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Analysis of a Practical Case of a Didactic Model for Critical Thinking with Artificial Intelligence (AI) in Higher Education.

Análisis de un caso práctico de un modelo didáctico para el pensamiento crítico con la Inteligencia Artificial (IA) en educación superior.

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ABSTRACT

This article presents a didactic model to facilitate the development of critical competence in university students through the use of generative artificial intelligence (GAI) chatbot tools. It is theoretically based on contemporary definitions of critical thinking, its learning process and effective teaching strategies. The model is configured by six dimensions that students have to develop in the completion of AI-supported learning tasks: Interrogation, Comparison, Critical Dialogue, Verification, Personal Re-elaboration and Reflection. An example of its implementation is presented in a case developed at the University of La Laguna (Spain). For its analysis, the proposed learning tasks are described and data on the opinion of the participating students was collected through a questionnaire of closed and open questions. It is concluded that the proposed model offers a structured guide for the critical use of AI by students in the execution of learning tasks and it is suggested to obtain further empirical evidence of its performance by implementing it in new university contexts.

RESUMEN

Este artículo presenta un modelo didáctico para facilitar el desarrollo de la competencia crítica en estudiantes universitarios mediante el uso de herramientas de chatbot de inteligencia artificial generativa (IAG). Se fundamenta teóricamente en las definiciones contemporáneas del pensamiento crítico, su proceso de aprendizaje y las estrategias didácticas efectivas. El modelo está configurado por seis dimensiones que tienen que desarrollar los estudiantes en la cumplimentación de tareas de aprendizaje apoyadas por la IA: Interrogación, Comparación, Diálogo crítico, Verificación, Reelaboración personal y Reflexión. Se presenta la ejemplificación de su puesta en práctica en un caso desarrollado en la Universidad de La Laguna (España). Para ello se describe la tarea de aprendizaje planteada y su análisis se apoya en la opinión del alumnado participante recogida a través de un cuestionario de preguntas cerradas y abiertas. Se concluye que el modelo propuesto ofrece una guía estructurada para el uso crítico de la IA por los estudiantes en la ejecución de tareas de aprendizaje y se sugiere obtener mayores evidencias empíricas de su funcionamiento implementándolo en nuevos contextos universitarios.

KEYWORDS · PALABRAS CLAVES

Educational Technology; Artificial Intelligence; Higher Education; Critical Thinking; Teaching Model.
Tecnología educativa; Inteligencia Artificial; Enseñanza Superior; Pensamiento Crítico; Modelo Didáctico.

1. Introduction

One of the most relevant challenges in higher education is to adequately prepare students and graduates to function professionally and personally in a world marked by complexity and rapid technological evolution. In this context, critical thinking emerges as a key competence for navigating and solving problems in such a dynamic environment (Paul & Elder, 2014). The incorporation of AI tools—especially generative chatbots—offers new opportunities to cultivate these skills, enabling personalized and accessible interactions (Holmes, Bialik, & Fadel, 2019).

Currently, ChatGPT and other generative AI (GAI) tools based on natural-language interaction (e.g., Gemini, Perplexity, Copilot, Groq) have become common resources for addressing academic tasks and challenges among students and instructors (Chiappe, Sanmiguel, & Sáez, 2025; Lo, 2023; Raman et al., 2023). These systems are able to generate responses that resemble those of human experts and emulate academic writing styles.

One of the most recurring concerns among university faculty regarding Artificial Intelligence (AI) is the rise in potential plagiarism and academic dishonesty among students, since generative AI tools make it easier to produce assignments without substantial intellectual effort. According to a recent survey in the United States, 65% of teachers reported fear about AI's impact on academic integrity, expressing concern about how these tools may be used to generate content without properly citing sources, thereby jeopardizing the originality of student work (Hamilton, 2024). Similarly, the Fundación CYD (2025) reports that nearly 90% of students in Spanish universities use GAI tools for their coursework. This is prompting universities to reconsider policies on teaching and assessment to avoid malpractice (Wilson, 2025).

In another study, Dwyer and Laird (2024) noted that "teachers lack confidence in their ability to discern between content generated by artificial intelligence versus content created by students" (p. 13), which is leading to increased use of anti-plagiarism software by faculty and, consequently, to stricter disciplinary measures for students.

