endeavors. AI supports teachers by relieving them of time- and effort-intensive activities by automating repetitive tasks, predicting academic performances, and interpreting vast amounts of data for decision-making (Popenici and Kerr, 2017). Similarly, the implementation of AI in educational administration can free up time for educators by automating administrative tasks, allowing them to focus on activities that require their expertise and interpersonal skills (Chaudhry and Kazim, 2022; Karsenti, 2019). Furthermore, the information provided by AI can assist educators in designing more personalized and individualized support programs, tailored to the specific needs of students (Hwang et al., 2020). Incorporating considerations of diverse learning paces and preferences will, in turn, have a positive impact on student motivation.

Nevertheless, the successful implementation of AI in education necessitates meticulous planning on the part of educators (Salmerón et al., 2023). The uncritical adoption of AI tools could result in the implementation of counterproductive uses for educational purposes. Similarly, a lack of sufficient knowledge of AI technologies may result in ineffective application. For instance, a lack of knowledge may render professors incapable of interpreting the information provided by learning analytics. Consequently, some studies have identified a certain degree of anxiety

and lack of security among professors when using AI (Chiu et al., 2023), as well as a tendency to excessive and non-rational use of these media due to a lack of knowledge (Humble and Mozeliuss, 2022). In light of these considerations, it is vital to provide rigorous training to university faculty on the scope and limitations of AI (González et al., 2023). To achieve this, it is necessary to implement policies that guarantee universal access to AI technologies in education, accompanied by training programs for educators and students on the effective and ethical use of these technologies (García-Peñalvo, 2023; Rodríguez et al., 2022).

In the context of higher education institutions, the application of AI can assist in enhancing competitiveness, ensuring alignment with the latest developments in academic disciplines, and cultivating a more attractive environment for students (Escotet, 2023). In contrast, UNESCO (2023) noted that a suitable environment for the use of AI in higher education still needs to be developed. For pedagogical innovation to be accompanied by a policy framework consistent with the current situation, it is necessary to ensure that the use of AI is informed, consensual, and sustained. Furthermore, it is recommended that initiatives for implementing AI in universities should seek to achieve equity, gender equality, and improvements in the conditions for students.

In this context, it is important to recall the observations made by Salmerón et al. (2023), who highlighted the necessity of establishing legal frameworks that regulate the use of AI in higher education and serve as a foundation for the implementation of initiatives that promote relevant, innovative, supportive, and environmentally and diversity-friendly education. Indeed, UNESCO (in Sabzalieva and Valentini, 2023) has identified many ethical concerns associated with utilizing ChatGPT in higher education, necessitating educational institutions' implementation of regulatory measures. Among the most significant problems are the following: lack of academic integrity, data protection, cognitive bias, lack of accessibility, and the commercial undertones in open access resources. These ethical challenges to society, such as the tension between privacy and surveillance, bias and discrimination, and the philosophical question of the role of human judgment, have also been addressed by other authors, including Vera (2023).

In either case, to achieve the expected pedagogical benefits, a direct connection between the theories of education and the application of AI in this context has yet to be established. It is acknowledged that AI has the potential to enhance the quality of higher education. However, it is unlikely that optimal results will be achieved through the sole use of AI, and it seems prudent to undertake prior pedagogical reflection. This will

permit us to critically assess how interventions with these tools should be designed and how the instruction that teachers carry out in parallel should be conducted (Castañeda and Selwyn, 2018). In fact, Chatterjee and Bhattacharjee (2020) have posited that education is a human endeavor and that technological solutions must be utilized as resources to maximize, assist, and enhance the effectiveness of human teaching, but not as a replacement for it. This is of particular significance when one considers that AI tools were not created by education experts but, rather, by AI experts and marketing professionals (Humble and Mozeliuss, 2022).

Another variable that should be mentioned is the educational context. The direct benefits of AI in higher education in all areas are contingent upon the social, cultural, and economic realities of the locale. This will influence, for instance, the attitude of the agents toward the integration of these tools into their daily practice. In more developed countries, there seems to be a prevailing view that modernizing and improving education involves including technology. Consequently, there is a willingness and eagerness on the part of the recipients to embrace these tools, which has a significant impact on the effectiveness with which they are utilized.

This is not the case in less developed countries, such as India, where an incubation process is necessary (Chatterjee and Bhattacharjee, 2020). A similar situation can be observed in Latin America, where the development of higher education has been more delayed compared with other regions. Although access to higher education and coordination among universities are both increasing in developing countries, the pace and magnitude of access to resources remain below those observed in other areas of the world. Furthermore, the development of higher education in this context is not comparable to development in other areas, such as industry, medicine, and the economy (Salas-Pilco and Yang, 2022).

According to Chatterjee and Bhattacharjee (2020), the attitude and behavior of agents in different contexts are determined by four variables: perceived risk, performance expectancy, effort expectancy, and facilitating conditions. Nevertheless, Salmerón et al. (2023) posited that AI can be employed as a resource to capture the attention and increase the motivation of students from poor backgrounds, who are more likely to drop out of university studies.

