From optimism to trust: how ChatGPT is reshaping student confidence in AI-driven learning

Del optimismo a la confianza: el impacto de ChatGPT en la confianza de los estudiantes en el aprendizaje asistido por IA

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ABSTRACT

Generative artificial intelligence, such as ChatGPT, is transforming the field of higher education, especially in supporting academic tasks. However, its effective adoption depends on factors such as students' trust and their perception of the tool's usefulness. This study analyzes how technological optimism, perceived usefulness, and ease of use influence university students' trust in ChatGPT. A quantitative methodology was employed, using structural equation modeling (SEM) based on data collected from 316 university students in Argentina. The survey included questions about optimism, perceived usefulness, ease of use, and trust in ChatGPT, with factorial analyses conducted to validate the constructs and examine the proposed relationships in the model. The results show that students' optimism significantly impacts their perception of usefulness and trust in ChatGPT, while ease of use does not have a direct significant effect on trust. This suggests that students value the practical benefits the tool brings to their learning process more than its ease of use. These findings suggest that universities should focus on highlighting the practical value of ChatGPT through specific training programs and fostering a critical use of the tool. It is also recommended to implement strategies that enhance the interaction between students and teachers and assess the potential of ChatGPT to improve students' academic performance.

Keywords: artificial intelligence; educational technology; machine learning; educational innovation; learning theories; trust.

RESUMEN

La inteligencia artificial generativa, como ChatGPT, está transformando el ámbito de la educación superior, especialmente en el apoyo a tareas académicas. Sin embargo, su adopción efectiva depende de factores como la confianza de los estudiantes y su percepción sobre la utilidad de la herramienta. Este estudio analiza cómo el optimismo tecnológico, la utilidad percibida y la facilidad de uso influyen en la confianza de los estudiantes universitarios en ChatGPT. Se empleó una metodología cuantitativa, utilizando un modelo de ecuaciones estructurales (SEM) basado en datos recopilados de 316 estudiantes universitarios en Argentina. La encuesta incluyó preguntas sobre optimismo, utilidad percibida, facilidad de uso y confianza en ChatGPT, y se realizaron análisis factoriales para validar los constructos y examinar las relaciones propuestas en el modelo. Los resultados muestran que el optimismo de los estudiantes impacta significativamente en su percepción de utilidad y confianza en ChatGPT, mientras que la facilidad de uso no tiene un efecto directo significativo sobre la confianza. Esto sugiere que los estudiantes valoran los beneficios prácticos que la herramienta aporta a su proceso de aprendizaje más que su facilidad de uso. Estos hallazgos sugieren que las universidades deberían centrarse en resaltar el valor práctico de ChatGPT mediante programas de capacitación específicos y en fomentar un uso crítico de la herramienta. También se recomienda implementar estrategias que mejoren la interacción entre estudiantes y docentes y evaluar el potencial de ChatGPT para mejorar el rendimiento académico de los estudiantes.

Palabras clave: inteligencia artificial; tecnología educativa; aprendizaje automático; innovación educativa; teorías de aprendizaje; confianza.

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INTRODUCTION

The introduction of generative artificial intelligence, particularly ChatGPT, has significantly transformed higher education. This tool, known for its ease of learning and affordability, has been rapidly adopted by university students (García Peñalvo et al., 2024). Like other emerging technologies, its adoption follows a diffusion pattern where early adopters embrace innovation faster (Rogers, 1995).

Research suggests that early adopters of AI tools, including ChatGPT, tend to exhibit higher technological optimism and innovativeness (Parasuraman & Colby, 2014) (Parasuraman, 2000; Parasuraman & Colby, 2014). This optimism influences their perception of usefulness, as they quickly recognize the tool's practical benefits in academic tasks (Davis, 1989).

ChatGPT's generative nature introduces unpredictability in its output, sometimes leading to inaccuracies or "hallucinations." This highlights the need for user discernment in evaluating its reliability. Trust in AI tools, defined as the willingness to rely on their output despite uncertainty (Mayer et al., 1995), is crucial for adoption. For students, repeated interactions with ChatGPT help them understand its strengths and limitations, shaping their trust in its academic applications.

The theoretical model of this study is based on the approach of Marimon et al. (2024), which analyzes the relationship between perceived usefulness, ease of use, and trust in generative AI tools in the workplace. This study adapts that model to the university context, considering that perceived usefulness and trust in tools like ChatGPT are critical factors for their adoption among students. As in the workplace, trust is identified as an essential mediator that can influence students' willingness to integrate these tools into their learning process.

The present study aims to explore how students' optimism toward new technologies, specifically ChatGPT, influences their perception of its usefulness and ease of use. Furthermore, the study investigates how these factors, in turn, impact trust in ChatGPT. Additionally, the direct relationship between optimism and trust is examined. By understanding these relationships, the study seeks to shed light on the role of optimism in shaping students' trust in AI tools, which is essential for their effective use in academic settings.

Literature review and research model

ChatGPT has become a valuable tool for university students, enabling content generation, idea development, and problem-solving (Tang et al., 2023; Zawacki-Richter et al., 2019). However, its adoption depends on students' trust, which is shaped by perceived usefulness and ease of use (Venkatesh et al., 2003).