This phenomenon challenges educators to rethink pedagogical strategies to ensure that AI is used ethically and responsibly (Kumar et al., 2023). Traditional plagiarism-detection technologies such as Turnitin have proven useful for identifying content copied from human sources. However, their ability to detect AI-generated text is limited, which heightens faculty concerns about maintaining fairness and justice in academic assessment (Hutson, 2024).

Moreover, the risk that students may resort to AI to avoid fundamental processes of inquiry and writing is significant. A recent study indicates that, although educators are aware of AI's potential advantages for improving academic performance, many fear that its unrestrained use undermines learning by impeding the development of fundamental skills such as critical analysis and independent writing (Karkoulian, Sayegh, & Sayegh, 2024).

1.1. Teaching and learning to use Generative AI critically

In this context of ubiquity and growing use of GAI tools, the university instructor faces a twofold challenge: on the one hand, to guide students in the ethical and responsible use of AI and, on the other, to remain vigilant regarding the risks this technology may entail in terms of academic dishonesty. Faced with this dilemma, Chan and Tsi (2023) propose an integrative approach in which AI technologies serve as allies in teaching and learning processes, yet always under the instructor's critical and pedagogical oversight.

Suriano et al. (2025), in a study with 241 university students, concluded that interaction with generative AI tools can be a valuable resource for developing students' critical-thinking skills. However, they emphasize the importance of adopting an educational approach that fosters active participation and deep understanding to promote critical analysis of information provided by AI-based chatbots.

Critical thinking is defined as the capacity to analyze, evaluate, and synthesize information in a reflective and logical manner to make informed decisions (Ennis, 2018; Facione, 2015). It also involves not only cognitive skills but affective dispositions, such as curiosity and open-mindedness. In education, critical thinking is essential for academic and professional development, enabling students to confront and solve complex problems effectively (Lai, 2011).

In this sense, cultivating students' critical thinking is a substantive educational goal in the face of the use of generative AI such as ChatGPT (Liang & Wu, 2024). Critical-thinking skills can be conceptualized as the ability to "express critical viewpoints, consider alternative perspectives, analyze, evaluate, synthesize, and provide justifications" (Liang, 2023).

1.2. Teaching Critical Thinking: Learning Tasks with AI

The development of critical thinking is a continuous process that requires both the acquisition of cognitive skills and the cultivation of dispositional attitudes (Halpern, 2019). Effective learning of critical thinking implies integrating theory and practice while fostering an environment that encourages ongoing reflection and questioning. In addition, self-regulated learning—where students actively manage their own learning—is essential to consolidating these skills (Zimmerman, 2002).

AI-mediated activities can be designed to foster these skills, offering students opportunities to interact with information in active and reflective ways. Table 1 provides examples of tasks that support students' development of critical thinking using AI. Artificial intelligence, and chatbots in particular, provides innovative tools to personalize and enrich learning processes (Luckin et al., 2018). These systems can deliver immediate feedback, adapt to individual student needs, and simulate interactions that promote critical thinking (Zawacki-Richter et al., 2019). However, their effectiveness depends on appropriate pedagogical integration that goes beyond mere technology use by incorporating strategies that promote analysis, evaluation, and synthesis of information (Chen, Chen, & Lin, 2020).

Table 1

*Types of AI-supported tasks to develop students' critical thinking (authors' own elaboration)*

Type of task	Description
Comparative Analysis of Responses Generated by Different AIs	Students submit the same prompt or instruction to different AIs (ChatGPT, Perplexity, Gemini, …) and compare the responses to assess similarities and differences.
Critical Evaluation of AI-Generated Content	Students develop the same content with AI and also with traditional academic sources (books, encyclopedias, the web). They then evaluate differences in depth, rigor, and veracity.
AI-Guided Research Projects	Students use AI tools to gather data, analyze information, and generate hypotheses. AI may help organize information and propose research avenues, while students decide on the project's focus and draw conclusions.
Creation of Interactive Content with AI Tools	Students use various AI tools to design simulations, infographics, concept maps, or games that explain a scientific or historical concept. These products can be reused in future classes.
Analysis of Products Generated by Different Student Groups on the Same Topic	Different groups produce work on the same topic using the same AI and then conduct a plenary comparison to analyze convergences and divergences.
Verification or Fact-Checking of AI Responses	Students verify whether data provided by an AI are correct or fabricated, consulting classic information sources (books) or reputable web resources.
Comparison Between AI Output and an Academic Article or Book on the Same Topic	Students compare an academic article or book with an AI-generated response on the same topic, assessing depth of analysis, coverage, data accuracy, and the sophistication of arguments.

