Prisma Social revista de ciencias sociales, No. 51
2025 e-ISSN 1989-3469. pp 246-261
DOI: https://doi.org/10.65598/rps.5940

Academic self-efficacy and diversity during the Artificial Intelligence era

Autoeficacia académica y diversidad en la era de la Inteligencia Artificial

Susana González-Pérez, Manuel M. Molina-López, Pablo González Rico, Gloria Aznar Fernández Montesinos

CEU Universities, Spain

KEYWORDS

Artificial Intelligence
Self-efficacy
Academic performance
Gender differences
Student confidence
Higher education
Technology adoption.

ABSTRACT

This study explores how university students engage with Artificial Intelligence (AI) tools and how these interactions affect their academic self-efficacy. It aims to identify the psychological and behavioral implications of AI usage in higher education, particularly in relation to students' self-confidence, autonomy, gender, and perception of competence.

Using a quantitative research design, the study surveyed 226 Spanish university students through an ad hoc online questionnaire. The instrument measured AI usage patterns, perceived usefulness and limitations of AI tools, and students' self-efficacy. Structural equation modeling was employed to analyze the relationships between perceived AI benefits, gender, and academic self-confidence.

The results show a significant and positive relationship between students' perception of AI usefulness and their self-efficacy. No statistically significant gender differences were found in either AI adoption or the manifestation of Dunning-Kruger effects. The overall use of AI tools was positively associated with students perceived academic competence.

This paper contributes to the growing body of literature on AI in education by focusing on its psychological effects, beyond technical performance. The study also raises awareness of the risks of overreliance and false self-confidence, calling for a more balanced integration of AI in academic settings.

PALABRAS CLAVE

Inteligencia Artificial
Autoeficacia
Rendimiento académico
Diferencias de género
Confianza
Educación superior
Uso de las tecnologías.

RESUMEN

Este estudio explora cómo el colectivo estudiantil universitario interactúa con las herramientas de Inteligencia Artificial (IA) y cómo estas interacciones afectan su autoeficacia académica. El objetivo es identificar las implicaciones psicológicas y conductuales del uso de la IA en la educación superior, en particular en relación con la autoconfianza, la autonomía, el género y la percepción de competencia de los/as estudiantes.

Mediante un diseño de investigación cuantitativa, se encuestó a 226 estudiantes universitarios españoles mediante un cuestionario en línea ad hoc. El instrumento midió los patrones de uso de la IA, la utilidad percibida y las limitaciones de las herramientas de IA, y la autoeficacia de los estudiantes. Se emplearon modelos de ecuaciones estructurales para analizar las relaciones entre los beneficios percibidos de la IA, el género y la autoeficacia académica.

Los resultados muestran una relación significativa y positiva entre la percepción de la utilidad de la IA por parte de los/as estudiantes y su autoeficacia. No se encontraron diferencias de género estadísticamente significativas ni en la adopción de la IA ni en la manifestación del efecto Dunning-Kruger. El uso general de herramientas de IA se asoció positivamente con la competencia académica percibida por los/as estudiantes.

Este artículo contribuye a la creciente literatura sobre la IA en la educación al centrarse en sus efectos psicológicos, más allá del rendimiento técnico. El estudio también aumenta la conciencia sobre los riesgos de la dependencia excesiva y la falsa autoconfianza, y pide una integración más equilibrada de la IA en los entornos académicos.

RECIBIDO: 24/07/2025
ACEPTADO: 28/11/2025

Cómo citar este artículo / Referencia normalizada: (Norma APA 7ª)
González-Pérez, S., Molina-López, M.M., González Rico, P., Aznar Fernández Montesinos, G. (2025) Academic self-efficacy and diversity during the Artificial Intelligence era. *Prisma Social, 51*, 246-261. https://doi.org/10.65598/rps.5940

1. Introduction

The history of technological progress is marked by successive revolutions that have reshaped production, communication, and knowledge. The First Industrial Revolution introduced mechanization powered by steam; the Second brought mass production via electricity and assembly lines; the Third introduced digital automation through computers and the Internet. Today, we are immersed in the Fourth Industrial Revolution, characterized by the convergence of the physical, digital, and biological spheres, driven by emerging technologies such as Artificial Intelligence (AI), the Internet of Things (IoT), and advanced robotics (Schwab, 2016). Among these, AI stands out as a transformative force with profound implications for the education sector.