The incorporation of ChatGPT in higher education has transformed how students interact with knowledge and manage their academic tasks (Forero-Corba & Negre Bennasar, 2024). From writing essays to conducting research, this tool offers flexible and accessible support that complements traditional teaching methodologies. Yet, for students to effectively adopt these technologies, it is crucial to understand the factors that shape their trust in them, as well as their perception of ChatGPT's utility and ease of use (García Peñalvo et al., 2024).

Existing research has explored trust in AI within workplace settings (Marimon et al., 2024), but there is limited understanding of its role in academic environments.

Addressing this gap, this study examines how students develop trust in ChatGPT, which is key to maximizing its educational benefits.

Acemoglu et al. (2023) warn about the dangers of blind optimism towards artificial intelligence, arguing that without a critical perspective and proper implementation, AI could exacerbate social inequalities, just as previous technological revolutions have done. These authors suggest that while technological optimism can accelerate the adoption of innovations, it can also lead to an overestimation of their benefits and an underestimation of their limitations, especially in contexts where result quality is crucial, such as education. This suggests that a balance between optimism and critical thinking towards AI is necessary to avoid excessive dependence on these technologies.

Acemoglu et al. (2023) emphasize that while technological innovations have the potential to increase productivity and improve living standards, their impact can be harmful if not managed equitably. Similarly, the 2024 Nobel Prize in Economics winner highlighted the importance of carefully considering the socio-economic implications of automation and AI. Although some research shows that optimism towards AI influences trust in its use (Marimon et al., 2024), Acemoglu's perspective serves as a reminder that such optimism must be accompanied by critical reflection to avoid perpetuating or worsening structural inequalities.

The Technology Acceptance Model (TAM) suggests that perceived usefulness and ease of use influence technology adoption (Davis, 1989). In educational AI, studies confirm that usefulness is a stronger predictor of trust and intent to use than ease of use (Al-Abdullatif & Alsubaie, 2024; Huang et al., 2022).

Moreover, trust in AI tools has been identified as a key factor in their adoption (Marimon et al., 2024; Mayer et al., 1995). Trust is defined as the willingness of the user to be vulnerable to the actions of the tool, expecting reliable and consistent outcomes. This is particularly relevant for generative AI, where the results are not always deterministic and may exhibit variations or "hallucinations" (Bender et al., 2021). Al-kfairy et al. (2024) highlight that trust in the accuracy and reliability of AI-generated results is a determining factor for continued use, especially in tasks requiring high levels of academic rigor.

This study references the model proposed by Marimon et al. (2024), adapting it to the context of university students using generative AI tools like ChatGPT. Marimon et al. (2024) developed a model analyzing the impact of the disposition towards adopting generative AI technologies and how trust in these tools influences engagement and performance in the workplace. Their research emphasizes the importance of trust as a key mediator between user experience and work engagement, showing that while ease of use is important, perceived usefulness and trust in the technology are crucial for generating a positive impact.

This study adapts the model proposed by Marimon et al. (2024) to the context of university students and their interaction with generative AI tools like ChatGPT. Marimon's original model, designed to analyze the impact of perceived usefulness, ease of use, and trust in the workplace context, provides a solid foundation for exploring the use of emerging technologies. However, key differences between professional and academic settings justify specific adjustments to the model.

In the educational context, students' willingness to adopt new technologies can be influenced by factors such as institutional support, prior digital training, and personal experiences with similar tools. Unlike the professional setting, where ease of use may be critical for rapid integration into the workflow (Marimon et al., 2024), in the academic realm, students tend to value the practical usefulness of a tool more. This is

because they face specific academic tasks that require relevant and precise results, rather than just an intuitive interface (Venkatesh et al., 2003).

Furthermore, students' technological optimism plays a determining role in adopting AI tools, as suggested by previous literature on the adoption of innovations (Parasuraman & Colby, 2014). The perceived usefulness of ChatGPT, its ability to facilitate the generation of academic content and support the resolution of complex problems, directly influences students' trust in this tool. This relationship between optimism, usefulness, and trust has been adapted to explore how students, rather than employees, integrate ChatGPT into their learning process.

By adapting the model of Marimon et al. (2024), this study proposes that trust in ChatGPT depends not only on perceived ease of use but mainly on its usefulness in specific learning contexts, such as writing essays and academic research. This highlights the importance of students perceiving tangible value in using the tool for them to trust its capabilities and adopt it continuously. The adaptation of this model thus aims to capture the particularities of the educational environment and the factors that facilitate the adoption of generative AI tools in higher education.

This study's model is adapted to explore how university students develop trust in ChatGPT, considering the constructs of optimism, perceived usefulness, and ease of use, similar to those proposed by Marimon et al. (2024). As with professionals, it is expected that students' disposition towards technology and their perception of ChatGPT's usefulness influence the level of trust placed in the tool. This approach provides a more comprehensive understanding of how trust in ChatGPT can facilitate its integration into the academic environment and how this trust could eventually improve the perceived usefulness of the tool in the learning process.

