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Artificial Intelligence as a Catalyst for Educational Innovation at ITP: Perspectives and Challenges of Teaching Practice

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Abstract. At TecNM, digital competencies represent an opportunity to strengthen institutional capabilities. In Mexico, educational institutions utilize indicators related to the use of information and communication technologies to devise strategies that enhance the integration of AI into teaching practices. The purpose of this research was to analyze the factors influencing the perception and adoption of Generative AI at the Pachuca Institute of Technology (ITP). The study employed a mixed-methods approach, incorporating both qualitative and quantitative elements. Data collection relied on a reliable and valid instrument—developed by Rodríguez-Rivas et al. (2026)—designed to assess the acceptance and use of Generative AI among higher education faculty. A total of 169 professors participated in the study. The collected data were analyzed using IBM SPSS software, with an exploratory factor analysis being performed. The results indicate that ITP stands at a juncture between innovation and modernization, offering an opportunity to advance faculty professional development.

Keywords: Generative Artificial Intelligence, Educational Innovation, Digital Teaching Competencies.

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1 Introduction

In the educational field, Generative Artificial Intelligence has been a watershed moment, becoming an ally for the technological community through its constant use of technology. However, other sectors, such as the economic and social sectors, have also significantly adopted its use, transforming it from a tool with diverse areas of specialization.

The role of generative artificial intelligence in higher technological education institutions has gained considerable relevance in recent years. This is due to the everyday use of tools capable of solving complex challenges, as well as automatically generating multimedia content, texts, and more. Its contribution to decision-making has led to its progressive integration into academic environments.

Technology in the university setting represents a significant opportunity for strengthening the teaching-learning process, as it has raised expectations through its application in personalized education.

This is further enhanced by the automation of teachers' tasks and its contribution to the generation of innovative resources in educational practice. On the other hand, concerns arise regarding technological dependence, given the presupposition of academic rigor, while also acknowledging the potential loss of control over the collection and use of personal data. However, the role of the teacher should be redefined according to the digitized context in which their practice unfolds.

Technological Institutes face significant and ongoing challenges due to their constant interconnection with scientific and technological advancements, playing a fundamental role in the transformation of productive sectors.

The importance of this research takes on unique characteristics, considering that in Technological Higher Education Institutions, the adoption of Generative Artificial Intelligence tools has a major impact on the professional training of students, as they will be the ones working in next-generation digitized workplaces.

1.1 Brief context regarding the integration of artificial intelligence into teaching practice.

Within this context, the Pachuca Institute of Technology (ITP), part of the National Technological Institute of Mexico (TecNM), represents a case study of great importance for analyzing and incorporating Generative Artificial Intelligence into teaching practices.

Furthermore, it is considered pertinent to study the perceptions of teachers regarding the strategic integration of technology in a regional environment characterized by industrial modernization processes, which generate a high demand for graduates with technological skills. In this context, the Pachuca Institute of Technology's specialization in applied engineering disciplines positions it strategically and as a leader, capable of assimilating the digital evolution of Higher Education.

This paper considers the particularities of a technological higher education institution where the adoption of artificial intelligence platforms in teaching practice is prioritized, taking into account the characteristics of the institutional context. For this study, a quantitative approach was used, allowing the analysis of four dimensions related to perceived usefulness, perceived ease of use, attitude toward use, and intention to use. This made it possible to determine pedagogical benefits and identify ethical risks, contributing to a more effective transformation of educational processes and improved planning in teaching and assessment.

The inclusion of Generative AI platforms in higher education institutions, and especially at the ITP, stemmed from multiple factors. These included the increasing accessibility for novice users, the diversification of the technological environment, and National Educational Digitization Policies such as the New Mexican Digital School, the National Digital Strategy, and the Digital Education Agenda. However, historical inequalities characterized by a disproportionate distribution of resources remain evident. Fortunately, the effort and commitment of students contribute positively to the acquisition of experience during the accelerated digital transformation that followed the COVID-19 pandemic Gil-Iranzo et al. (2024).

Gutiérrez-Martín et al. (2022) mention that technological integration in higher education does not depend exclusively on the availability of tools, but rather on variables such as perceived usefulness, compatibility, usability, and institutional support. These variables make a difference, shaping key factors in the acceptance and integration of generative artificial intelligence by faculty. Therefore, understanding faculty perceptions of generative AI platforms is undoubtedly fundamental for predicting successful inclusion scenarios and organizational inertia.