1.3. A didactic model to develop critical thinking with AI

In a recent work (Area-Moreira, 2025), we formalized a didactic model specifically created for planning and assessing learning tasks aimed at developing students' critical thinking with Generative AI. The model comprises six dimensions: Inquiry, Comparison, Critical Dialogue, Verification, Personal Re-elaboration, and Reflection (see Figure 1). It has already been piloted within university courses, providing a systematic structure to guide instructors in the planning, implementation, and assessment of learning tasks and processes in which students engage critically and autonomously with AI tools. It also helps students orient their learning by leveraging GAI's potential to facilitate processes of analysis and reflection.

Figure 1

Dimensions of the didactic model for critical thinking with AI
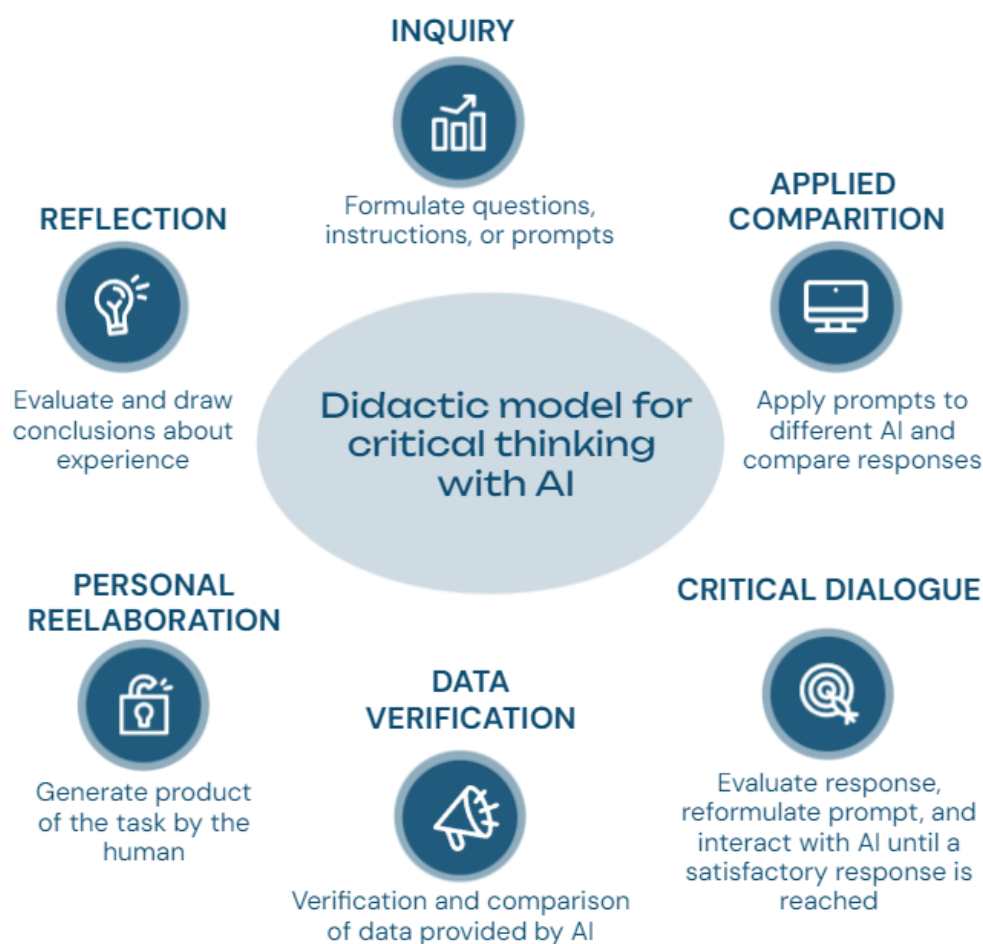
Source: own elaboration.

1.3.1. Inquiry: Formulating Questions and Instructions

The first step in critical AI-mediated learning is teaching students how to craft questions and build appropriate instructions or prompts to interact with AI systems. The goal is to ensure students understand how the quality of AI responses depends directly on the precision and clarity of the instructions provided. This entails formulating prompts that retrieve precise, relevant, and enriching information, leveraging the full potential of AI tools.