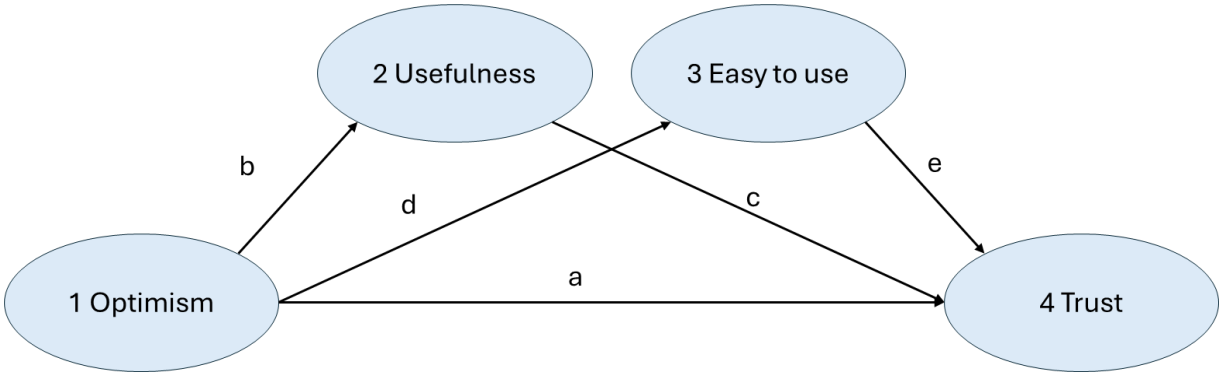
Nevertheless, key differences between the workplace and educational contexts justify adapting Marimon et al.'s (2024) model. In the educational setting, students' readiness to accept and use new technologies may be influenced by additional factors, such as institutional support, prior digital training, and past learning experiences with similar technologies. Moreover, studies like Ly et al. (2024) on the adoption of digital learning platforms in universities suggest that intrinsic motivation plays a particularly relevant role in the academic context, as students who perceive that a technology contributes to their personal academic development are more willing to integrate it into their study routine.

Therefore, this study differs from previous research by adapting the approach of Marimon et al. (2024) to the particularities of the university context, incorporating the role of students' optimism towards technology, and exploring its effect on perceived usefulness and trust in ChatGPT. Through this adaptation, the study aims to shed light on the mechanisms that facilitate the integration of generative AI tools in educational contexts, contributing to a more comprehensive understanding of the factors influencing the adoption of these technologies by students.

In conclusion, the proposed research model is based on adapting the approach of Marimon et al. (2024), tailored to the context of university students and their interaction with generative AI tools like ChatGPT. This model integrates the constructs of optimism, perceived usefulness, ease of use, and trust, seeking to understand how these variables influence students' adoption and acceptance of ChatGPT. The central hypothesis suggests that students' optimism towards technology and their perception of its usefulness play a key mediating role in developing trust in the tool, which in turn affects their willingness to use it effectively in academic contexts. Thus, the model

allows for evaluating not only the adoption of the tool but also how generated trust impacts its continued use and the integration of AI into learning processes.

Figure 1
Research model



Source: elaborated by the authors.

METHODOLOGY

This section describes in detail the steps followed in our research, while in the next section the results will be depicted, summarized and commented on.

Questionnaire design

The questionnaire was thoughtfully designed to encompass various aspects relevant to our study. It commenced with items measuring respondents' readiness to adopt new technologies, then moved on to questions evaluating the level of acceptance, frequency of use, and trust in these tools.

To ensure both validity and relevance, the items for each construct were carefully chosen or adapted from Marimon et al., (2024), as well as other well-established, validated sources within the field. Table 1 provides a comprehensive breakdown of the constructs and the specific items included in the study. Since the introduction of generative artificial intelligence, particularly ChatGPT in 2023, the landscape of higher education has undergone a profound transformation.

The questionnaire was carefully designed to assess key constructs in our study, aligning with the Technology Acceptance Model (TAM) (Davis, 1989). It first evaluated respondents' technological optimism and perceived usefulness of ChatGPT, as previous research highlights that perceived usefulness strongly influences trust and intention to use AI tools (Al-Abdullatif & Alsubaie, 2024; Huang et al., 2022). The questionnaire also measured ease of use and trust in AI tools, incorporating validated scales from prior studies (Marimon et al., 2024). Factorial analysis was conducted to confirm construct validity, ensuring that each item accurately captured its intended dimension and aligned with the theoretical framework.

ChatGPT, a general-purpose tool known for its ease of learning and affordability, has rapidly gained traction in higher education, supporting students in academic writing, research, and problem-solving tasks.