Beyond the pragmatic approach, the perspectives and challenges of teaching practice, the study of Generative AI adoption allows for a deeper exploration of educational innovation. The break with the traditional model brings with it pedagogical transformation, a diversity of interaction between teachers and students, assessment tools, and the organizational structures that support academic activities.

From this perspective, Generative Artificial Intelligence can be understood as a catalyst for institutional modernization rather than simply as a technological tool.

This research addresses a complex phenomenon involving various pedagogical, cultural, organizational, and technological components. The main objective is to analyze teachers' perceptions and adoption of Generative Artificial Intelligence,

identifying its implications for educational innovation and the strengthening of institutional capacity. Furthermore, Jardon et al. (2024) notes that while generative AI tools offer immediate support, it is essential to maintain a balance that prioritizes personal interaction.

The research developed leads to the design and proposal of a conceptual model that incorporates capabilities for the integration of generative AI, thus promoting educational innovation. Cheung & Vogel (2013) refer to the UTAUT theory, a methodology designed to understand the variables of perceived utility, ease of use, performance expectancy, social influence, and enabling conditions that determine teachers' intentions, as shown in Figure 1.

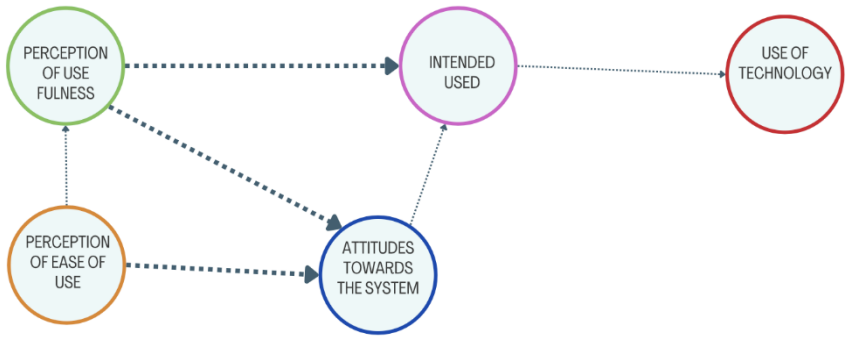

Fig. 1 *UTAUT model. (Venkatesh et al., 2012).*

A teacher's commitment and integration, particularly regarding artificial intelligence literacy, does not depend solely on their own initiative. Three dimensions converge and simultaneously reduce resistance to change:

• Performance expectation. This relates to the teacher's conviction regarding their preparation and technological adoption.

• Social influence. This relates to the teacher's perception of support from their family, society, and even the educational community, which facilitates continuous adaptation.

• Enabling conditions. This relates to the actual work environment, where the teacher can access training, material resources, and technical support, ensuring that it doesn't remain merely an intention.

According to Dahlander et al. (2021), innovation is not a direct result of technology. Following this logic, the Technological Institute of Pachuca is envisioned as a benchmark for innovation by effectively incorporating Generative AI, if and only if the fundamental dimensions of the UTAUT methodology are articulated.

2 Methodology

2.1 Participants

Faculty members from the Technological Institute of Pachuca, affiliated with departments such as Industrial Engineering, Computer Systems Engineering, Mechanical Engineering, Electrical Engineering, Civil Engineering, Business Management Engineering, and Basic Sciences, participated in the study. A total of 169 completed surveys were obtained.

Figure 2 shows the participants' ages, categorized into the intervals of 31–40, 41–50, and 51–60 years; it is clearly evident that 81% of them are between 41 and 60 years old.

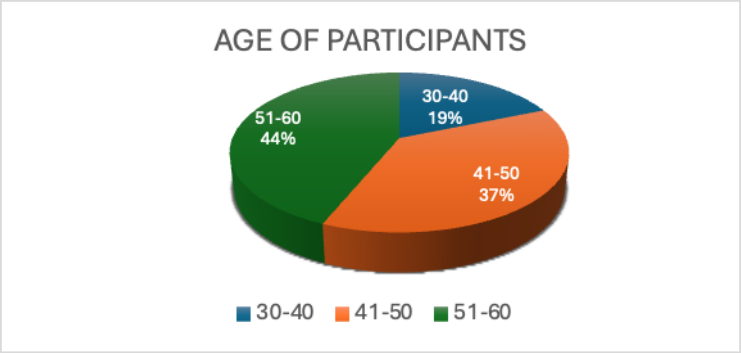

Fig.2 *Age of participants*

For this research, surveys were administered to active faculty members at the institution with the central purpose of analyzing the factors that influence the perception and adoption of Generative Artificial Intelligence, as well as its implications for innovation processes.