In higher education, AI is rapidly redefining how knowledge is delivered, accessed, and evaluated. Intelligent systems—such as adaptive learning platforms, virtual tutors, and automated feedback tools—offer the potential to personalize learning experiences, increase student motivation, and enhance academic performance (Elbadiansyah et al., 2024). However, this technological shift also raises important questions about the psychological and cognitive impact of AI on students. In particular, it is crucial to understand how AI influences learners' self-perception, autonomy, and confidence in their own capabilities.

The mass adoption of AI among university students is a global trend. According to the Digital Education Council (2024), 85% of students report using AI tools in their academic activities. The *Bosch Tech Compass Report* (2024) further reveals that Spain leads in AI adoption among surveyed countries, followed by Italy and Colombia, with 65% of the general population using AI tools. Despite this rapid uptake, 72% of users acknowledge having received no formal training on how to use these technologies, a gap particularly significant in the Spanish academic context.

This widespread but uneven integration of AI has sparked debate about its impact on student self-efficacy—the belief in one's ability to succeed in specific academic tasks. While numerous studies underline the benefits of AI in enhancing engagement and self-confidence through personalized learning and real-time feedback (Kamalov et al., 2023; Motlagh et al., 2023), other research cautions against overreliance on these systems (Zhai, Wibowo & Li, 2024). In some cases, students may develop an inflated sense of competence that undermines their ability to solve problems independently, thereby affecting their learning outcomes and self-efficacy perceptions (Yilmaz & Yilmaz, 2023; Zhai et al., 2021).

Given this background, the present study explores the role of AI in shaping both, female and male students' self-efficacy perceptions in higher education. Specifically, it examines the relationship between the perceived usefulness and ease of use of AI technologies and students' willingness to adopt them, and how this adoption influences their self-confidence and self.

By addressing these hypotheses, this study aims to contribute to the growing body of literature on digital transformation in education, providing empirical evidence on both the empowering and limiting effects of AI on student development. The findings are intended to inform educators, policymakers, and technology developers about how to better align AI tools with pedagogical objectives, ensuring their responsible and equitable use in academic settings.

1.1 Theoretical background

The first significant contribution to mathematical logic was made in 1931 by the Austrian intellectual Kurt Gödel (Gödel, 1931). His groundbreaking work laid the foundations for the development of AI, a term formally introduced in the 1950s through the pioneering efforts of Alan Turing (Turing,

1950) and John McCarthy (McCarthy, 1955). These early theorists proposed that machines could be designed to carry out complex computations and emulate human behavior, thereby defining the core objective of AI.

Today, AI is transforming virtually every industry and reshaping many aspects of daily life, particularly in the way people interact and learn (Lund & Wang, 2023). The education sector is no exception (Yevura, 2023): AI is rapidly entering classrooms around the world, affecting both students and teachers. While universities are quickly adopting AI tools, academic research should not only explore the challenges but also emphasize the potential benefits for teaching and learning. AI has the capacity to enhance student learning, productivity, and self-confidence. However, it also presents notable limitations—such as reduced opportunities for imagination and creativity, and the absence of a physical learning environment—which can negatively affect students' attitudes toward learning (Ahmad et al.; Zhai et al., 2021).

Thus, Higher education is undergoing a profound transformation shaped by the growing diversity of student profiles, digitalization, and the incorporation of emerging technologies such as AI. In Spain, university students come from varied socio-economic, cultural, and academic backgrounds, including an increasing number of students from vocational training pathways (Rubio-Andres et al., 2023). This heterogeneity reflects differing expectations and motivations, influencing how students engage with the learning process and perceive the role of higher education. While some view university primarily as a vehicle for acquiring technical skills and entering the labor market, others value a more holistic model that emphasizes transversal competences such as creativity, analytical reasoning, and critical thinking. In both perspectives, the role of digital tools—especially AI—has become increasingly prominent.