1.3.2. Applied Comparison: Contrasting Sources

Once questions have been crafted, students apply the same instructions to different AI tools (e.g., ChatGPT, Gemini, Copilot, Perplexity) and compare the outputs. This phase helps students recognize differences among algorithms and how each tool can generate responses with varying degrees of precision and relevance. It aims for students to analyze the validity, coherence, and veracity of information from diverse sources, enabling systematic comparison to detect biases, errors, or limitations.

1.3.3. Critical Dialogue: Dialogic Interaction

Dialogue with AI is essential to fostering an interactive learning process. Students refine and reformulate their questions based on the responses obtained, identifying gaps and improving their capacity to ask more specific and focused questions. This encourages iterative human–machine exchanges in which the student questions, clarifies, redefines, or deepens understanding through successive queries.

1.3.4. Data Verification: Checking and Validating

Verification is crucial, allowing students to check whether information provided by AI is accurate. Students should avoid uncritical reliance on immediate AI outputs by consulting reliable print and digital sources, contrasting AI-generated information with existing knowledge and identifying possible errors, biases, or inaccuracies. This emphasizes systematic and critical data verification to ensure validity.

1.3.5. Personal Re-elaboration: Constructing Knowledge

Students rework AI-provided responses using their own words and discourse. The objective is to transform machine-generated information into an original intellectual product, thereby promoting critical thinking and autonomy. Students construct original (textual, visual, audiovisual) outputs from AI-generated information, actively reinterpreting and personalizing it, and integrating automated information into a personal, original, and critical discourse.

1.3.6. Reflection: Developing Metacognition

Students reflect on their interaction with AI, identifying both the potential and the limitations of these tools. They evaluate how AI assisted their learning and recognize the risks of over-reliance. Reflection fosters awareness of cognitive processes and strategies used to solve problems and build knowledge, enabling students to analyze how AI tools contribute to—or limit—the development of their thinking and to identify strengths, biases, or gaps in human–machine interaction.

2. Metodology

The practical case presented below was carried out at the University of La Laguna during the 2023–2024 academic year in the course "Las Tecnologías de la Información y la Comunicación en la Educación," a third-year subject in the Primary Education Teacher Degree. The experience took place within an educational innovation project titled Hybrid and Flexible Teaching (Hyflex) Supported by AI Tools, approved by the Vice-Rectorate for Teaching Innovation and Quality. The project's main objective was to offer students flexibility in choosing learning pathways and to facilitate and support the use of AI tools to complete assignments.