The research was based on the UTAUT methodology and contemporary conceptual frameworks on digital teaching competencies and educational innovation. This system can be seen in Figure 3.

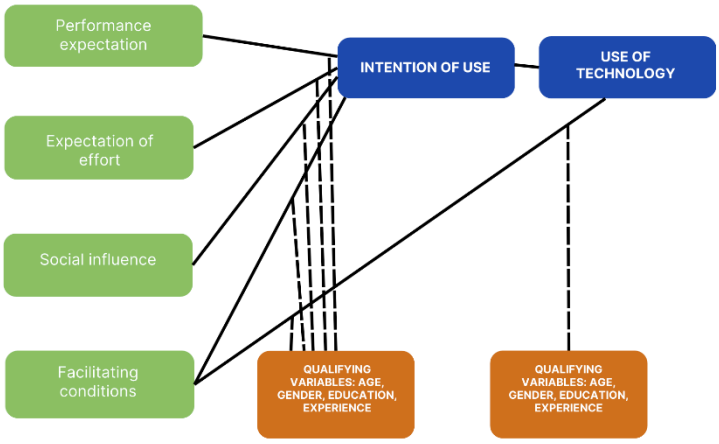

Fig.3 *Proposed theoretical model (Source: Adapted from Venkatesh et al. 2003)*

Note. The diagram shows the variables that determine the intention to use technology. Adapted from "User Acceptance of Information Technology: Toward a Unified View," by V. Venkatesh, M. G. Morris, G. B. Davis, and F. D. Davis, 2003, MIS Quarterly, 27(3), p. 447 (jstor.org). Copyright 2003 by Management Information Systems Research Center.

These perspectives allowed for the examination of both the individual variables associated with technological acceptance and the organizational factors that influence the integration of Generative AI tools into academic practice.

Given that the incorporation of Artificial Intelligence in Mexican Higher Education is a relatively recent phenomenon, it was considered pertinent to adopt an approach that combined statistical trend analysis with a contextual interpretation of the results obtained.

2.2 Method

For this analysis, a descriptive, qualitative, and quantitative study was used because it sought to investigate the characteristics of the phenomenon under study through interaction, as reaffirmed by Jones (2025), thanks to the observation and measurement of its elements.

2.3 Instrument

For the collection of quantitative data, the UTAUT instrument, a reliable and valid tool for evaluating the acceptance and use of Artificial Intelligence (AI) among higher education faculty, was used. Developed by Rodríguez-Rivas et al. (2026), the instrument consists of 15 items in a 5-point Likert format, grouped into the following dimensions: Perceived usefulness, Perceived ease of use, Attitude toward use, Intention to use.

2.4 Procedure

This research study was conducted by administering a questionnaire to faculty members from various academic departments to determine the internal and external factors influencing the adoption and integration of generative artificial intelligence into their pedagogical practice.

The collected data was analyzed using descriptive and inferential statistical techniques. Subsequently, the results were interpreted in light of the specific institutional characteristics of the ITP (Technological Institute of Pachuca) and the context of Technological Higher Education.

Beyond the identification of quantitative patterns, the analysis aimed to understand the organizational and pedagogical implications of adopting Artificial Intelligence in the teaching field.

An IBM SPSS statistical program was used to determine the validity and reliability of the questionnaire for the analysis of the use, adoption and application of Generative Artificial Intelligence platforms to teachers of the Technological Institute of Pachuca; an exploratory factor analysis was applied.

3 Results

Table 1 presents the results for the KMO value and Bartlett's test of sphericity, showing a certain correlation structure among the variables.

Table. 1 *Perceived utility.*

KMO and Bartlett´s Test		
Kaiser-Meyer-Olkin Measure of Sampling Adecuacy		.639
Bartlett´s Test Sphericity	Approx. Chi-Square	560.479
	df	231
	Sig.	<.001

The graph in Figure 4 shows that, according to the Kaiser criterion for factor analysis, values must exceed 1.0; consequently, five dimensions are initially considered, as the others—falling below the 1.0 threshold—contribute little information. While the "break" appears to occur between factors 4 and 5, four factors are retained in this study to ensure significant variance.