In Ecuador, the incorporation of generative AI into university teaching has advanced faster than the institutional frameworks meant to guide it. Systematic reviews of the Ecuadorian case report persistent gaps in digital infrastructure, teacher training and normative guidelines (Palacios Bustamante et al., 2026), and studies of institutional policies find that most

universities lack formal guidance on the ethical use of these tools (Guillen Romero et al., 2025). Evidence from Ecuadorian universities points to widespread student use of generative AI alongside an almost complete absence of institutional orientation, with adoption driven largely by students themselves (Mora Torres, 2026). Research on AI in Latin American higher education remains scarce and concentrated in a few countries (Salas-Pilco and Yang, 2022), and studies on Ecuadorian education students have documented uneven levels of digital literacy (Pegalajar-Palomino and Rodríguez-Torres, 2023). This makes the participants in the present study an unusual case: students who engaged with AI tools under explicit academic guidance, within a research methods course, in a system where such guidance is not the norm. Their perceptions are therefore informed rather than merely intuitive, and they are formed under material conditions—cost of access, availability of infrastructure—that differ from those of the European and North American contexts where most of the available evidence has been produced.

Taken together, this body of work has established both the pedagogical potential of AI and the ethical and institutional conditions that constrain it. Less attention, however, has been paid to how students themselves articulate these two sides at once. Similarly, there is a paucity of research on the socioemotional impact of the use of AI tools (Chiu et al., 2023). Humble and Mozeliuss (2022) conducted a systematic review and identified potential threats of AI tools, highlighting the psychological effects that these tools can have on students and teachers. Ouyang et al. (2022) likewise report a discrepancy between the potential of AI in higher education and its current implementation, at least in online settings.

Existing evidence therefore tends either to measure effects on performance or to survey general attitudes toward adoption, and it says little about students who have received explicit academic training in these tools. SWOT analysis offers a suitable framework for addressing this gap, since it elicits favorable and unfavorable elements, and internal and external ones, within a single structure.

Methodology

In this section, the research questions are presented, as well as the study sample and the procedure for collecting and subsequently analyzing the data.

Objective and research questions

This research study employs a qualitative approach to investigate the perceptions of students regarding the use of AI in their university educational experience. This leads to the following research questions:

- What weaknesses and threats do students identify in the use of AI for their academic work?
- What are the strengths and opportunities that students associate with the use of AI in academia?

Participants

The sample was selected through a non-probabilistic convenience sampling method. The data collection instrument was distributed among the students of the subject «Elaboration of the educational and sports research project (qualitative model)» of the Physical Activity and Sports Pedagogy degree program of the Faculty of Physical Culture of a public university in Ecuador during the 2023/2024 academic year. The subject is taught in the sixth semester and comprises a total of 120 hours. The objective of this subject is to guide students in the process of developing a qualitative research project in the field of education and sport. The subject deals with the development of competencies to identify relevant problems, formulate research questions, design an appropriate methodology, and conduct a qualitative study. The subject is taught in Spanish, the mother tongue of all participants.

Given the non-probability convenience sampling strategy and the recruitment of all 88 participants from a single course, academic program, and institution, the findings should be interpreted as context-specific evidence reflecting the perceptions of the group studied. Accordingly, the results are not intended to be statistically representative of, nor should they be generalized to, the broader Ecuadorian university student population. Nevertheless, the detailed description of the study context and participant characteristics enables readers to assess the potential transferability of the findings to educational settings with similar characteristics.

A total of 88 subjects responded to the electronic questionnaire, with 31.8% (n=28) identifying as female and 68.2% (n=60) as male. The mean age of the female respondents was 23.14 years (standard deviation=3.26), whereas the mean age of the male respondents was 23.12 years (standard deviation=2.79). When both female and male students are considered, the mean age of the sample is 23.13 years with a standard deviation of 2.93.

Procedure for data collection and analysis

Data were collected at a single time point, at the end of the semester in which the aforementioned course was delivered. Data collection was conducted in March 2024 using an electronic questionnaire administered via Google Forms. The questionnaire was administered after completion of the course activities involving the use of artificial intelligence (AI) tools, thereby allowing participants to respond based on their educational experiences with these technologies during the course.

The instrument was designed to explore students' perceptions of the integration of AI into their university education and was structured according to the four dimensions of the SWOT framework: strengths, opportunities, weaknesses, and threats. Each dimension was addressed through an open-ended question asking participants to identify and explain at least two aspects related to their experience with the academic use of AI tools. Open-ended questions were selected in accordance with the qualitative and exploratory nature of the study, as they allowed participants to articulate their perceptions in their own words without restricting their responses to categories or response options predetermined by the researchers.