2.1. Didactic implementation: The AI-supported learning task

The proposed instructional activity consisted of developing a conceptual report or essay on a relevant course topic or problem (e.g., Flipped Classroom, Gamification, Educational Robotics, Hybrid Teaching, Digital Teaching Resources, Digital Competence, e-learning, among others). Students were instructed to address the following components:
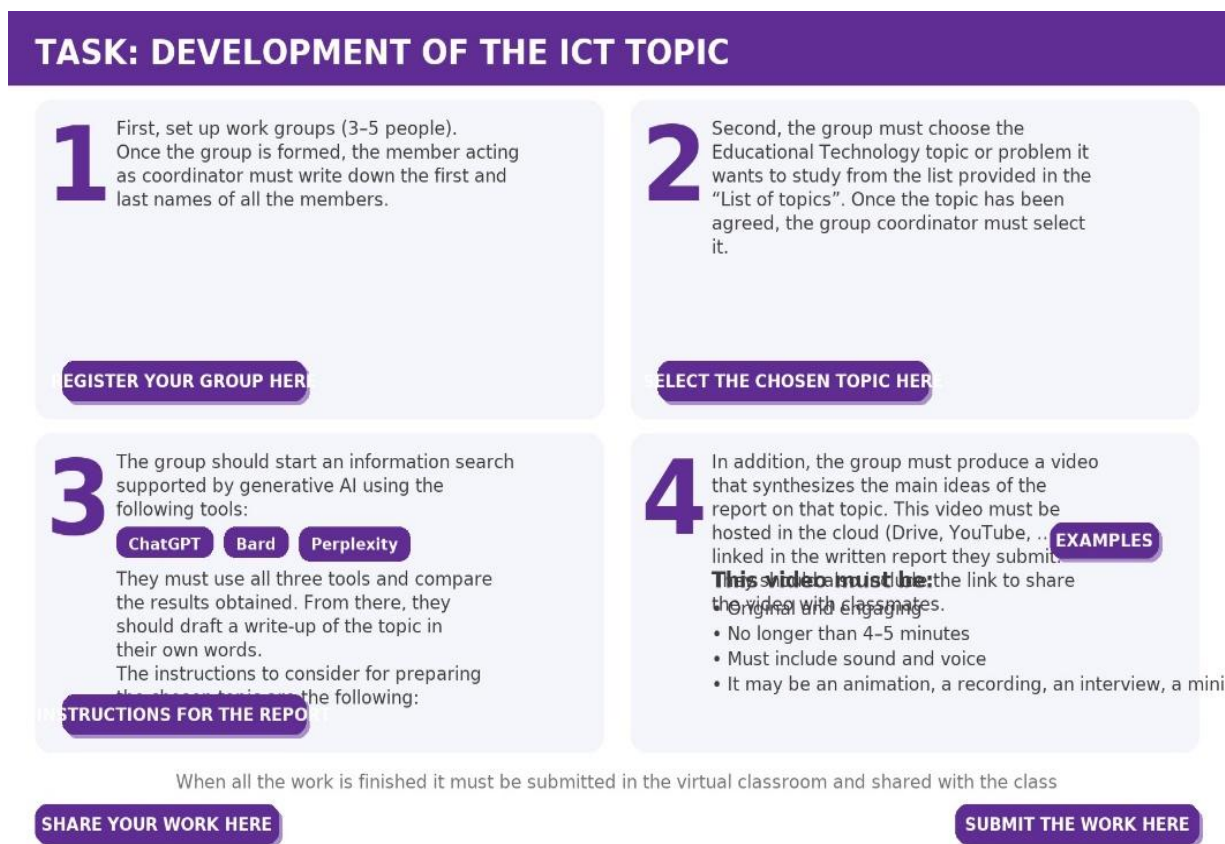
- A synthesis of key concepts related to the topic
- Positive and negative aspects in a table format
- Examples and case studies
- Recommendations for instructors
- Bibliography and relevant web links

Students were asked to prepare the essay by crafting a prompt or instruction to submit to an AI system. They were also instructed to apply the same prompt to three different AI tools (ChatGPT, Gemini, and Perplexity) and subsequently compare, verify, and assess the responses, following the theoretical model of critical AI use described above.

Finally, students had to write the essay report and include the prompts used, the responses generated by the different AIs, and the comparative analysis among them. The assignment was to conclude with an appraisal and conclusions about the experience of consulting AI (see Figure 2 for the assignment guidelines posted in the course's virtual classroom).

Figure 2

Guidelines for the academic task to be developed with AI

TASK: DEVELOPMENT OF THE ICT TOPIC

1 First, set up work groups (3–5 people). Once the group is formed, the member acting as coordinator must write down the first and last names of all the members.

REGISTER YOUR GROUP HERE

2 Second, the group must choose the Educational Technology topic or problem it wants to study from the list provided in the "List of topics". Once the topic has been agreed, the group coordinator must select it.

SELECT THE CHOSEN TOPIC HERE

3 The group should start an information search supported by generative AI using the following tools:

ChatGPT   Bard   Perplexity

They must use all three tools and compare the results obtained. From there, they should draft a write-up of the topic in their own words.
The instructions to consider for preparing the chosen topic are the following:

INSTRUCTIONS FOR THE REPORT

4 In addition, the group must produce a video that synthesizes the main ideas of the report on that topic. This video must be hosted in the cloud (Drive, YouTube, …) linked in the written report they submit. This video must be: the link to share the video with classmates.
• Original and engaging
• No longer than 4–5 minutes
• Must include sound and voice
• It may be an animation, a recording, an interview, a mini

EXAMPLES

When all the work is finished it must be submitted in the virtual classroom and shared with the class

SHARE YOUR WORK HERE   SUBMIT THE WORK HERE

Source: own elaboration.

2.2 Objectives and methodology of the case analysis

The purposes of this analysis were:

- Identify students' views on the educational potential of AI as future teachers.
- Understand their evaluation of the AI-supported learning task.

The methodology consisted of an exploratory study of students' subjective views, collected through a questionnaire including both closed and open-ended questions. The instrument was developed by the researchers and administered at the end of the course via the virtual classroom.