Fig.4 *Sedimentation graph*

Table 2 shows the structure of the dimensions; a principal component analysis with rotation was performed, identifying five components with eigenvalues greater than 1. Collectively, these components explain 82.65% of the total data variance. Following rotation, the first component accounts for 18.27% of the variance, demonstrating a balanced distribution and thus allowing for an optimal interpretation of the analyzed dimensions.

Table.2 *Perceived utility* Extraction Method: Principal Component Analysis

Total Variance Explained

	Initial Eigenvalues			Sums of Aquared Loading			Rotation Sums of Squared Loadings		
Component	Total	% of variance	% cumulative	Total	% of variance	% cumulative	Total	% of variance	% cumulative
1	3.793	25.290	25.290	3.793	25.290	25.290	2.741	18.270	18.270
2	2.994	19.959	45.248	2.994	19.959	45.248	2.591	17.271	35.541
3	2.465	16.435	61.683	2.465	16.435	61.683	2.514	16.761	52.302
4	1.614	10.762	72.445	1.614	10.762	72.445	2.219	14.793	67.095
5	1.531	10.210	82.655	1.531	10.210	82.655	2.162	14.414	81.510

3.1 Component 1: Perceived Usefulness

Figure 5 shows that 93% of the surveyed teachers consider the use of Generative Artificial Intelligence in professional practice to be highly useful, as it enables significant time optimization. This perspective reflects an approach focused on optimizing resources and allowing teachers to dedicate their attention directly to their students.

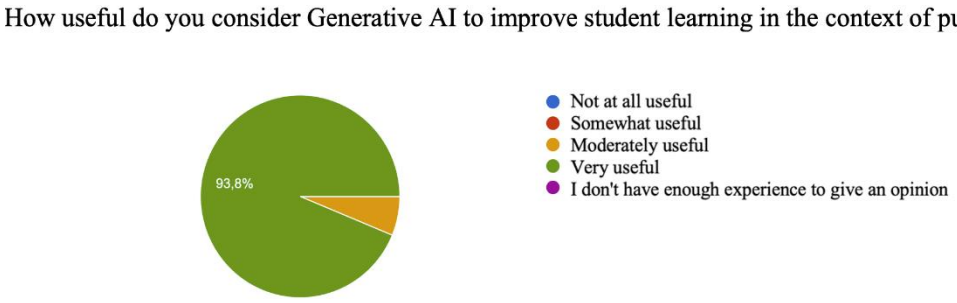

Fig. 5 *Perceived utility*

Figure 6 shows that 47% of respondents indicated that Generative AI provides tangible benefits by helping to improve educational materials while also fostering creativity. Meanwhile, 29% of responses highlighted significant time savings as an additional benefit. Finally, 24% stated that Generative AI is capable of personalizing content to enable adaptive learning.

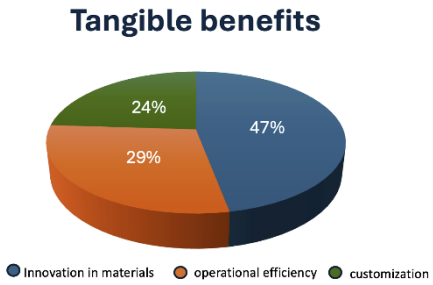

Fig. 6 *Tangible benefits*

3.2 Component 2: Perceived ease of use

Figure 7 shows that 31% of teachers perceive no barriers to usage and feel capable of seamlessly incorporating generative AI into their teaching. However, the study reveals a divide between a lack of knowledge regarding its pedagogical application and the absence of usage barriers.