The SWOT framework was used as an *a priori* analytical structure to organize the exploration of students' perceptions. To ensure conceptual consistency throughout data collection and subsequent analysis, strengths were defined as favorable attributes or characteristics that participants perceived in their current use of AI during university education, whereas weaknesses referred to unfavorable attributes or perceived limitations associated with such use. Opportunities were conceptualized as favorable conditions or possibilities that could arise from the further integration of AI into educational processes, whereas threats referred to potentially unfavorable conditions, risks, or consequences associated with such integration. Accordingly, these four dimensions constituted *a priori* organizational categories, whereas the specific thematic categories within each dimension were subsequently developed from the content of participants' responses during the analytical process.

The following questions were administered:

- Strengths: What strengths have you identified in the use of artificial intelligence during your university education? Please identify and explain at least two strengths.
- Opportunities: What opportunities have you identified in the use of artificial intelligence during your university education? Please identify and explain at least two opportunities.
- Weaknesses: What weaknesses have you identified in the use of

artificial intelligence during your university education? Please identify and explain at least two weaknesses.

- Threats: What threats have you identified in the use of artificial intelligence during your university education? Please identify and explain at least two threats.

The questions followed a parallel structure across the four SWOT dimensions to promote consistency in data collection while allowing participants to elaborate freely on their responses. Because the instrument consisted of open-ended questions designed to explore perceptions rather than a psychometric scale intended to quantify a latent construct through numerical scores, psychometric measures of internal consistency, such as Cronbach's alpha, were not calculated. Instead, the methodological quality of the instrument was supported by the conceptual alignment between the questions and the four predefined dimensions of the SWOT framework, together with transparent reporting of the instrument structure and administration procedure.

SWOT analysis is a widely recognized tool for evaluating business plans, strategic alliances, and personal growth in the corporate environment. Furthermore, it has been demonstrated to be beneficial in educational settings, where it can assist with strategic planning and decision-making (Benzaghta et al., 2021). In light of the growing necessity for strategic planning and decision-making in universities, particularly concerning the implementation of AI in higher education, SWOT analysis has emerged as a crucial instrument (Gürel and Tat, 2017).

SWOT analysis provided a structured framework for organizing information, offering a comprehensive overview of internal (strengths and weaknesses) and external (threats and opportunities) factors that may influence AIED. Strength was defined as a resource or capability that enables AI to achieve its defined objectives. Opportunity was defined as an external condition or possibility that could favor the integration of AI into the training of education professionals. Weakness was defined as a limitation or shortcoming associated with AI that impedes progress toward defined objectives. Finally, a threat was defined as any unfavorable external condition that impedes the integration of AI by presenting a barrier or constraint, thus limiting the achievement of objectives (Zhu and Justice Mugenyi, 2015).

This study considered the perspectives of sixth-semester undergraduate students, who are key actors in the incorporation of AI in their training process. The objective was to unravel their needs and perceptions. The findings have the potential to inform the development of relevant

university policies and training programs aimed at faculty, thus optimizing the implementation of AI.

At the beginning of the course, and before artificial intelligence (AI) tools were incorporated into the academic activities, students were asked about their prior experience with these technologies. Ten percent of the participants reported using AI tools for academic activities, whereas the remaining students indicated that they were aware of AI but were not familiar with its practical use. This initial assessment provided a characterization of participants' prior experience with AI before their subsequent exposure to these technologies during the course.

During the course, which comprised a total of 120 academic hours, various AI tools were incorporated as resources to support learning and research activities. These included ChatGPT 3.5, Claude, Microsoft Copilot, and Consensus, among others. Students also used AI-based tools to support different research-related tasks, including information and scientific literature searches, audio transcription, consultation and processing of PDF documents, and the transcription and summarization of audiovisual content, as well as other activities planned as part of the course curriculum.

Exposure to these tools occurred before administration of the SWOT questionnaire, which was completed at the end of the course. Accordingly, the responses collected through the instrument reflect the perceptions of students who, despite having limited prior experience with AI at the beginning of the course, had subsequently gained academic exposure to a range of AI tools and applications. This sequence was relevant to the study design because it enabled participants to formulate their perceptions of the strengths, weaknesses, opportunities, and threats associated with AI based on their academic experiences during the course.

Once the SWOT questionnaire had been completed, participants' responses were exported to a Microsoft Excel database, reviewed for completeness, and organized for analysis. Each participant was assigned an alphanumeric code consisting of the prefix INF followed by a sequential number (e.g., INF. 4) to preserve confidentiality and maintain the traceability of individual excerpts throughout the analytical process. The responses were subsequently organized into four separate datasets corresponding to the a priori dimensions of the SWOT framework: strengths, weaknesses, opportunities, and threats.

ChatGPT 4.0 was used as an auxiliary tool during the preliminary organization of the qualitative data. For each SWOT dimension, the corresponding responses were provided to the model together with their alphanumeric identifiers. Based on the documented analytical procedure,

the instructions provided to the model were intended to: (a) identify responses with semantically similar content and propose their grouping into preliminary categories; (b) generate a descriptive label for each grouping; (c) formulate a preliminary definition summarizing its content; and (d) select representative examples from the responses while retaining their corresponding alphanumeric identifiers. This procedure resulted in a preliminary tabular organization of the qualitative data, the structure of which is illustrated in Table 1.