Table 1
Items proposed for the questionnaire

Optimism	OPT1	ChatGPT contributes to improving my learning in university.
	OPT2	ChatGPT provides me with more freedom and flexibility in my studies.
	OPT3	ChatGPT gives me more control over my academic tasks.
Innovation	INN1	Other classmates come to me for advice on using ChatGPT.
	INN2	Generally, I am one of the first in my group of friends to try new technologies like ChatGPT when they come out.
	INN3	I can usually learn to use new tools like ChatGPT without help from others.
	INN4	I keep up to date with the latest developments in ChatGPT and similar technologies in areas of my interest.
Usefulness	USE1	I find ChatGPT useful for my academic tasks.
	USE2	Using ChatGPT makes it easier to complete my tasks.
	USE3	Using ChatGPT allows me to complete my work faster.
Easy to Use	EAS1	I find ChatGPT easy to use.
	EAS2	Learning to use ChatGPT was easy for me.
	EAS3	I find it easy to get ChatGPT to do what I need.
Trust	TRU1	I feel comfortable with the information ChatGPT provides for my studies.
	TRU2	I trust ChatGPT to help me with my academic tasks.
	TRU3	ChatGPT helps me with my university assignments.
	TRU4	If I have a challenging problem in my studies, I use ChatGPT.
	TRU5	I feel confident about data protection with ChatGPT's tools.
	TRU6	I feel adequately protected against issues with ChatGPT tools used in my studies.
	TRU7	I trust that ChatGPT's tools comply with established legal standards in the academic field.

Source: elaborated by the authors.

Survey administration and demographics

The survey was distributed and completed in October 2024, yielding 316 fully completed responses. The respondents were Argentinian students with experience using generative AI (GenAI) tools in their academic work. The majority of respondents were female (60.8%), and most were young adults, with 67.4% aged between 18 and 25 years. In terms of education, 52.8% had completed secondary school, while 25.6% held a university degree. The sample included students from both public (26.6%) and private (73.4%) universities, with most attending classes of 10 to 50 students.

Regarding AI usage, 35.4% reported using generative AI tools rarely, while 10.4% used them daily. The study provides insights into students' trust in AI within Argentina's higher education system, though findings may vary in other cultural and institutional contexts.

Table 2
Demographic characteristics of the sample

	Number	%
Gender		
Male	124	39.2
Female	192	60.8
Total	316	100.0
Age		
Between 18 and 20 years	81	25.6
Between 21 and 25 years	132	41.8
Between 26 and 35 years	47	14.9
Between 36 and 45 years	34	10.8
Between 46 and 55 years	20	6.3
> 55	2	0.6
Total	81	25.6
Education		
Secondary education	167	52.8
Technical or professional education	49	15.5
University degree	81	25.6
Postgraduate (Master's/Doctorate)	10	3.2
Prefer not to answer	9	2.8
Total	316	100.0
Frequency of GenAI Use		
I don't use artificial intelligence	68	21.5
Very rarely	112	35.4
Once a week	52	16.5
Once a day	51	16.1
Intensively, every day	33	10.4
Total	316	100.0
University		
Universidad Católica de Cuyo	210	66.5
Universidad Nacional de San Juan	74	23.4
Universidad de Congreso	18	5.7
Other	14	4.4
Total	316	100.0
University ownership		
Public	84	26.6
Private	232	73.4
Total	316	100.0
Class size		
Fewer than 10 students	18	5.7
Between 10 and 50 students	209	66.1
Between 50 and 100 students	66	20.9
More than 100 students	23	7.3
Total	316	100.0

Source: elaborated by the authors.

Assessment of the research model

Initially, three separate Exploratory Factor Analyses (EFA) were carried out using principal component analysis with varimax rotation. This step aimed to identify and refine the items that would most accurately represent each construct for the subsequent research model analysis. This approach ensured that the constructs were both statistically sound and aligned with the study's research objectives.

The first EFA was performed using items from the dimensions “Optimism” and “Innovativeness,” adapted from the TRI scale. The second EFA applied items adapted from the Technology Acceptance Model (TAM), focusing on the dimensions “Usefulness” and “Ease of Use.” The third and final EFA addressed items selected for the “Trust” dimension.

After completing the EFAs, the research model, shown in Figure 1, was tested using Structural Equation Modeling (SEM). This analysis employed the robust maximum likelihood method based on the asymptotic variance-covariance matrix, with the assistance of EQS software. The psychometric properties of each construct were rigorously assessed, including reliability (using Cronbach’s alpha and composite reliability (CR)) and convergent validity (evaluated through average variance extracted (AVE)). In addition, a discriminant analysis was performed to assess the distinctiveness of the dimensions, comparing the square of each AVE with its correlations to other dimensions.

The model's overall fit was evaluated through various metrics, including the Bentler-Satorra chi-square, its coefficient and degrees of freedom, as well as other fit indices such as the Comparative Fit Index (CFI) and the Root Mean Square Error of Approximation (RMSEA). Once the model fit was confirmed, the standardized coefficients were examined and interpreted to provide insights into the relationships between the constructs.

The validation of the questionnaire was conducted prior to the study, following the methodological guidelines established by Marimon et al. (2024). The instrument was developed by adapting validated items from previous studies, ensuring conceptual alignment with the constructs under investigation. The selection and refinement of items were based on expert judgment, with a panel of specialists in educational technology and psychometrics reviewing the questionnaire to assess its clarity, relevance, and construct validity. Additionally, a preliminary pilot test was carried out with a small group of university students to evaluate comprehension and response consistency. The psychometric properties of the instrument were examined through exploratory and confirmatory factor analyses, assessing reliability using Cronbach’s alpha and composite reliability indices. These procedures ensured that the questionnaire effectively captured the intended dimensions and met the necessary validity and reliability standards for subsequent data collection.