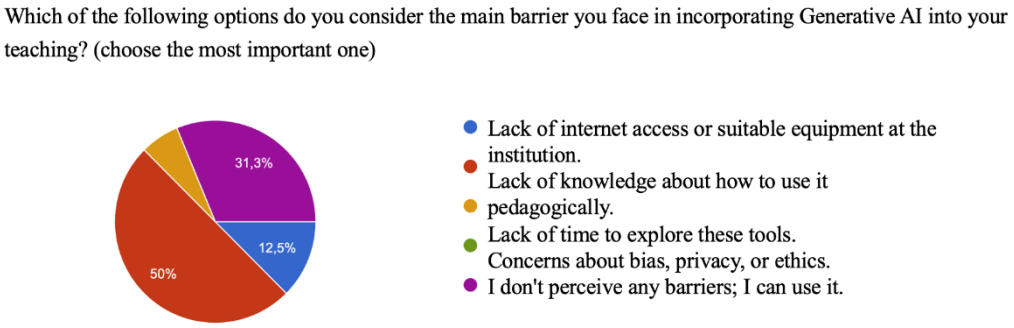

Fig. 7 *Perceived ease of use*

Figure 8 reveals that 50% of participants acknowledge a lack of knowledge regarding pedagogical application, indicating the existence of gaps in the incorporation and use of generative AI. Meanwhile, 12% of respondents cite a lack of internet access within the Technological Institute's facilities as an obstacle.

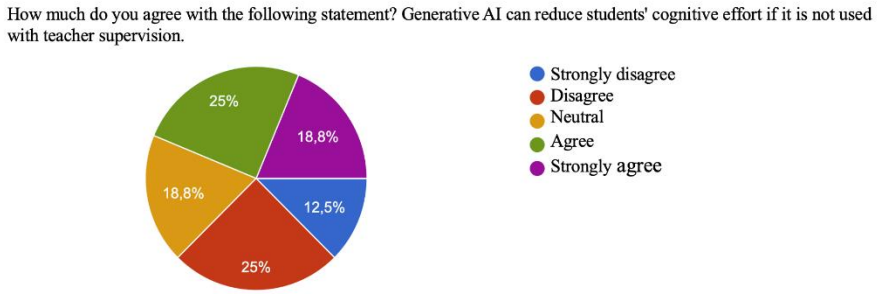

Fig. 8 *Attitude of use*

3.3 Component 3: Attitudes towards use

Figure 9 shows that only 18.8% of respondents agree that Generative AI can reduce students' cognitive effort if used without teacher supervision. Similarly, 18.8% maintain a neutral stance and 12.5% strongly disagree, revealing interpretations that fail to focus on the implications of unsupervised use by students.

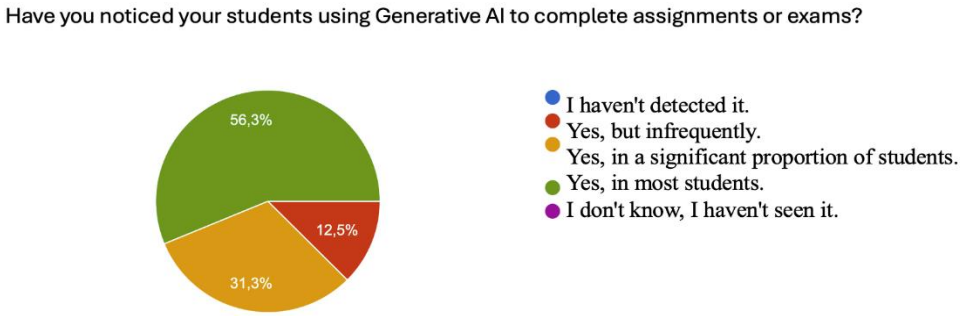

Fig. 9 *Cognitive effort*

3.4 Component 4: Intention to Use

Figure 10 reveals that 56.3% of the surveyed educators would recommend that their higher education counterparts incorporate generative artificial intelligence into their courses, provided it is done cautiously checking for biases while simultaneously fostering critical thinking.

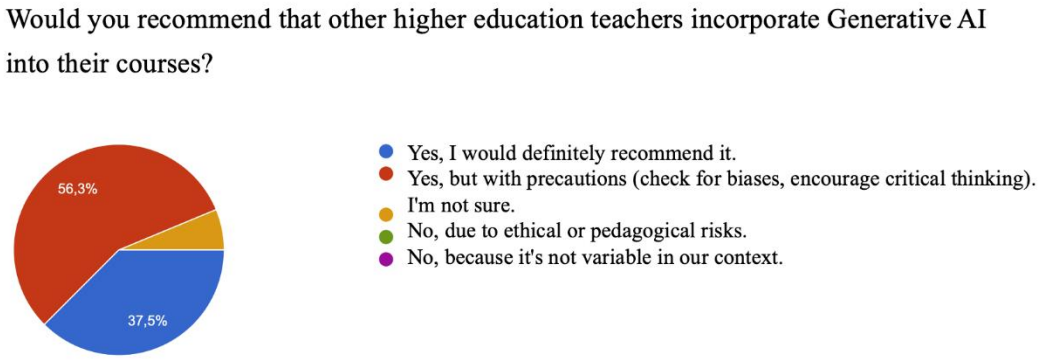

Fig. 10 *Intention to use*

4 Conclusions

Regarding Perceived Usefulness, a prevailing appreciation for Generative AI in optimizing academic activities was identified; over 93% of surveyed academics agree that integrating Generative AI helps strengthen their teaching practice, representing a substantial step forward in educational transformation. In their study, Andreoli et al. (2024) note that Generative AI often leads to dynamic and flexible approaches, while also offering a critical perspective on its implementation.