The outputs generated by ChatGPT 4.0 were treated as preliminary analytical proposals rather than as a definitive categorization framework or independently derived interpretive findings. The researchers subsequently reviewed the proposed groupings and categories against the original responses and their corresponding SWOT dimensions. This review was undertaken to assess the correspondence between individual excerpts and the proposed categories, as well as the conceptual coherence of the resulting groupings. Accordingly, AI was used to support the initial organization of the qualitative corpus, whereas responsibility for data interpretation and final analytical decisions remained with the researchers (Goyanes et al., 2025; Nguyen-Trung, 2025; Pozo-Sánchez et al., 2026).

To maintain analytical traceability, the alphanumeric identifiers assigned to participants were retained throughout the different stages of the analytical process, allowing excerpts included in the preliminary groupings to be linked back to the original responses. Consequently, the illustrative excerpts used to support the categories in the presentation of the findings could be cross-checked against their original source.

TABLE 1. Fragment of results table generated by ChatGPT 4.0

Category	Detailed description	Reply ¹
Applied innovation.	This category encompasses the ability to use AI to create novel ideas and original solutions and to identify opportunities arising from the use of new technologies. It includes both the generation of innovation and the implementation of technology in educational practices and other relevant fields.	INF. 1: AI offers more accurate diagnoses in medical care. INF. 2: Creativity. INF. 3: In physical education, it helps to plan independently. INF. 14: The ability to rapidly process and analyze large volumes of data enables AI. INF. 3: AI has implemented dynamic classrooms to make students more participatory and creative in their work.

1 The examples provided were translated from Spanish into English by the authors of this paper.

Administration procedure and ethical considerations

Before accessing the questionnaire, participants were provided with information about the purpose of the study, the voluntary nature of their participation, the confidential handling of their information, and the academic and scientific use of the data. Participation was not linked to students' course grades, and students were free to decide whether to participate in the study. After providing informed consent, participants were given access to the electronic questionnaire and completed the open-ended questions individually.

Data were collected at a single time point; therefore, the responses represent participants' perceptions at the end of the educational experience undertaken during the course. The study was not designed to assess changes before and after exposure to AI tools or to evaluate the effect of such exposure on academic performance. Accordingly, the data allow for the characterization of participants' perceptions within this specific educational context but do not permit causal inferences regarding the relationship between AI use and academic outcomes.

Regarding ethical considerations, the study was conducted in accordance with the ethical principles applicable to research involving human participants, as established in the Declaration of Helsinki (World Medical Association, 2025). The study protocol was reviewed and approved by the Human Research Ethics Committee of the Central University of Ecuador (CEISH-UCE), under approval code 001-PSN-2024. Prior to data collection, participants were provided with clear information regarding the study objectives and procedures, the exclusively academic and scientific use of the information collected, the measures implemented to ensure the confidentiality of their responses, and their right to withdraw from the study at any time without penalty or adverse consequences. Participation was voluntary and was contingent upon prior provision of informed consent.

All information was handled confidentially throughout the study. For analytical purposes, participants' responses were coded using alphanumeric identifiers, thereby avoiding the inclusion of directly identifiable information in the reporting of the findings. The data collected were used exclusively for academic and scientific purposes.

Results and discussion

The results of the study are presented below according to the four SWOT dimensions. Figure 1 presents the categories identified in each of these dimensions based on the AI-assisted qualitative analysis reviewed by the researchers.



FIGURE 1. Categories derived from the AI-assisted qualitative analysis process, organized according to the SWOT dimensions, with the number and proportion of participants contributing to each category

Note. n represents the number of unique participants whose responses contained at least one element assigned to the corresponding category; percentages were calculated using the total sample (N = 88) as the denominator. Because individual participants could contribute content to more than one category within the same SWOT dimension, categories were not mutually exclusive and percentages therefore do not sum to 100%.

Following the final organization of the categories, descriptive frequencies were calculated to characterize their recurrence within the study sample. For each category, n represented the number of unique participants whose responses contained at least one excerpt assigned to that category. If a participant referred to the same category in both responses within a SWOT dimension, that participant was counted only once for that category. Percentages were calculated using the total sample (N = 88) as the denominator. Because a participant could contribute content to more than one category, categories were not mutually exclusive and their percentages were not expected to sum to 100%. These frequencies were used solely to describe the recurrence of categories within the study sample and should not be interpreted as estimates of population prevalence or statistical representativeness.