AI-driven educational platforms are reshaping how knowledge is acquired and evaluated, offering personalized learning environments and real-time feedback. Although these tools promise to enhance student engagement and performance, they also raise questions about their psychological impact on learners, particularly regarding autonomy, motivation, and self-efficacy. According to the Digital Education Council (2024), 85% of students currently use AI tools in their academic work, with Spain showing the highest usage among surveyed countries (Bosch Tech Compass Report, 2024). However, 72% of students report having received no training on how to use these technologies, which highlights a significant gap between adoption and understanding. To explore the mechanisms behind student engagement with AI, this research draws upon the Technology Acceptance Model (TAM) proposed by Davis (1989), which posits that the perceived usefulness and ease of use of a technology are key predictors of its adoption. This model aligns with Rogers' Diffusion of Innovation Theory (2014), which categorizes users based on their willingness to adopt innovation. In the context of AI in education, these theories provide a framework for understanding student behavior and motivation.

Furthermore, gender has emerged as a relevant variable in the adoption of AI tools in higher education. Research by Ofosu-Ampong (2023) and Gado et al. (2021) suggests that male and female students may differ in their level of engagement, familiarity, and comfort with AI technologies. These differences extend to how students perceive and respond to the ethical dimensions of AI use, as highlighted by Jang, Choi, and Kim (2022). However, despite this growing body of evidence, it remains unclear whether gender plays a significant role in shaping the relationship between AI usage and students' academic self-efficacy. Specifically, further research is needed to determine whether the use of AI tools affects male and female students' self-confidence in distinct ways, or if such effects are consistent across genders. Addressing this gap is essential for ensuring equitable integration of AI in educational environments (Jang et al., 2022).

Based on this theoretical background, the first hypothesis of this study is proposed:

> H1a: Students will consider AI to be a tool that facilitates learning and can improve their academic results.
>
> H1b: Male and female students will differ in their likelihood of adopting AI depending on their perceptions of usefulness and ease of use.

Moreover, Higher education needs to keep pace technological advances using AI responsibly to create meaningful experiences (Lytras et al., 2024) and assure that one of the principles of AI serves as a tool of empowerment, innovation and transformation (Alangari et al. 2024).

Within the evolving relationship between AI and higher education, a key emerging construct is student self-confidence—defined as the belief in one's ability to overcome academic challenges, such as understanding complex material, solving problems, and successfully navigating assessment tasks (Wulan & Sari, 2020).

This perception is shaped by multiple factors, most notably their own academic performance. Students who achieve positive results are more likely to develop greater self-confidence, while repeated academic setbacks can diminish their belief in their abilities. Pressure to meet both internal and external expectations—such as those from family or future career goals—also plays a significant role, often affecting students' emotional well-being and self-perception (Molina-Lopez et al., 2024).

Other key influences on self-confidence include students' sense of personal responsibility and autonomy in managing their learning, particularly during the transition to higher education. This shift often demands more independent study and decision-making, making successful adaptation a crucial factor in building confidence. In addition, supportive social networks—comprising peers, family, and academic staff—can reinforce students' self-belief and resilience throughout their academic journey (Zapata & Onwuegbuzie, 2023). Within this framework, it is essential to consider how emerging educational technologies, such as AI, contribute to shaping students' self-perceptions and confidence in their academic abilities.

In addition to usefulness and usability, another theoretical lens that enriches the analysis of AI adoption is the Uses and Gratifications Theory (Katz, 1973; Rubin, 2009), which explains why individuals choose specific media or tools based on the gratification and satisfaction they derive from them. In educational settings, students are more likely to use AI tools when they believe these tools help them achieve better results and enhance their learning experience.

This proactivity is rooted in a motivational drive to obtain academic gratification, as argued by Chang et al. (2022), making the theory highly relevant to understanding students' behavioral engagement with AI. Thus, students who feel that AI improves their academic performance may experience an increased sense of self-efficacy and confidence when using these technologies (Rodríguez-Ruiz, Marín-López & Espejo-Siles, 2025; Wang, Sun & Chen, 2023). This idea can be supported by Bandura's Social Cognitive Theory (2001), which states that the belief in one's own capabilities can lead to actions that contribute to the achievement of success or established goals. It is common for students to use AI tools to make inquiries that facilitate the understanding of content in areas where they feel or perceive themselves to be insecure. These inquiries may materialize into tangible outcomes such as better grades or increased efficiency in completing tasks, which could lead students to consider that a proper relationship with AI tools may be associated with improved effectiveness and greater self-confidence. This positive feedback could translate into

greater proactivity toward autonomous learning and a closer relationship with technology. In other words, it appears that students' perception of AI's impact on academic performance has not only a technical but also a psychological effect, strengthening self-efficacy and self-confidence. This, in turn, could result in a motivational spiral and the development of new competencies (Wang, Sun & Chen, 2023).