The sample consisted of 75 students enrolled in the Primary Education Teacher Degree at the University of La Laguna. For this study, three specific questions on AI use and perception were added: two closed-ended items (multiple choice) and one open-ended question (for students' opinions, appraisals, and reflections). Specifically, the following questions were presented:

- Which statements about the usefulness of AI in education do you agree with? (multiple selections allowed)
- Rate your satisfaction with the experience of using the three AIs (ChatGPT, Gemini, Perplexity) in this course.
- From your point of view, what are the potentialities and negative aspects of using AI in teaching and learning?

The data were entered into an Excel database to analyze the selected options and to categorize and code open-ended responses. For the latter, students' answers were compiled in a spreadsheet; through analysis, we deductively established salient thematic indicators for each response, which allowed us to organize results around those indicators and interpret the information obtained.

3. Analysis and results

The end-of-course survey showed that students are aware of AI's potential usefulness both for teaching activities (e.g., preparing lesson plans, assessments, resources) and for students when completing learning tasks (e.g., information search, writing assignments). Consequently, they believe that the didactic use of AI tools should be promoted in university teaching and express interest in deepening their learning to apply these tools in Primary Education (see Figure 3).

Figura 3

*Students' opinions on the usefulness of AI in education*
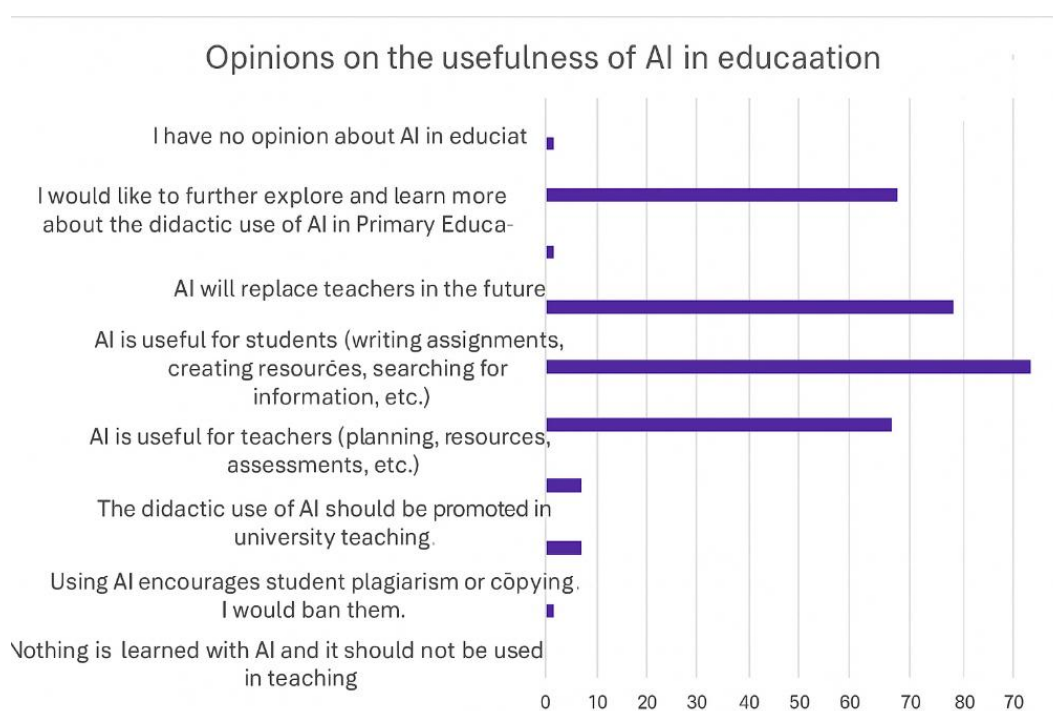
Source: own elaboration.

Moreover (see Figure 4), the vast majority of students evaluated the AI-supported task positively when using and comparing different AI tools. Very few considered it indifferent, and only one student reported disliking the task and finding it difficult.