Among the strengths identified by participants, accessibility and expansion was the most frequently represented category (n = 51, 58.0%), followed by optimization and automation (n = 45, 51.1%) and educational customization (n = 26, 29.5%). Comprehensive research support (n = 18, 20.5%) and evaluation and feedback (n = 16, 18.2%) were also identified. Less frequently represented categories included applied innovation (n = 14, 15.9%), decision support and improvement (n = 8, 9.1%), and professional development and innovation (n = 8, 9.1%). Because participants could contribute to multiple categories, these percentages represent category recurrence rather than mutually exclusive distributions.

Regarding opportunities, expanded access to educational resources was the most frequently represented category ($n = 42$, 47.7%), followed by educational optimization and automation ($n = 37$, 42.0%). Personalized learning was identified in the responses of 21 participants (23.9%), while research support and optimization ($n = 19$, 21.6%) and educational innovation ($n = 18$, 20.5%) were also recurrent. Improving accessibility and inclusion was identified less frequently ($n = 8$, 9.1%).

Among the perceived weaknesses, accessibility and cost was the most frequently represented category ($n = 29$, 33.0%). Technological dependence and lack of understanding or personalization were each identified in the responses of 25 participants (28.4%). Limitations in learning and skill development and outdated or inaccurate information were each represented by 22 participants (25.0%), whereas biases and ethics was identified in 15 participants' responses (17.0%).

Among the perceived threats, algorithmic biases and information manipulation was the most frequently represented category ($n = 29$, 33.0%), followed by technological dependence ($n = 28$, 31.8%). Privacy and data security and workforce replacement and displacement were each identified in the responses of 25 participants (28.4%). Lack of human interaction was represented by 14 participants (15.9%), whereas plagiarism and academic dishonesty was identified in eight participants' responses (9.1%).

Concerning the shortcomings identified by students, the research findings underscore several aspects of AIED. First, there is concern about the potential for technological dependence, which reflects an over-reliance on AI to perform tasks that have previously required human intervention. Such a phenomenon could result in the loss of essential skills and capabilities in individuals, as well as a tendency to delegate cognitive and operational tasks to automated systems. Concurrently, it may result in diminished judgment and problem-solving abilities.

This would be related to another weakness repeatedly identified as the limitation in learning and skills development. The overuse of AI in education may impede the development of critical, creative, and interpersonal skills in students, as well as the opportunity to exercise capabilities such as critical thinking, creativity, and social skills. The limited interaction with human instructors may impede the development of social and emotional skills, which are crucial aspects of holistic education (Gazquez et al., 2023).

1. «High dependence on AI» (INF. 48).
2. «Students do not develop reasoning skills» (INF. 5).
3. «Limiting creativity» (INF. 41).

This result is inconsistent with the findings of Chiu et al. (2023), who observed the development of skills as a potential benefit of AI. In our study, the student body asserted that AI does not facilitate the development of these skills and may even impede their acquisition. In this context, Chatterjee and Bhattacharjee (2020) proposed that, for learners to benefit from the capabilities of technological tools, they must not be viewed as substitutes for tasks but, rather, as resources that can enhance the effectiveness of learners' problem-solving abilities. However, for this to be possible, it is first necessary to engage in pedagogical reflection.

Furthermore, deficiencies in comprehension and customization are evident in the solutions provided by AI, which may impede its capacity to adapt to specific individual requirements or to comprehend complex contexts in a manner comparable to that of a human being. Despite the advancement of technology, AI systems often fail to fully capture the nuances and intricacies of the human context, resulting in solutions that may be overly generic or inappropriate for specific cases. This issue has already been identified by Salmerón et al. (2023) as a potential risk for teachers. Insufficient mastery of AI tools can result in their ineffective application.

4. «AI may have difficulty understanding context» (INF. 14).
5. «AI may lack personalized interaction» (INF. 37).

Furthermore, concerns were raised regarding the accessibility and cost of AI technology. Limited access due to economic barriers or a lack of adequate technological infrastructure could exacerbate existing inequalities in access to technology education and AI resources. This result is particularly noteworthy, as the participants come from Ecuador, a country where the development of higher education is not on par with that of developed nations (Salas-Pilco and Yang, 2022).

6. «Not everyone has the resources to use AI» (INF. 12).
7. «Some of these tools come at a high cost» (INF. 57).

The participants mentioned the potential for biases and ethical issues in AI systems to perpetuate existing inequalities, emphasizing the importance of careful design and management to mitigate these risks. This would necessitate significant reflection on the principles of fairness and ethics in AI application, a topic that has been extensively discussed by organizations such as UNESCO (2023) and authors such as Salmerón et al. (2023) and Vera (2023). In particular, UNESCO (2023) has emphasized the necessity of regulating the use of AI tools to prevent the emergence of ethical concerns associated with their deployment.

8. «Algorithmic bias and lack of transparency» (INF. 38).
9. «Ethical challenges and privacy» (INF. 84).

Finally, it is necessary to acknowledge the lack of currency and veracity of information provided by AI systems, which can be problematic in an environment where accuracy and timeliness of information are critical. The accelerated evolution of knowledge and information may impede the capacity of these systems to remain current, which could result in the dissemination of outdated or erroneous data. These deficiencies are related to the aforementioned ethical and accessibility issues.