Unlike Bandura's concept of self-efficacy -which refers to an individual's belief in their ability to successfully carry out tasks and achieve goals- the Dunning-Kruger effect describes a cognitive bias in which individuals with low competence overestimate their abilities. According to Dunning and Kruger (1999), individuals with limited experience or knowledge may exhibit inflated self-confidence, not due to a grounded sense of capability, but rather as a result of their inability to accurately assess their own performance, tending male students to overestimate their abilities more than females in technological and academic domains (Kruger & Dunning, 1999; Ehrlinger & Dunning, 2003).

A recent study published by Guan et al. (2025) examined the relationship between AI knowledge, AI-related self-efficacy, and the acceptance of this technology. The findings revealed that AI knowledge has a non-linear effect on its acceptance, mediated by AI-related self-efficacy. Specifically, individuals with limited knowledge of AI tended to overestimate their understanding and skills, which led to inflated self-efficacy and, consequently, greater acceptance of AI—even without a deep understanding of its implications. This overestimation can lead to a false sense of efficacy that is disconnected from actual competence.

This leads to the following hypothesis:

> H2: Male students are more likely to exhibit Dunning-Kruger effects when using AI than female students

This discussion would be incomplete without addressing the broader cognitive and transversal competences that higher education aims to foster, particularly in the context of digital transformation. For instance, creativity, understood as the ability to generate original and useful ideas for solving complex problems or improving quality of life (Cropley, 2005; Chang et al., 2022), is essential in adapting to rapidly evolving environments. It enables students to address unstructured problems and connect insights across disciplines.

Recent developments in AI have prompted scholars to revisit the very definition of creativity (Wang, Sun & Chen, 2023), giving rise to the concept of co-creativity, which describes collaborative innovation between humans and AI systems. Likewise, analytical thinking—the ability to deconstruct complex issues and assess options based on evidence (Omar & Zoube, 2023)—remains a key skill for making informed academic and professional decisions (Kozikoğlu, 2023). In turn, critical thinking involves evaluating information objectively and constructing reasoned arguments (McKinley, 2013; Enríquez et al., 2021). It is foundational to academic writing and intellectual autonomy but can be undermined when students delegate evaluative judgment to AI systems. As Malik (2023) points out, overuse of AI risks diminishing students' capacity for critical inquiry, particularly when they rely passively on machine-generated answers. In this context, promoting self-efficacy is not just a psychological goal but a prerequisite for preserving these higher-order competences in a rapidly evolving educational landscape.

In this vein, AI use in education is not without its risks. Excessive reliance on AI tools may result in superficial learning and an overestimation of one's competence. Kamalov et al. (2023) and Motlagh et al. (2023) highlight how generative AI systems, such as ChatGPT and Bard, enable

students to obtain instant answers without engaging in critical or analytical thinking. While this may temporarily boost students' confidence, it can hinder the development of independent problem-solving skills and reduce long-term retention of knowledge. Furthermore, to keep academic integrity and promote critical thinking some authors like Mantas et al. advise not to use AI in written assessments (Mantas, 2024)

Similarly, Yilmaz and Yilmaz (2023) and Zhai et al. (2021) describe how reliance on AI in programming and technical subjects can lead to a false sense of mastery; students perform well when supported by AI, but experience anxiety and performance drops when required to complete tasks independently. Almasri (2024) introduces the notion of competence illusion, where students believe they have internalized knowledge that was actually mediated by technology.

In this line, Aleksandara (2023) also warns that overdependence on AI can leave students unprepared for learning environments where these tools are not available. These findings are consistent with Bandura's (1997) theory of self-efficacy, which emphasizes the importance of authentic mastery experiences in building a robust sense of competence. When students achieve success primarily through AI rather than personal effort, their self-efficacy becomes fragile and vulnerable to failure.

Consequently, this study examines whether the use of AI in academic learning environments enhances or diminishes students' self-efficacy beliefs:

> H3: The limitations of AI in learning will demonstrate a negative impact on students' self-efficacy.

2. Methodology

The research aims to gain insights of the use of AI among Spanish students. The aim of this study is to explore the relations of the use of AI and self-efficacy. In an era where AI technologies are becoming increasingly embedded in educational processes, this study seeks to examine the psychological and behavioral dimensions associated with AI adoption—specifically, how students' confidence in their academic abilities may be shaped by their interaction with these tools.