The questionnaire was administered in Spanish, as the target population consisted of university students from Argentina. To ensure semantic and conceptual equivalence of the items, the version used underwent a linguistic validation process to adapt it to the local context. The response scale employed was a 5-point Likert scale, ranging from 1 ("Strongly Disagree") to 5 ("Strongly Agree"), allowing for an accurate measurement of participants' perceptions of the studied variables. Additionally, the reliability and validity of the instrument were assessed through psychometric analyses, including the calculation of Cronbach’s alpha coefficient and a confirmatory factor analysis to evaluate the construct structure. The questionnaire was administered online via a survey platform, ensuring accessibility and efficient data collection.

The study sample consisted of 316 university students from Argentina, representing a diverse range of academic backgrounds and experiences with AI. In terms of educational level, 52.8% of participants had completed secondary education, 25.6% held a university degree, and 15.5% had technical or professional training. Regarding their familiarity with AI tools, 34.2% reported having minimal prior experience, 42.7% had moderate exposure, and 23.1% indicated frequent use in

academic contexts. The sample included students from both public (26.6%) and private (73.4%) universities, ensuring a heterogeneous representation of the higher education landscape. These demographic details provide a comprehensive understanding of the sample composition and contextualize the study's findings within the broader adoption of AI in higher education.

To ensure methodological transparency and rigor, the data analysis included both descriptive and inferential statistical techniques. An analysis of variance (ANOVA) was conducted to examine significant differences between groups regarding their perceptions of ChatGPT's usefulness, ease of use, and trust. The selection of ANOVA was justified by its effectiveness in comparing mean differences across multiple independent groups while controlling for variance within the sample. Additionally, box plots were used to visually represent the distribution of responses for key variables, allowing for the identification of potential outliers and variability patterns. These techniques were chosen to provide a comprehensive understanding of the data, ensuring a robust analysis of the relationships between the studied constructs.

An in-depth analysis was conducted to further examine the role of non-determinant variables, such as the number of students or email usage. While these variables did not exhibit significant direct effects, additional exploratory analyses were performed to assess potential indirect influences. The results suggest that their lack of impact may be attributed to contextual factors, such as institutional differences or varying levels of technological adoption among respondents. Additionally, measurement limitations could have contributed to their reduced significance. Importantly, their exclusion does not compromise the robustness of the model, as confirmed through supplementary statistical validation. This discussion has been integrated into the results section to provide a more nuanced interpretation of the findings.

All statistical analyses were conducted using SPSS version 27 and R software (version 4.2.1). The data processing included descriptive statistics, reliability analysis (Cronbach's alpha), and inferential tests to assess relationships between variables. ANOVA was employed to compare mean differences across groups, while confirmatory factor analysis (CFA) was performed using the lavaan package in R to validate the measurement model. Additionally, box plots were generated to visualize data distribution and detect potential outliers. The methodological approach followed established best practices in statistical analysis, ensuring the replicability of the procedures. Detailed steps for data preprocessing, coding, and transformations are outlined to facilitate reproducibility in future research.

Doble mediation role of "Usefulness" and "Easy to use"

A critical aspect of this study, as illustrated in Figure 1, is the mediation role of "Usefulness" and "Easy to use" in the relationship between "Optimism" and "Trust". This section is dedicated to an in-depth analysis of this mediation effect, which represents the secondary objective of the paper.

The methodology for assessing the mediation role of both constructs was inspired by the seminal works of Baron & Kenny, 1986; Hayes, 2009; Zhao et al., 2010. These foundational studies provide a framework for understanding the mechanisms through which "Usefulness" and "Easy to use" influences the transition from optimism to trust.

RESULTS

The structure outlined in the previous section was followed to present the main empirical results based on the collected data. Before proceeding with the analysis, Harman's Single-Factor Test was conducted to check for potential common method bias (CMB). An EFA using all 46 items identified eight factors with eigenvalues greater than one, with the first factor accounting for only 17.92% of the total variance. This finding suggests that CMB was not a significant issue in this study.

As noted earlier, the analysis began with three EFAs. The criteria for retaining items followed the guidelines from Ladhari (2012) and Wolfinbarger and Gilly (2003), which included: (i) items loading at 0.7 or higher on a factor, (ii) items not loading at more than 0.50 on two factors, and (iii) items having an item-to-total correlation greater than 0.50.

The first EFA, focusing on the "Optimism" and "Innovativeness" dimensions from the TRI scale, confirmed the distinction between these two original dimensions. Cronbach's alpha was calculated for both constructs, with "Optimism" exceeding the 0.7 threshold for reliability, while "Innovativeness" did not, leading to its exclusion from further analysis.

The second EFA, which analyzed the dimensions of "Usefulness" and "Ease of Use" together, revealed two items in each dimension with loadings greater than 0.7. Both dimensions demonstrated favorable Cronbach's alpha values, supporting their reliability, and were retained for the final model.

The third and final EFA, conducted on the seven original items for "Trust," retained six items, with Cronbach's alpha surpassing the 0.7 reliability threshold, ensuring its inclusion in the model.