10. «Information that is not clear» (INF. 87).
11. «There are some artificial intelligence tools that are not up to date» (INF. 53).

Within the framework of threats, a small number of participants (9.1%) highlighted plagiarism and academic dishonesty as a concern. Easy access to AI tools capable of generating textual content can encourage dishonest practices, which, in addition to making plagiarism difficult to detect, can erode the values of honesty and originality in education.

12. «Plagiarism and academic dishonesty: Students could resort to using AI to generate academic papers with little or no effort. AI assistants could facilitate plagiarism and cheating» (INF. 15).

The threats to data privacy and security were also identified as significant concerns. The collection and processing of sensitive data in educational environments using AI can potentially expose personal and academic information to security risks and misuse. This is associated with the necessity for the implementation of rigorous data-security regulations and practices. In response to these concerns, UNESCO (2023) has proposed a solution involving the consensual and sustained informed use of AI, accompanied by a policy framework that is commensurate with the current situation. In the absence of ethical use, there is a risk of adverse consequences, including the misuse of personal data, the amplification of existing biases in educational materials, and a loss of trust in educational technology (Educación 3.0, 2024).

13. «Data privacy and security: The collection and processing of student data by AI systems pose privacy and security risks. There could be vulnerabilities that expose sensitive personal or academic information» (INF. 6).

Another significant concern identified by the participants is the potential replacement and displacement of jobs. Students perceived that AI may automate roles traditionally performed by human personnel, which could have a significant impact on employment and the human experience in education. Furthermore, there is a concern that AI may lead to a dehumanized educational experience. In this context, it is crucial that those working in education are involved in designing the tools they use in their daily work (Humble and Mozeliuss, 2022).

14. «There is concern that AI may eventually replace university faculty and staff in certain functions» (INF. 6).
15. «AI-driven automation in education could have labor market implications for teachers and administrative staff» (INF. 6).

Concerns were also expressed about the potential for technology dependence. Excessive reliance on AI technology may impede the autonomous development of cognitive and creative abilities, as well as increase the likelihood of technological failure. In this context, participants emphasized the importance of fostering a healthy balance between technology and human skills. Furthermore, these human skills are also linked to interaction. The overuse of AI in education may reduce the opportunities for direct interaction between students and educators, which, in turn, may have implications for the social and emotional development of students, as well as the sense of community and belonging in the educational environment. Accordingly, further studies are needed on the psychological effects of AI use, which Humble and Mozeliuss (2022) have already identified as an intrinsic threat of these tools.

16. «Excessive use of AI may generate technological dependence on the part of teachers and students, which would negatively impact their autonomous development of cognitive skills» (INF. 36).
17. «Excessive dependence on this technology can lead to the loss of important human skills such as critical thinking» (INF. 27).

Finally, they identified algorithmic bias and information manipulation as a significant threat to the fairness and equity of educational processes. This raises ethical concerns and philosophical questions about the role of human judgment in the process (Vera, 2023). AI algorithms may contain inherent biases that affect the presentation of educational material and assessments (Buolamwini and Gebu, 2018). The collection and use of data in AI systems, particularly in the educational context, raises ethical concerns about privacy and the concentration of personal data. This can

result in the perpetuation of inequalities and the compromise of objectivity in teaching and learning.

18. «Vulnerability to algorithmic manipulation and bias: AI algorithms used in education may be subject to manipulation and bias» (INF. 38).

In terms of strengths, the participants highlighted the applied innovation and capacity of AI to generate original solutions and take advantage of new technologies. This implies the creation of novel ideas and the implementation of technology in educational practices and other relevant fields. This, in turn, is linked to educational personalization and the capacity of AI to adapt learning to the individual needs of each student, adjusting content and teaching methods to learning needs and paces (Humble and Mozelius, 2022). In the participants' view, this personalization could enhance the efficacy of the educational process. Additionally, the students perceived AI as a support for decision-making and for seeking opportunities and resources for improvement. As Hwang et al. (2020) posited, this would not only have a positive effect on the student body but also on teaching. Educational personalization enables the design and implementation of more personalized and individualized accompaniment. AI enables both content and learning pace to be adapted to the individual needs of each learner, which the respondents associated with better learning outcomes and information retention. The implementation of large-scale personalization enables the realization of a learner-centered approach that was previously challenging to achieve (Doroudi, 2023; Gazquez et al., 2023; Karsenti, 2019).

19. «The ability to rapidly process and analyze large volumes of data enables AI» (INF. 14).
20. «AI has implemented dynamic classrooms to make students more participatory and creative in their work» (INF. 3).