To achieve this, the study employs a quantitative research design, utilizing a structured, ad hoc online survey developed for the purpose of this investigation. The questionnaire comprised 20 items, divided into three key sections: demographic information, patterns of AI usage, perceived benefits and limitations of AI tools, and self-efficacy, measured through a Likert-scale format ranging from 1 (strongly disagree) to 5 (strongly agree). These items were designed to capture both behavioral data (frequency and type of AI use) and attitudinal constructs (perceptions of usefulness, confidence, and learning outcomes).

The data collection was carried out over three months, from October 1st to December 21st, 2024. The final demographic sample consisted of 56.2% male and 43.8% female students, aged between 18 and 25, who were pursuing different degree programs within the Faculty of Economics and Business. Participants were recruited through email invitations and online academic platforms. Professors encourage participation by calling into action while in class. Various reminders were sent, too.

The final sample size was 226 university students. The sample includes representation from a variety of disciplines, academic levels, and demographic backgrounds, allowing for a broad view of AI engagement among the student population. In many of the questions we used the Likert scale.

2.1 Measure

Data was collected using a structured questionnaire developed to assess university students' perceptions of artificial intelligence (AI) tools within their academic environment. The questionnaire was adapted based on previous literature and tailored to the specific context of AI-assisted learning. It included items measuring three primary variables: *Perceived Benefits*, *Resulting Outcomes*, and *Limitations*. Each item was rated on a five-point Likert scale (where 0 indicated "Not at all" and 5 "Completely agree").

To ensure clarity and relevance, the questionnaire was reviewed by a panel of experts in educational technology and piloted with a small group of university students enrolled in different degree programs within the Faculty of Economics and Business. The pilot facilitated language adjustments to match students' usage and comprehension, ensuring contextual fit and minimizing ambiguity.

Perceived Benefits capture students' beliefs about the positive impact of AI tools on their academic learning process. This includes perceived improvement in learning and enhancement of academic results. For example, items prompted students to reflect on statements such as, "Using AI tools has helped me understand the course material better" and "AI tools have improved my academic performance."

Resulting Outcomes evaluate the practical and affective consequences of AI use, including students' satisfaction with AI tools, their willingness to recommend these tools for academic and creative purposes, and their opinion on whether AI should be integrated into university teaching. Sample items include, "I am satisfied with the AI tools applied to my academic tasks," "I would recommend AI tools to other students," and "AI tools should be officially incorporated into university courses."

Limitations focus on the potential cognitive constraints perceived by students when using AI, particularly regarding creativity, analytical thinking, and critical thinking. The questionnaire addressed concerns that AI might limit personal creativity, reduce engagement in analytical problem-solving, or hinder the development of critical evaluation skills. Representative items included statements such as, "Using AI tools restricts my ability to think creatively," "AI use reduces my analytical thinking," and "AI tools limit my critical thinking skills."

Additional demographic information was collected, including age, gender, and degree program enrollment, to characterize the sample and contextualize findings.

The comprehensive design of the questionnaire allowed for a multidimensional understanding of how AI tools are perceived in higher education, balancing perceived advantages with recognized limitations to inform future pedagogical integration.