Table 3 presents the reliability analysis of the four constructs. Internal consistency was confirmed through Cronbach's alpha and CR, both of which exceeded the recommended threshold of 0.7 (Hair Jr et al., 2010). Additionally, the AVE surpassed the cut-off point of 0.5 (Nunnally & Bernstein, 1994), validating convergent validity for the constructs.

Table 3
Loads of the four constructs and statistics for their reliability analyses

	1		2		3		4	
	Optimism		**Usefulness**		**Ease of use**		**Trust**	
	OPT2	0.746	USE3	0.793	EAS2	0.789	TRU6	0.802
	OPT1	0.724	USE3	0.771	EAS3	0.757	TRU5	0.784
							TRU2	0.777
							TRU1	0.776
							TRU7	0.705
Alpha Cronbach	0.825		0.814		0.690		0.861	
Composite Reliability	0.702		0.759		0.748		0.879	
Average Variance Extracted	0.540		0.612		0.598		0.592	

Source: elaborated by the authors.

Table 4 provides the results of the discriminant validity analysis, which was conducted using linear correlations or standardized covariances between latent factors by examining whether the inter-factor correlations were less than the square root of the AVE (Fornell & Larcker, 1981). Table 4 shows that the square roots of each AVE were greater than the off-diagonal elements, vouching for discriminant validity.

Table 4
Correlation matrix of latent factors

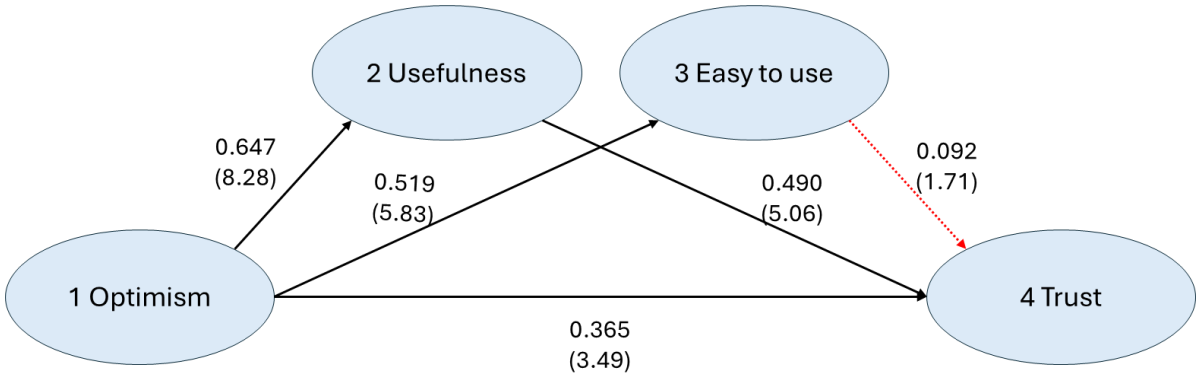
		1	2	3	4
1	Optimism	*0.735*			
2	Usefulness	0.514	*0.782*		
3	Easy to use	0.425	0.470	*0.773*	
4	Trust	0.591	0.633	0.469	*0.770*

Source: elaborated by the authors.

Once the items that would be used in the whole model were selected, the model was conducted using SEM (based on covariances). The fit indices obtained in the model estimation showed that the variables converged towards the factors established in the research model. The Satorra–Bentler χ2 was 182.5, with 49 degrees of freedom and a p-value of 0.000; χ2/df was 3.72, which was below the acceptable limit of 5. The root mean-square error of approximation (RMSEA) was 0.093 and the CFI was 0.924. Taking the significance of the robust χ2 statistic with caution and noting the global indicators, the global fit was acceptable (Hair Jr et al., 2010).

Figure 2 shows the research model with the standardized coefficients and its t-values associated on brackets. All coefficients are significant (at significance of 0.05) expecting the path between "Easy to use" and "Trust". Therefore, three hypotheses are accepted, while the fourth was refused. This finding is particularly important and will need a detailed analysis. It is not proved that "Easy to use" impacts directly on "Trust".

Figure 2
Research model with standardized coefficients and associated t-values



Source: elaborated by the authors.

The results of this study provide compelling insights into how university students develop trust in generative AI tools like ChatGPT. First and foremost, the analysis reveals that "Optimism" has a direct and significant impact on "Trust," as well as on both "Usefulness" and "Ease of Use." These effects are equally strong, suggesting that students who are more optimistic about new technologies not only find ChatGPT easier to use but also perceive it as a more useful tool in their academic tasks. However, a critical distinction emerges when examining the paths leading to trust: while "Usefulness" significantly impacts "Trust," "Ease of Use" does not.

Table 5 presents the decomposition of the mediation effects of "Usefulness" and "Ease of Use" between "Optimism" and "Trust," which is central to the research model. Remarkably, the direct effect of optimism on trust is as strong as the total indirect effect (through "Usefulness" and "Esay to use"), with both showing an identical standardized path coefficient of 0.365. This rare coincidence highlights the importance of both the direct and mediated pathways in building trust. However, a deeper look at the indirect effects reveals that "Usefulness" plays the crucial role in this mediation, whereas "Ease of Use" contributes little to the development of trust.

