Journal of Information Systems Engineering and Management
2025, 10(43s)
e-ISSN: 2468-4376
https://www.jisem-journal.com/

Research Article

Effects of the Use of Generative Artificial Intelligence on the Development of Teaching Competencies: A Quantitative Study in Higher Education Institutions

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ARTICLE INFO

Received: 22 Dec 2024

Revised: 18 Feb 2025

Accepted: 26 Feb 2025

ABSTRACT

This study investigates the impact of the use of generative artificial intelligence (AGI) tools on the development of teaching competencies in higher education institutions. Through a quantitative methodology based on surveys applied to 217 professors from Latin American universities, perceptions, levels of use, and relationships between the use of IAG and the development of digital, pedagogical and evaluative competencies were analyzed. The results show a significant positive correlation between the frequent use of IAG and the strengthening of key teaching competencies, especially in the design of interactive activities, personalization of learning and automated feedback. Implications for teacher training and the institutional design of technological integration policies are discussed. In addition, an emerging conceptual framework is proposed to categorize the impact of the IAG on teaching praxis and recommendations are introduced based on comparative scenarios of good institutional practices in Latin America.

Keywords: generative artificial intelligence; teaching competencies; higher education; educational innovation; educational technology; institutional policy.

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Introduction

The accelerated advancement of artificial intelligence (AI), especially in its generative aspect, is substantially transforming educational environments. Tools such as ChatGPT, DALL-E and Copilot have begun to be incorporated into university contexts with the potential to enrich teaching-learning processes. These technologies make it possible to generate personalized content, didactic suggestions, automated rubrics, conceptual outlines and even feedback for students in real time, which represents an unprecedented opportunity to redesign teaching practice.

In this scenario of technological disruption, the need arises to evaluate whether the use of these tools effectively contributes to the development of teaching competencies, understood as the set of knowledge, skills, attitudes and values necessary to teach in an ethical, efficient and reflective manner. In particular, digital, pedagogical and evaluative competences become essential to take advantage of the benefits of GAI in a critical and contextualized way.

In addition to pedagogical interest, the emergence of advanced language models has sparked debates about the role of the teacher in the face of automation, the intellectual property of the content generated and the redefinition of the role of creativity in teaching. In many contexts, teachers face the challenge of integrating technologies without clear guidance, leading to tensions between innovation and preserving educational quality. Higher education institutions therefore face the challenge of updating their curricular frameworks and teacher training strategies to respond to these transformations.

The incorporation of artificial intelligence in teaching is not merely a technical issue, but also a cultural, ethical and political one. Therefore, it is essential to understand how teachers appropriate these technologies and what effects their use produces on pedagogical practices. As universities adopt digital transformation policies, it is necessary to generate empirical evidence that guides institutional decisions and guarantees inclusive, sustainable and relevant innovation processes.

In this context, this study aims to analyze the impact of the use of generative artificial intelligence tools on the development of teaching competencies in Latin American higher education institutions. From a quantitative approach, it is intended to explore the relationships between the use of these technologies and the strengthening of key skills for teaching in digital environments. Implications for institutional policy, continuing education and teaching quality are also discussed.

This work is part of an emerging line of research that seeks to understand not only the technical potentialities of artificial intelligence, but also its real effects on educational processes. The objective is to move towards an integrative, critical and situated vision of educational transformation driven by emerging technologies, with the teacher as the protagonist of this process.

1. Theoretical framework

The development of teaching competencies in the digital age requires an in-depth analysis of the existing conceptual frameworks that articulate technology with pedagogy. The integration of generative artificial intelligence (AGI) into educational processes has given rise to new ways of thinking and teaching, in which technological innovation is closely linked to improving learning.

Teaching competencies, understood as the set of knowledge, skills, attitudes and values necessary to plan, implement and evaluate effective and ethical teaching-learning processes, have been studied in numerous international frameworks. Among them, the DigCompEdu, developed by the European Commission (Redecker, 2017), stands out, which structures the digital competences of teachers in six areas: professional commitment, digital resources, teaching and learning, assessment, student empowerment and development of students' digital competence.

This framework has been widely adopted as a reference in public policies and institutional strategies in Europe and Latin America. In particular, in countries such as Spain, Colombia and Mexico, adaptations

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of DigCompEdu have been implemented to guide teacher training processes. According to the Horizon 2022 Report, 67% of higher education institutions in Latin America recognize the need to incorporate teaching digital competence frameworks in the face of the advance of AI and other disruptive technologies.

According to UNESCO data (2021), more than 54% of teachers in Latin America report feeling unprepared to integrate emerging technologies such as AI into their pedagogical practice. This is due to a lack of specific training and the absence of clear institutional policies that regulate their use and encourage the development of a critical and ethical digital culture.