3. Data analysis and results

3.1 Model Fit and Measurement Reliability

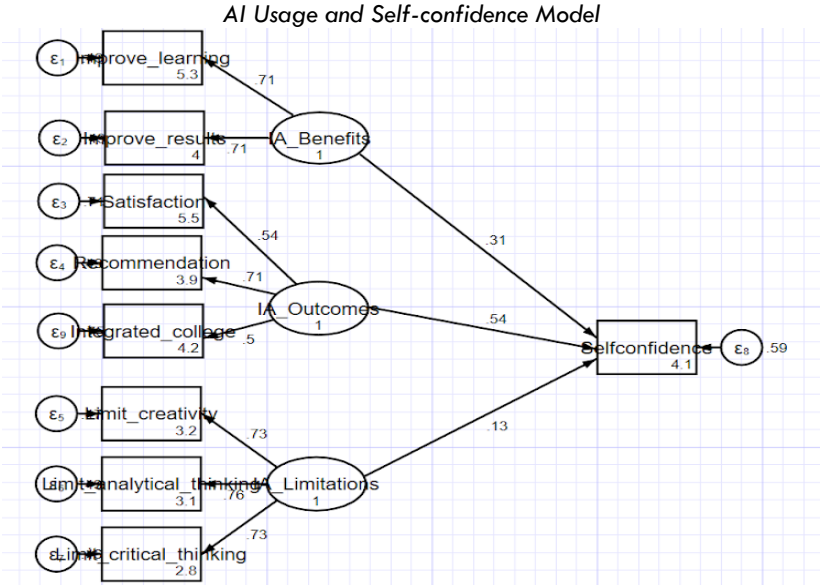
SEM analyses were conducted using Stata 15.1, employing full information maximum likelihood estimation to handle missing data (Enders, 2010). Model fit was evaluated using a combination of standard indices, including the chi-square to degrees of freedom ratio (χ^2/df), root mean square error of approximation (RMSEA), Tucker–Lewis index (TLI), and comparative fit index (CFI). According to established guidelines (Byrne, 1998; Hu & Bentler, 1999; Raykov & Marcoulides,

2000), model fit is considered acceptable when RMSEA < 0.06, CFI > 0.90, TLI > 0.90, and χ^2/df < 2.

In our model (see Figure X), the RMSEA value was 0.06, with CFI and TLI values of 0.963 and 0.946 respectively, and a χ^2/df ratio within an acceptable range. These results indicate that the proposed model demonstrates an adequate and satisfactory fit to the observed data.

Figure 1

AI Usage and Self-confidence Model



Source: own elaboration.

3.2 Hypothesis Testing Results

H1a: Students will consider AI to be a tool that facilitates learning and can improve their academic results.

The results support H1a, indicating that students' perception of AI as a tool that facilitates learning and improves academic performance is a significant predictor of AI usage ($\beta = 0.71$, $p = 0.000$). This highlights the importance of both perceived usefulness and ease of use in driving students' adoption of AI tools.

H1b: Male and female students will differ in their likelihood of adopting AI depending on their perceptions of usefulness and ease of use.

Contrary to our initial hypothesis, H1b was not supported. The multigroup SEM analysis revealed no statistically significant gender differences in the relationship between perceived AI benefits and self-confidence. Both male (Group 1) and female (Group 2) students exhibited identical standardized path coefficients from AI Benefits to Self-confidence ($\beta = 0.997$, $p = 0.000$), indicating a strong and consistent positive association across genders. Moreover, the mean comparison of perceived AI benefits between the two groups showed no significant difference (Group 1: $M = 0$; Group 2: $M = 0.023$, $p = 0.780$), further confirming the absence of gender-based variability in perception.

These findings suggest that gender does not function as a moderating variable in the relationship between AI-related perceptions and self-confidence. In practical terms, this implies that both male

and female students are equally likely to experience increased self-confidence when they perceive AI tools as beneficial and easy to use in academic contexts. This challenges some assumptions in the literature that posit potential gender-based technological adoption gaps (Venkatesh & Morris, 2000), at least within the specific context of educational AI tools among adolescents.

Such results may reflect a narrowing digital gender divide in younger cohorts, particularly in environments where both genders have equal access to technology and digital literacy education. Future studies might explore whether this parity persists across different educational levels, cultural contexts, or types of AI applications, as well as whether other factors (e.g., prior experience, subject area, or teacher support) might more significantly influence adoption behavior than gender alone.

Together, these findings reinforce the robustness of the model and suggest that students, regardless of gender, are equally likely to benefit from and adopt AI tools when these are perceived as accessible and beneficial to their academic success.

> *H2: Male students are more likely to exhibit Dunning-Kruger effects when using AI than female students.*

The results of the analysis do not support H2, which hypothesized that male students would be more prone to Dunning-Kruger effects in the context of AI usage compared to female students. Contrary to expectations, the data revealed no statistically significant gender differences in the manifestation of Dunning-Kruger effects. Both male (Group 1) and female (Group 2) students demonstrated comparable patterns, suggesting that overestimation of competence in using AI tools is not disproportionately present among male students in this sample.

These findings challenges common assumptions in the literature which often report that male students tend to overestimate their abilities more than females in technological and academic domains (Kruger & Dunning, 1999; Ehrlinger & Dunning, 2003). The absence of such a difference in this study may reflect increased digital fluency across genders in younger populations or the possibility that AI tools present a novel enough domain where both genders share similar levels of uncertainty and perceived mastery.