Similarly, the participants mentioned enhanced assessment and feedback processes as strengths, highlighting the fact that AI can provide accurate assessments and constructive feedback in real time for both the student learning process and teaching practice. AI systems offer the potential for immediate and individualized assessments, providing students with valuable feedback in real time (Harry and Sayudin, 2023). This results in a more dynamic and personalized approach to assessment, with continuous adjustments and improvements. As Chiu et al. (2023) posited, this would also impact motivation.

21. «Real-time assessment and feedback: AI can provide immediate assessments and feedback on students' work. This allows them to

identify areas for improvement more quickly and effectively, facilitating deeper learning» (INF. 6).

Another strength highlighted was optimization and automation, which was previously identified by Popenici and Kerr (2017). This is understood as an improvement in the performance of operational and administrative tasks through process optimization and automation. AI enables the delivery of educational feedback in a personalized manner and at a fast and frequent pace, as well as the automatic rating of students and the provision of personalized support and recommendations (Karsenti, 2019). AI can analyze vast quantities of data and provide feedback on student performance, thereby enabling educators to gain a deeper understanding of their instructional methods. This can enhance learning outcomes and student performance (Harry and Sayudin, 2023). Similarly, AI simplifies procedures, reduces manual workload, and increases efficiency in various educational operations. Furthermore, the optimization of such systems is contingent upon their accessibility and expansion. AI facilitates access to educational resources for a more extensive audience and expands the reach of education globally. It is evident that AI technology can overcome geographical and socioeconomic barriers, thereby providing educational opportunities to previously excluded groups. In this regard, Escotet (2023) underscored the necessity to transfer educational technology across cultural boundaries. It is imperative that this transfer is conducted in a manner that respects identity and does not adhere to a single pattern.

- 22. «Processes large amounts of data quickly and efficiently» (INF. 11).
- 23. «Optimize processes to carry them out in less time. Lighten the burden of repetitive work» (INF. 12).
- 24. «Automation of administrative tasks can be accomplished through AI systems that can perform a variety of administrative tasks at university institutions, such as managing student records, scheduling classes, evaluating exams, and communicating with students» (INF. 20).

On a more professional level, the participants considered that AI can be a support for professional growth and development, suggesting it will better prepare them for their future professional challenges.

- 25. «Gives job opportunity» (INF. 4).
- 26. «Great job opportunities in the career studied» (INF. 9).

As a final strength, the participants highlighted comprehensive research support. It was recognized that AI can facilitate and enhance research processes, including the identification of pertinent information

and data analysis, and enable researchers to gain deeper insights and make more efficient discoveries. Chiu et al. (2023) report benefits along these lines, although the present data do not allow such an effect to be verified. The challenge now is to invest in research and development to create more sophisticated AI tools that can be tailored to individual educational needs efficiently (Educación 3.0, 2024).

27. «Research tasks can be automated to facilitate the work» (INF. 11).
28. «It can analyze large amounts of data in real time, identifying patterns and trends that might go unnoticed by humans» (INF. 19).
29. «Ease of obtaining information in research» (INF. 18).
30. «AI allows access to enormous amounts of information almost instantaneously» (INF. 24).
31. «It can accelerate scientific research» (INF. 34).

The final dimension, opportunities, addresses the extensive range of opportunities afforded by AI for enhancing the teaching and learning process. The most frequently represented category was expanded access to educational resources (47.7%), which mirrors the accessibility and expansion category identified among the strengths, while research support and optimization (21.6%) echoed the research-related strength discussed above. The participants were attracted to learning personalization, suggesting that AI enables the customization of educational content and the learning experience to suit individual needs. This encompasses adjustments to specific learning paces, styles, and difficulties. Consequently, an enhanced, more efficient, and more motivating educational process will be achieved, and a deeper and more lasting learning experience will be promoted (Humble and Mozellius, 2022).

32. «One-on-one support and tutoring: AI [tools] can provide individualized support and tutoring to students. They are available at any time to answer questions, explain complex concepts, provide feedback on assignments and homework, and advise in the learning process» (INF. 6).
33. «Personalization of learning data analytics to improve teaching» (INF. 21).

Furthermore, the integration of educational optimization and automation with AI appears to be a crucial step in enhancing the efficacy of educational task and process management. From administrative management to test grading, AI contributes to the efficient management of resources and time. Indeed, the participants anticipated that educators would now engage in more meaningful interactions and creative tasks,

which would facilitate the implementation of innovative and personalized teaching and learning approaches. In this context, it is important to note that university faculty will require training to achieve the desired level of efficiency (González et al., 2023).

34. «Optimize processes to carry them out in less time» (INF. 5).
35. «The implementation of artificial intelligence offers opportunities to improve operational efficiency and automate tasks» (INF. 14).

Another category of opportunities is the creation of new teaching and learning methodologies. These include the use of immersive technologies such as virtual and augmented reality. Although Ouyang et al. (2022) posited that AI offers opportunities that are yet to be fully realized, the participants of this study contended that the resources currently employed facilitate the transformation of the educational space and provide students with rich and immersive learning experiences that motivate and engage them while generating authentic and applicable learning contexts. Furthermore, the democratization of these resources facilitates more equitable access to content and enables the advancement of scientific knowledge.