Figura 4

Degree of student satisfaction with the AI-supported task
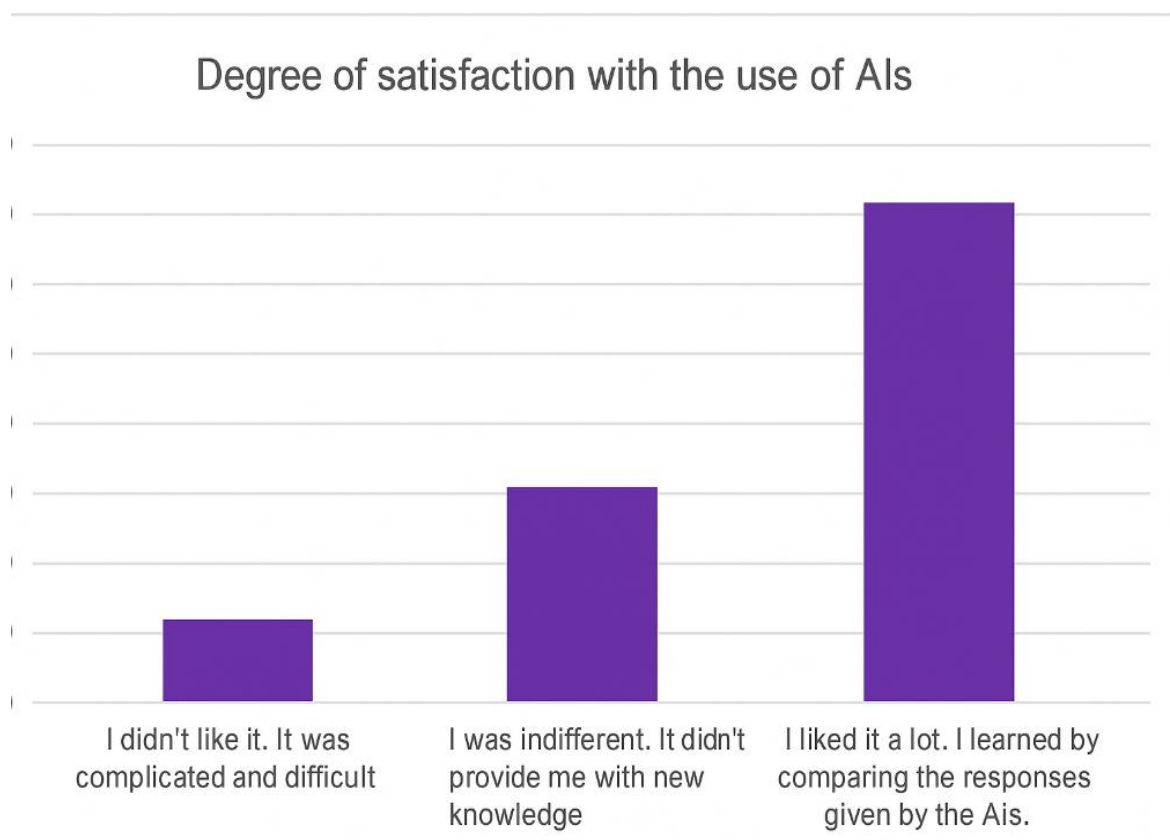
Source: own elaboration.

With regard to the qualitative analysis of students' open-ended responses, one of the positive aspects highlighted is rapid access to information, valuing the ability of AI tools to quickly and efficiently retrieve relevant information.

"From my point of view, the potential of using AI in teaching and learning is that it provides information more immediately and quickly."
"It greatly simplifies the process of searching for information."
"It can help serve as a starting point for research papers and helps gather and compare a large amount of information very easily."

This rapid and efficient access to information, in turn, saves work time—another aspect students valued highly. A notable benefit is the optimization of working time when using these tools. Such optimization is seen in AI's handling of mechanical tasks such as creating

outlines, planning activities, or designing assessment instruments, thereby freeing up time for more meaningful aspects of teaching and learning.

> *"The potential is that they can save us a lot of work when creating."*
> *"The positives are many, as they help minimize working time and you can rely on them to generate your own ideas and conclusions."*
> *"The potential is that we can save students' working time on aspects that do not contribute much learning through AI, and focus more on those key aspects and competencies they should develop."*
> *"For planning, organizing information, or creating images, it can work well."*

Another frequently mentioned benefit is AI's capacity for learning personalization, aligned with a Universal Design for Learning perspective. Several respondents noted that AI tools can serve as powerful instruments for accessibility and personalization of teaching–learning processes, supporting individualized learning adapted to students' needs.