The implications are clear: to foster trust in ChatGPT, the perceived usefulness of the tool is essential. Whether or not students find the tool easy to use is less important in this regard. This suggests that the learning curve for using ChatGPT is not a major barrier to trust development; once students have mastered its basic functionality, their trust hinges primarily on the tool's ability to deliver valuable, reliable outputs.

According to Zhao et al. (2010), this finding points to a complementary mediation through "Usefulness" and no mediation through "Ease of use". In other words, perceived usefulness in the results generated by ChatGPT enables the increasing of trust, regardless of how easy the tool is to use. This underscores the critical role that the practical benefits of generative AI play in shaping student trust, suggesting that developers and educators should focus on demonstrating the tangible value of these tools rather than emphasizing ease of use alone.

Table 5
Correlation matrix of latent factors

	Total effect	**Partial indirect effect**	**Total indirect effect**	**Direct effect**
Optimism → Trust	0.730 (3.89)	(b*c) 0.317 (d*e) 0.048	0.365 (3.91)	(a) 0.365 (3.49)

Source: elaborated by the authors.

Every cell shows the standardized value and in brackets the p-value. The letters a, b, c and d correspond to the notation in Figure 1.

DISCUSSION

The findings of this study provide a deeper understanding of how university students develop trust in generative artificial intelligence tools, specifically ChatGPT. Consistent with the adapted model of Marimon et al. (2024), it was found that students' optimism towards technology has a significant impact on both their perceived usefulness and trust in ChatGPT. However, the analysis also revealed a key difference in the academic context: the "Ease of Use" of ChatGPT does not have a direct

significant impact on "Trust," unlike what has been observed in studies focused on the workplace.

This finding suggests that, in the academic realm, students tend to prioritize the perceived practical usefulness of the tool over its ease of use. One possible explanation is that university students, when facing specific academic demands, value more the tangible benefits of ChatGPT, such as its ability to generate relevant and accurate content, rather than the simplicity of its interface. This contrasts with the workplace context analyzed by Marimon et al. (2024), where ease of use played a more prominent role in employee trust, possibly due to the need for quick and seamless integration into the workflow.

The relationship between "Optimism" and "Trust" was particularly robust, indicating that those students who maintain a positive attitude towards adopting new technologies are more inclined to trust ChatGPT. This result aligns with the technology adoption literature, which suggests that optimism towards technological innovations can be a strong predictor of willingness to accept new tools (Parasuraman & Colby, 2014). However, this study expands on this understanding by demonstrating that, in the context of higher education, perceived usefulness acts as a crucial mediator between optimism and trust.

The findings of this study have significant practical implications for the design of technological training programs in universities. Given that the perceived usefulness of ChatGPT directly influences students' trust, universities should focus on developing programs that not only teach the basic use of the tool but also highlight its practical benefits in academic settings. For example, specific workshops could be implemented to demonstrate how to use ChatGPT for essay writing, literature review preparation, and generating innovative ideas for research projects. These activities would allow students to directly experience the tool's value in various areas of their academic training.

Moreover, integrating training modules into existing courses could be an effective strategy to encourage continuous use of ChatGPT. In research methodology courses, for instance, ChatGPT could be used to guide students in the structure and organization of their work, while in social science courses, it could help simulate debates on complex topics. This practical approach would enable students to see how ChatGPT can be a useful and relevant tool in their learning process, thereby increasing their willingness to adopt it.

Promoting a critical use of Artificial Intelligence

The adoption of ChatGPT must also be accompanied by efforts from universities to promote a critical use of generative artificial intelligence. The results show that students with an optimistic attitude towards technology tend to trust ChatGPT more, which is positive for its adoption. However, it is essential that this trust does not translate into an uncritical use of the tool. Educators should emphasize that, although ChatGPT can be an ally in the learning process, it is not infallible and may generate inaccurate or biased information.

To foster critical use, training programs could include activities that encourage students to compare the information generated by ChatGPT with traditional academic sources. This would enable them to assess the quality of ChatGPT's responses and discern when it is more appropriate to use the tool. Additionally, instructors could

design assignments requiring students to justify and analyze the results obtained with ChatGPT, thus promoting a reflective and critical approach.

Developing digital and ethical competencies

Integrating artificial intelligence into higher education should be accompanied by a strengthening of students' digital and ethical competencies. ChatGPT, like other artificial intelligence tools, operates through complex algorithms whose processes are not always transparent to the user. Therefore, it is essential that students understand the basic functioning of these technologies and the potential biases that could influence their results. Universities should develop training modules addressing ethical issues such as data privacy, intellectual property, and the social impact of artificial intelligence.

The results of this study underscore the importance of students perceiving the usefulness of ChatGPT, as those who do so are more likely to integrate it into their learning process. However, this integration must go hand in hand with a critical understanding of the technology's limitations, so that students can leverage its benefits in a conscious and responsible manner.

Finally, this study suggests that universities should consider the perceived usefulness of generative AI tools as a key factor when designing their curricula. Integrating technologies like ChatGPT should not be seen as an end in itself, but rather as a means to enrich the learning experience and develop critical skills in students. Universities that lead in adopting these tools have the opportunity to create interdisciplinary programs that connect artificial intelligence with different areas of knowledge.