36. «It encourages creativity when creating a forecast. Analyzes large amounts of data in much less time than a person» (INF. 7).
37. «Innovation in teaching and learning. AI opens up new possibilities for innovation in teaching and learning at the university level» (INF. 20).
38. «One opportunity is educational innovation, as it offers opportunities to develop new teaching methodologies» (INF. 27).

The final category identified pertains to enhancing accessibility and inclusion. The informants perceived that AI could create more inclusive educational environments for individuals with special needs and provide tailored solutions for those who lack convenient access to knowledge. In light of these considerations, consistent with UNESCO (2023), it is vital to ensure that initiatives aimed at implementing AI in higher education prioritize equity, equality, and improvements in educational outcomes for all. The ultimate objective is to implement adaptive AI technologies that personalize the learning experience of students with special needs and facilitate their integration and academic success. It is of the utmost importance to promote educational equity, ensuring that all students have equitable access to AI resources, thus preventing the exacerbation of educational disparities (Pegalajar-Palomino and Rodríguez-Torres, 2023).

39. «Improving accessibility and inclusion: AI can play a key role in creating more inclusive and accessible educational environments» (INF. 20).

Conclusions

The objective of this study was to describe the perceptions that a group of Ecuadorian university students hold about the use of AI tools in their academic training. This study conducted a SWOT analysis from the perspective of Ecuadorian university students who have had experience with the introduction of a novel educational paradigm associated with AI.

The qualitative analysis of the 88 SWOT answers revealed a notable concern regarding the potential impact of AI on ethical issues. The issues of algorithmic bias, privacy and data security, and plagiarism were identified as factors requiring further review with the aim of enhancing the educational experience. Similarly, it was deemed essential to assess the pedagogical applications of AI tools with the objective of optimizing the teaching-learning process. In terms of positive aspects, broader access to educational resources and the optimization of academic tasks were the most frequently cited benefits, and the creation of an individualized learning space according to needs was also perceived as a benefit of AI. In the participants' view, AI could adapt content and teaching strategies to the needs of each learner, adjusting the difficulty and pace of learning to each student's progress. The literature associates this kind of personalization with higher motivation and engagement (Chiu et al., 2023), and participants also saw in AI a means of designing more inclusive educational systems.

Participants also perceived that AI could transform how academic research is conducted, by helping them locate pertinent sources, discern patterns in data, and anticipate outcomes based on prior information.

Nevertheless, though AI can facilitate learning, participants perceived a risk of becoming overly reliant on this technology. In their view, continued access to automated suggestions may result in a decline in critical thinking skills and creativity, as students may prefer the easy path provided by AI rather than striving to find solutions on their own.

Participants also raised ethical concerns, particularly about data privacy and the fair use of the technology. AI systems rely heavily on data collected from learners, which can include personal information, learning behavior, and even emotional factors. In the absence of appropriate safeguards, this data may be susceptible to leakage or misuse.

The data gathered here describe what a specific group of students perceives, not what AI actually produces in their academic work. Establishing whether the personalization, optimization, or dependence they report translates into measurable changes in learning would require designs incorporating objective performance indicators, which fall outside the scope of this study.

Beyond this, and given the changing nature of current AI systems, the results obtained in this study may not be fully generalizable. The present era is one of regulatory, adaptive, and interpretive engagement with the developing paradigm, underscoring the significance of studies that adopt a multifaceted perspective on the diverse actors involved in the process. As a future research direction, we propose action research studies to assess the direct impact of these tools on student work.

A key limitation of this study relates to the sampling strategy and recruitment context. The sample was selected using non-probability convenience sampling and comprised 88 students from a single course, academic program, and public university in Ecuador. Accordingly, the findings reflect context-specific perceptions within this particular educational setting and should not be interpreted as statistically representative of the broader Ecuadorian university student population. Furthermore, participants' educational backgrounds and academic experience with AI tools may differ from those of students in other disciplines, institutions, or educational contexts. Future research should include participants from a broader range of academic programs, universities, and institutional contexts to examine the consistency and transferability of the patterns identified across diverse higher education settings.

Contribución de autoría

Mari Mar Boillos participó en las fases de conceptualización, análisis de datos, investigación, recursos, validación, redacción del borrador original, y redacción, revisión y edición del texto final.

Ángel Freddy Rodríguez-Torres participó en las fases de curación de datos, análisis de datos, adquisición de fondos, metodología, *software*, supervisión, redacción del borrador original, y redacción, revisión y edición del texto final.

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Potenciales conflictos de interés

Ninguno.

Declaración de uso de IA

En el desarrollo del manuscrito se utilizó inteligencia artificial generativa (IA-G). Su uso se limitó exclusivamente a mejorar la legibilidad y el lenguaje de la obra, incluyendo apoyo en la traducción, y en ningún caso se empleó como fuente directa de información.

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