> *"AI makes it possible to create individualized learning adapted to the student's needs."*
> *"On the one hand, it can personalize learning to adapt to the individual needs of students."*
> *"AI resources make it possible to adapt activities to students' needs."*

Students also pointed out that AI tools can streamline teaching–learning processes by enabling faster feedback and facilitating access to instructional resources, thus supporting evaluation processes.

> *"Provide instant feedback, improve efficiency in assessment, and facilitate access to interactive educational resources."*
> *"It allows you to gather, organize, and provide access to a wide range of educational resources."*

Another salient aspect is the inspiration AI tools can provide. Students reported that these tools help generate ideas and spark creativity to start projects or classroom tasks. However, they sometimes framed this as a potential drawback, as overreliance on AI might discourage students' own creativity.

> *"Contribution of ideas and creativity in the creation of resources."*
> *"It helps when you need ideas or you go blank, but some people may create all their content with it."*
> *"As potential, I would highlight the ease and support these tools provide to give us a base and help when creating educational content."*

Regarding negative aspects, many respondents converged on the idea that AI tools can foster plagiarism or copying of information verbatim, without undergoing prior processes of review, analysis, and comparison.

"The only negative aspect I see is using it to do your assignments and plagiarize what AI writes for you."

"To be honest, the negative aspects are that students will plagiarize; they won't compare information and will try to do everything through AI."

"The negative aspects I see are that students may stop doing tasks to copy directly from AI."

Plagiarism connects to another negative aspect: erroneous or incorrect information. In many cases, students use AI-provided information verbatim, leaving little room to exercise critical thinking or to verify the information offered by the tool.

"However, a negative aspect I would highlight is that this information, in some cases, may be incorrect."

"It can help serve as a starting point for research papers and helps to gather and compare a large amount of information very easily, but it is necessary to filter, select, and be careful with the erroneous information it can sometimes provide."

As interactive tools that rely on human–machine exchanges, concerns also arise about data protection and user privacy—an issue students explicitly flagged.

"Student safety may be at risk due to the Internet connection."

"Because of that broad range of information, it could be misused with no security at all."

Beyond technological issues, students also mentioned human and social factors. One is the reduction of human interaction.

"That they replace certain aspects that are fundamental for students' personal development."

"It can lead to overdependence on technology and reduce human interaction."

Other concerns included potential losses in cognitive skills—particularly creativity, autonomy, reasoning, and critical thinking.

"Students should not overuse these tools, since they can create dependence that may affect their ability to solve problems on their own."

"There may be a tendency to do everything with AI without having critical thinking, simply because it is faster and easier."

4. Discusion and conclusions

The didactic model for university teaching presented here is intended as a coherent and structured guide for integrating the pedagogical use of AI in higher-education contexts. The case analysis shows students' positive appraisal of this approach, recognizing it as significant support for carrying out academic tasks that demand analysis, argumentation, and the autonomous construction of knowledge.

Unlike technophobic or technophilic stances (Selwyn, 2016), this model rests on a critical and balanced position that acknowledges both the potential and the risks of AI in higher education. Far from advocating exclusion or uncritical adoption, it argues for responsible incorporation of AI as a mediating tool in the educational process. In this respect, it aligns with critical Educational Technology approaches that emphasize the active role of instructors as mediators and guarantors of an educational appropriation of technologies (Area & Adell, 2021).

The model also contributes to strengthening core 21st-century competences, such as intellectual autonomy, critical capacity, and advanced digital competence (Ferrari, 2013; Redecker, 2017). By positioning AI as a resource subordinated to educational aims—where students become active subjects in constructing knowledge—students should be able to interrogate content, contrast sources, and reflect on their own cognitive processes (Pérez Gómez, 2012; 2024).

Finally, the model's effectiveness lies not only in technical use of digital tools but in its potential to reconfigure pedagogical practices for a university education committed to fostering students' critical, ethical, and autonomous development. The challenge, therefore, is not technological but pedagogical: to educate reflective citizens capable of acting responsibly in a complex digital society (Area, 2025).

In conclusion, the didactic model proposed theoretically and trialed in this practical case offers a structured guide for students' critical engagement with AI when completing learning tasks in university teaching contexts. This approach not only enhances students' technological or digital competence but also strengthens their intellectual and critical capacities, which are essential for future academic and professional success.

A limitation of the present work is that this didactic model has not yet been sufficiently validated empirically. As a future line of work, we are implementing new projects to deploy the proposed model both in other courses across different programs and in diverse university contexts.

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