Moreover, it may suggest that AI-induced metacognitive misjudgment—where students think they are more proficient than they are—is a widespread issue not confined to one gender. This insight emphasizes the importance of developing educational interventions that foster accurate self-assessment and critical reflection for all students, regardless of gender. Future research might examine whether specific AI use cases (e.g., writing assistance, coding, decision support) elicit different confidence-competence gaps and whether these vary by other factors such as age, academic discipline, or prior exposure to AI.

This finding aligns with prior research emphasizing the role of perceived usefulness and outcome expectations in fostering technology self-efficacy (Bandura, 1997; Venkatesh & Davis, 2000). When students experience or anticipate tangible academic gains from AI—such as improved performance, efficiency, or learning outcomes—they are more likely to internalize a sense of competence, which in turn bolsters their willingness to continue using and exploring AI tools in educational settings.

Importantly, this highlights the feedback loop between gratification and confidence: the more students associate AI with meaningful academic outcomes, the more capable they feel in using it,

potentially reinforcing continued engagement. Educational practitioners may leverage this dynamic by demonstrating concrete academic applications of AI to foster both motivation and self-efficacy among learners.

H3: The limitations of AI in learning will demonstrate a negative impact on students' self-efficacy.

The results offer partial support for H3, suggesting a nuanced relationship between AI use, its perceived limitations, and students' self-efficacy. Specifically, the analysis reveals a significant and positive effect of overall AI usage on perceived self-efficacy ($\beta = 0.305$, $p = 0.002$), indicating that students who engage with AI tools more frequently or meaningfully tend to report greater confidence in their academic capabilities. This finding reinforces the notion that active engagement with AI technologies contributes to students' academic self-belief, supporting the hypothesis that deeper integration of AI into learning enhances perceived competence (Bandura, 1997; Venkatesh & Davis, 2000). When students experience or anticipate tangible academic gains from AI—such as improved performance, efficiency, or learning outcomes—they are more likely to internalize a sense of competence, which in turn bolsters their willingness to continue using and exploring AI tools in educational settings.

However, the analysis of the AI Limitations variable—intended to assess whether recognizing AI's limitations would diminish self-efficacy—yielded a positive but non-significant effect ($\beta = 0.1302$, $p = 0.056$; $z = 1.91$). While this suggests a potentially weak positive relationship, it does not reach conventional levels of statistical significance ($p < 0.05$). Contrary to expectations, the data does not support the idea that awareness of AI's limitations undermines students' confidence. Rather, it hints that such awareness might coexist with—or even slightly bolster—self-efficacy, possibly because students who critically assess AI's shortcomings still maintain agency over how and when to use it effectively.

Taken together, these findings underscore the importance of meaningful AI engagement in academic settings as a predictor of students' confidence in their academic skills. While perceived limitations of AI do not significantly detract from this confidence, the clear benefit stems from proactive and purposeful use of the technology. This suggests that educational strategies should focus less on shielding students from AI's flaws and more on empowering them to engage with AI tools critically and confidently.

4. Conclusions

While AI has the potential to boost students' self-confidence by providing immediate feedback and support, excessive dependence can lead to false confidence, making students vulnerable when faced with challenges without technological assistance. To maximize the benefits of AI while preserving essential cognitive skills, educational institutions must adopt a balanced and intentional approach to integrating these tools.

This study explores the psychological and behavioral dimensions of AI adoption in academic settings, focusing on the interplay between perceived utility, ease of use, gender differences, and self-efficacy. The findings offer several important insights.

First, students are more likely to adopt AI tools when they perceive them as both useful for enhancing academic performance and easy to use. This aligns with prior research rooted in technology acceptance models and reinforces the importance of perceived value and usability in influencing students' engagement with educational technologies.

Second, there were not observed statistically significant gender differences in how AI benefits impact students' self-confidence. Both male and female students demonstrated equivalent levels of perceived benefit from AI use, suggesting that attitudes toward the utility of AI in academia are broadly consistent across genders. This finding is important as it challenges the often-assumed gender gap in technology adoption and points toward a more universal student experience with AI tools.

Third, there was also not observed that male students are more likely to exhibit Dunning-Kruger effects in their AI use. Both male and female students exhibited similar self-assessments in relation to their actual competence with AI tools. This outcome highlights the need for a more nuanced understanding of overconfidence and perceived expertise in educational contexts, suggesting that cognitive biases like the Dunning-Kruger effect may not differ significantly by gender in this domain.