For example, computer science departments could collaborate with social sciences and humanities faculties to design courses that teach students how to apply generative AI tools in data analysis, text interpretation, and the creation of innovative projects. This interdisciplinary collaboration would not only strengthen the use of artificial intelligence in higher education but also prepare students for an increasingly digitalized and competitive professional environment.

Overall, these findings highlight the importance of developing an approach focused on the tangible benefits that ChatGPT and other AI tools can offer university students. By demonstrating how these technologies can support and enhance learning, universities can promote a broader and more effective adoption of generative AI in their programs. This will not only facilitate the integration of AI into the academic environment but also empower students to become critical and informed users, ready to face future technological challenges.

Key findings and practical implications

Trust in ChatGPT emerges as a crucial factor in its adoption among university students. The study confirms that students' willingness to integrate AI tools into their academic activities is significantly influenced by their perception of the tool's usefulness. This reinforces the relevance of technology acceptance models, emphasizing the need to build confidence in AI to promote its effective use in education.

The research also highlights that perceived usefulness plays a more significant role in AI adoption than ease of use. While an intuitive interface can facilitate initial

engagement, students prioritize the practical benefits ChatGPT offers for their learning processes. As a result, higher education institutions should focus on enhancing students' digital competencies through structured training programs that foster meaningful and effective AI integration in academic settings.

To ensure responsible AI adoption, universities must develop clear policies that uphold ethical considerations and academic integrity. These policies should provide guidelines for responsible AI use while encouraging faculty members to incorporate AI-based technologies in their teaching. By fostering a critical and informed approach, educators can help students navigate the potential benefits and limitations of generative AI tools, ensuring their responsible and effective use in higher education.

CONCLUSIONS

The findings of this study have the potential to redefine how universities design and implement generative artificial intelligence integration policies, such as ChatGPT, in their academic programs. By demonstrating that the perceived usefulness of ChatGPT has a more significant impact on students' trust than ease of use, this study suggests that higher education institutions should focus on showcasing the practical value of these tools for learning, rather than merely facilitating their use. This implies that AI integration policies should prioritize the creation of training spaces where the concrete benefits of these technologies for developing academic skills—such as essay writing, research, and solving complex problems—are evident.

Universities could benefit from establishing policies that promote the incorporation of ChatGPT in specific curricular activities, such as workshops, course modules, and interdisciplinary projects, aiming to reinforce students' perception of the tool's usefulness. Moreover, these policies should encourage the development of critical and ethical competencies, ensuring that students not only adopt the technology but also become thoughtful and responsible users.

The results of this study provide valuable insights into how university students develop trust in generative AI tools like ChatGPT. First and foremost, the analysis reveals that "Optimism" has a direct and significant impact on both "Trust" and "Usefulness" as well as "Ease of Use." These effects are equally strong, suggesting that students who are more optimistic about new technologies not only find ChatGPT easier to use but also perceive it as a more useful tool for their academic tasks.

However, an important distinction arises when examining the pathways to trust: while "Usefulness" significantly impacts "Trust," "Ease of Use" does not. This suggests that the learning curve for using ChatGPT is not a major barrier to developing trust; once students master its basic functionality, their trust depends primarily on the tool's ability to deliver valuable and reliable results.

The results of this study open several avenues for future research that could expand the understanding of the impact of generative AI in academia. Firstly, it would be valuable to explore how the use of ChatGPT affects interactions between students and teachers, analyzing whether this tool facilitates more effective communication and how it influences classroom dynamics. For instance, studies could be designed to evaluate whether the use of ChatGPT enhances student participation in academic debates or assists teachers in providing more personalized feedback.

Another area of interest for future research is the impact of ChatGPT on students' academic performance assessment. Given that this tool can support the preparation of academic work and the understanding of complex concepts, it would be relevant to

investigate whether its use translates into measurable improvements in students' grades or the quality of their work. This would enable universities to more accurately assess the added value of integrating ChatGPT into teaching and learning processes, as well as adjust their technology adoption policies to maximize academic benefits.

Given that this study focuses on students' perceptions, an inherent limitation is the subjectivity of responses, which may introduce biases in the interpretation of findings. Individual differences, prior experiences, and institutional contexts could have influenced participants' evaluations of ChatGPT's usefulness and trustworthiness. While self-reported data provide valuable insights into user attitudes, they may not fully capture behavioral patterns or long-term adoption trends. To address these limitations, future research could incorporate qualitative approaches, such as in-depth interviews or focus groups, to explore the underlying motivations behind students' perceptions. Additionally, longitudinal studies would allow for a more comprehensive analysis of how trust in AI tools evolves over time, contributing to a deeper understanding of the phenomenon.

Finally, future research could focus on longitudinal studies that analyze the use of ChatGPT over time, to understand how students' perceptions of usefulness and trust in the tool evolve as they become more familiar with it. This would help universities develop long-term implementation strategies that adapt to students' changing needs and the continuous development of generative AI.

This study provides a solid foundation for designing more effective educational policies in AI integration, while raising key questions that deserve further exploration in future research. The strategic integration of tools like ChatGPT can not only enrich students' learning experiences but also prepare universities for a future where artificial intelligence is a central component of the educational experience.

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