Furthermore, teachers recognize tangible benefits regarding the improvement of educational materials, demonstrating that intelligent tools are highly valuable provided they are used within an ethical academic framework and without sacrificing creativity. Significant time savings were also highlighted, alongside the ability to personalize content to suit different learning styles. However, this acceptance must be grounded in sound precautions that ensure reliable information while minimizing risks associated with technological dependency.

Regarding Perceived Ease of Use, teachers show strong acceptance of Generative AI viewing it as a way to broaden innovative horizons despite facing barriers such as a lack of internet access and uncertainty about how to apply the technology pedagogically. Nevertheless, Pramanik et al. (2026) suggest that a lack of teacher literacy and the connectivity gap continue to result in uneven adoption.

Regarding attitudes toward usage, only 18% of the surveyed teachers are convinced that AI significantly reduces cognitive effort a finding that reaffirms once again that the teaching role cannot be replaced by artificial intelligence. Instead, AI should be viewed as a complement to the practical aspects of pedagogical work, enabling teachers to leverage their talents and focus on activities requiring critical thinking, creativity, or the guidance of specific student processes.

Intention to use aligns with perceived utility. In this context, the ITP (Instituto Tecnológico de Pachuca) is well-positioned to consolidate an educational innovation model aligned with the challenges of modernization. A key finding is the teachers' willingness to learn, a trait attributed to their familiarity with technology, as noted by Mintz et al. (2023). Furthermore, generative AI stands as a driver of innovative methodologies that foster continuous professional development.

Finally, this research lays the groundwork for the Technological Institute of Pachuca to consolidate its objective of promoting technology in response to the needs of the environment, emphasizing a process of adaptation to new technologies.

Further research is suggested, taking into account larger samples and, if possible, all 254 Technological Institutes, as it is considered relevant to conduct this study longitudinally. This would provide an opportunity to identify which teachers have difficulties using and adopting Artificial Intelligence, allowing for actions to be taken that contribute to incorporating new strategies that involve the TecNM community.

References:

Akgun, S., & Greenhow, C. (2022). Artificial intelligence in education: Addressing ethical challenges in K-12 settings. *AI and Ethics, 2*(3), 431–440. https://doi.org/10.1007/s43681-021-00096-7

Andreoli, S., Aubert, E., Cherbavaz, M. C., & Perillo, L. (2024). Entre humanos y algoritmos: percepciones docentes sobre la exploración con IAG en la Enseñanza del Nivel Superior. *Revista Iberoamericana de Tecnología en Educación y Educación en Tecnología*, (37), 63–77. https://doi.org/10.24215/18509959.37.e6

Bond, M., Khosravi, H., De Laat, M., Bergdahl, N., Negrea, V., Oxley, E., Pham, P., Chong, S. W., & Siemens, G. (2024). A meta systematic review of artificial intelligence in higher education: A call for increased ethics, collaboration, and rigour. *International Journal of Educational Technology in Higher Education, 21*, Article 4. https://doi.org/10.1186/s41239-023-00436-z

Cheung, R., & Vogel, D. (2013). Predicting user acceptance of collaborative technologies: An extension of the technology acceptance model for e-learning. *Computers & Education, 63*, 160–175. https://doi.org/10.1016/j.compedu.2012.12.003

Chiu, T. K. F., Meng, H., Chai, C. S., King, I., Wong, S., & Yam, Y. (2022). Creation and evaluation of a pretertiary artificial intelligence (AI) curriculum. *IEEE Transactions on Education, 65*(1), 30–39. https://doi.org/10.1109/TE.2021.3085878

Crompton, H., & Burke, D. (2023). Artificial intelligence in higher education: The state of the field. *International Journal of Educational Technology in Higher Education, 20*, Article 22. https://doi.org/10.1186/s41239-023-00392-8