Fourth, it was found that students who perceive AI as improving their academic performance report higher self-confidence in using technology. This result underscores the crucial role of gratification—the perception that AI meaningfully contributes to one's learning outcomes— in fostering self-efficacy. It suggests that when students experience tangible benefits from AI, it reinforces their belief in their ability to effectively engage with such tools.

Finally, while the impact of AI limitations on self-efficacy did not reach conventional statistical significance, the data hint at a weak positive relationship, suggesting that students may not necessarily be discouraged by AI's shortcomings. Contrary to expectations, limitations might foster critical awareness or resilience rather than undermine confidence. Importantly, AI usage overall was shown to have a significant and positive effect on students' perceived self-efficacy. This supports the view that meaningful interaction with AI technologies contributes to greater academic self-belief, even in the face of potential drawbacks.

In summary, the study provides robust evidence that students' perceptions of AI's usefulness and their engagement with it significantly enhance academic self-efficacy. While gender-based differences and negative impacts of AI limitations were not supported, the findings suggest that the positive reinforcement gained from using AI outweighs concerns about its imperfections. These conclusions have practical implications for educators and institutions aiming to integrate AI into learning environments: emphasizing AI's academic value and ensuring accessible, easy-to-use tools may be key strategies for empowering learners and boosting their academic confidence.

5. Future lines and recommendations

Artificial Intelligence is rapidly transforming the way we live, learn, and interact. While its integration into education offers substantial benefits, excessive reliance on AI tools may have unintended psychological consequences. This study contributes to the ongoing debate by examining the relationship between AI usage and students' self-efficacy and self-confidence. Based on data collected from Spanish university students, the findings suggest that AI use may negatively influence perceived self-efficacy, particularly when students overestimate their understanding and competence.

Despite the study's valuable insights, several limitations should be acknowledged. The research was conducted using a sample exclusively composed of Spanish students, which may limit the generalizability of the results to other educational or cultural contexts. Future research would benefit from cross-national comparisons involving diverse educational systems and student populations. In addition, the study relied on self-reported data, which may be subject to response

bias. Complementary research using qualitative methods—such as interviews, focus groups, or observational studies—could provide deeper insights into students' motivations, attitudes, and behavioral patterns related to AI use.

Moreover, the findings indicate a need for universities to address the emerging risk of inflated self-efficacy stemming from superficial or uncritical use of AI tools. Students with limited knowledge of AI may develop unwarranted confidence in their capabilities, leading to reduced engagement in autonomous learning and critical thinking. Educational institutions should therefore promote metacognitive awareness and offer training that fosters a more informed, reflective, and strategic use of AI. These initiatives could include workshops on AI literacy, the development of critical digital skills, and the incorporation of reflective practices into the curriculum.

Given the rapid pace of technological adoption, this study serves as a timely call for a balanced integration of AI into academic environments—one that not only embraces innovation but also safeguards the cognitive and psychological development of students. Future research should examine the long-term effects of AI use on academic performance, self-regulation, and transversal competencies such as creativity, critical thinking, decision-making, and problem-solving. There is also an urgent need for ethical frameworks, pedagogical adaptations, and interdisciplinary collaboration to guide the responsible and equitable implementation of AI in higher education (Motlagh et al., 2023).

Additionally, future studies could explore how faculty attitudes and institutional cultures mediate the impact of AI on learning outcomes. The role of educators as facilitators of critical engagement with AI technologies is particularly relevant, as they can help students navigate the balance between technological assistance and the cultivation of independent intellectual skills. Research should also address how differences in digital access, prior knowledge, and learning preferences shape students' experiences with AI—especially in increasingly diverse and inclusive higher education systems.

Finally, policy-level recommendations should aim to integrate AI literacy into national and institutional curricula, not only as a technical skill but as part of a broader digital and ethical competence. Collaboration between universities, technology developers, and policymakers will be essential to ensure that AI adoption in education aligns with pedagogical goals and social equity. By fostering environments that encourage reflective, ethical, and inclusive use of AI, higher education can harness the full potential of these tools while mitigating their unintended consequences.

6. Acknowledegments

The researchers received funding from the MOEVE-USP CEU Chair.

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