Dwivedi, Y. K., Kshetri, N., Hughes, L., Slade, E. L., Jeyaraj, A., Kar, A. K., Baabdullah, A. M., Koohang, A., Raghavan, V., Ahuja, M., Albanna, H., Albashrawi, M. A., Al-Busaidi, A. S., Balakrishnan, J., Barlette, Y., Basu, S., Bose, I., Brooks, L., Buhalis, D., … Wright, R. (2023). Opinion paper: "So what if ChatGPT wrote it?" Multidisciplinary perspectives on opportunities, challenges and implications of generative conversational AI for research, practice and policy. *International Journal of Information Management, 71*, Article 102642. https://doi.org/10.1016/j.ijinfomgt.2023.102642

Jardón Gallegos, M. del C., Allas Chisag, W. D., Zamora Valencia, D. A., & Cedeño Saltos, N. E. (2024). Impacto de la inteligencia artificial en la educación superior: percepciones de alumnos y profesores sobre el uso de IA en el aprendizaje y la evaluación. *Reincisol, 3*(6), 7008–7033. https://doi.org/10.59282/reincisol.V3(6)7008-7033

Gil Iranzo, R., Gutiérrez-Ujaque, D., & Teixidó Cairol, M. (2024). From anxiety to empowerment: The impact of artificial intelligence on students' perceptions in higher education. *REDU. Revista de Docencia Universitaria, 22*(2), 85–104. https://doi.org/10.4995/redu.2024.22009

Gutiérrez-Martín, A., Pinedo-González, R., & Gil-Puente, C. (2022). ICT and media competencies of teachers. Convergence towards an integrated MIL-ICT model [Competencias TIC y mediáticas del profesorado. Convergencia hacia un modelo integrado AMI-TIC]. *Comunicar, 30*(70), 21–33. https://doi.org/10.3916/C70-2022-02

Jones, K. M. L. (2025). Generative AI in qualitative research and related transparency problems: A novel heuristic for disclosing uses of AI. *International Journal of Qualitative Methods, 24*, 1–14. https://doi.org/10.1177/16094069251404329

Kasneci, E., Sessler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F., Gasser, U., Groh, G., Günnemann, S., Hüllermeier, E., Krusche, S., Kutyniok, G., Michaeli, T., Nerdel, C., Pfeffer, J., Poquet, O., Sailer, M., Schmidt, A., Seidel, T., … Kasneci, G. (2023). ChatGPT for good? On opportunities and challenges of large language models for education. *Learning and Individual Differences, 103*, Article 102274. https://doi.org/10.1016/j.lindif.2023.102274

Pramanik, A., Sahoo, A. K., Rani, A., & Bajpai, A. (2026). Cognitive load reduction in the context of artificial intelligence: A conceptual framework for teachers. *Asian Journal of Education and Social Studies, 52*(7), 681–693. https://doi.org/10.9734/ajess/2026/v52i73199

Ramírez-Medina, R., Zapata-Peña, J., Aguilar-Chuquizuta, D., & Bastidas-Muñoz, E. (2026). Artificial intelligence-powered digital learning platforms and their performance in higher education. *International Journal of Computational Innovations, Intelligent Systems and AI, 2*(1), 48–69. https://doi.org/10.64439/cisai.v2i1.32

Rodríguez-Rivas, J. G., Ayala-Partida, F., & Campa-Galindo, L. (2026). Aceptación de la inteligencia artificial generativa en docentes: adaptación y validación de un instrumento basado en el TAM. *Revista Portal de la Ciencia, 7*(2), 217–232. https://doi.org/10.51247/pdlc.v7i2.766

Mintz, J., Holmes, W., Liu, L., & Perez-Ortiz, M. (2023). Artificial intelligence and K-12 education: Possibilities, pedagogies and risks. *Computers in the Schools, 40*(4), 325–333. https://doi.org/10.1080/07380569.2023.2279870

Venkatesh, V., Thong, J. Y. L., & Xu, X. (2012). Consumer acceptance and use of information technology: Extending the unified theory of acceptance and use of technology. *MIS Quarterly, 36*(1), 157–178. https://doi.org/10.2307/41410412

Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education—Where are the educators? *International Journal of Educational Technology in Higher Education, 16*, Article 39. https://doi.org/10.1186/s41239-019-0171-0