In addition, the scientific literature has begun to document the benefits and limitations of the use of tools such as ChatGPT, Bing AI or audiovisual resource generation tools in the university classroom. Heffernan et al. (2023) identify three main benefits: (1) efficiency in the production of materials, (2) personalization of learning, and (3) improvement in the quality of assessment. However, they also warn about the risks of over-dependence, misinformation and loss of intellectual authorship.

The perspective of the TPACK (Technological Pedagogical Content Knowledge) model is also key to understanding how teachers integrate IAG. This model states that effective teaching with technology requires not only technical knowledge, but also pedagogical and disciplinary content knowledge. AGI, therefore, should be understood not as an autonomous solution, but as a mediating tool that depends on the professional judgment of the teacher to generate true meaningful learning processes.

Table 1. Comparison of teaching competence models with AI

Model	Key dimensions	Application to IAG
DigCompEdu	Assessment, digital resources, teaching	AI-generated material design
TPACK	Pedagogy, technology, content	Contextual and thoughtful use of IAG
Marco UNESCO	Ethics, inclusion, innovation	Institutional policies for the use of AI

Finally, it is important to note that the use of HAIs in educational contexts cannot be neutral. As Selwyn (2019) argues, all educational technology is loaded with values, and their adoption implies political decisions about what type of education to promote. In this sense, it is crucial to move towards a broader approach to teaching competence, which incorporates ethical, critical and social dimensions of the use of smart technologies.

The consolidation of a critical teaching culture in the face of AI requires not only technical training, but also pedagogical reflection, ethical debate and active participation in the co-construction of technological governance frameworks. This conceptual basis nourishes the present study, which seeks to provide empirical evidence on how IAG is impacting teacher professional development in the context of Latin American higher education.

3. Methodology A quantitative cross-sectional study was developed. The sample was composed of 217 professors from different universities in Mexico, Colombia, Peru and Ecuador, selected through non-probabilistic convenience sampling. The instrument used was a structured questionnaire, validated by expert judgment and with a reliability determined by Cronbach's alpha ($\alpha = 0.89$).

The pilot phase was applied to 35 teachers, and the instrument was adjusted based on reliability and internal validity analyses. A total of 28 items were incorporated into four sections: general use of AGI, perception of impact on teaching practice, institutional barriers, and willingness to methodological change. Multivariate analysis was used to identify patterns of relationship between variables. Two open-ended questions were also incorporated to obtain qualitative insights that would enrich the quantitative findings.

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3.1. Ethical considerations and informed consent The study was approved by an academic ethics committee. All participants gave informed consent and anonymity was guaranteed in the processing of the data. It was explained to each teacher that the results would be used only for research purposes and that they would have access to the final report.

4. Results The results show that 64% of the teachers surveyed use IAG tools at least once a week, highlighting the use of text generators, lesson planning assistants and automated assessment platforms. Significant differences were identified according to disciplinary area, with greater use in teachers of social sciences and education.

Table 2. Frequency of use of IAG tools

Frequency of use	Percentage
Daily	18%
Several times a week	46%
Once a week	18%
Occasionally	14%
Never	4%

Table 3. IAG tools most used by teachers

Tool	Percentage of use
Text generators (ChatGPT, etc.)	82%
Assistants to plan classes	68%
Automatic assessment creators	59%
Imagers/Resources	43%

Table 4. Perception of impact on specific dimensions

Dimension evaluated	High Impact (%)	Medium impact (%)	Low impact (%)
Didactic planning	78	17	5
Automated Assessment	66	24	10
Creation of digital assets	71	21	8
Student Interaction and Engagement	59	32	9

4.1 Further analysis

In order to gain a deeper understanding of the underlying patterns in the use of generative artificial intelligence (AGI) by teachers, an exploratory factor analysis (EFA) was carried out based on the responses collected in the four dimensions evaluated: frequency of use, type of tool, perception of impact and level of competence development. This analysis allowed us to identify three latent factors that group the teaching behavior regarding the use of AGI:

- **Factor 1: Strategic pedagogical integration**. It groups items related to didactic planning, adaptation of content and alignment with learning objectives. It represents 38% of the total explained variance.
- **Factor 2: Evaluative innovation and feedback**. It includes the use of tools to generate exams, rubrics, automated feedback and monitoring of student progress. It contributes 26% of the variance.

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- **Factor 3: Instrumental digital competence**. It includes the use of IAG as an auxiliary tool, without explicit integration into pedagogical processes, with 19% of the variance explained.

Together, these factors explain 83% of the total variance observed, revealing a consistent internal structure in the way teachers use AGI. This result corroborates that there are different levels of technological appropriation, from basic use to complex pedagogical design mediated by artificial intelligence.

Additionally, a hierarchical cluster analysis was carried out to segment teachers according to their usage patterns. Three predominant profiles were identified:

1. **Digital explorers (41%):** Teachers who have begun to experiment with IAG in specific activities, with a high predisposition to their integration.
2. **Strategic integrators (35%):** Teachers who already use these tools systematically and with pedagogical coherence.
3. **Resistant users (24%**): They show skepticism and low frequency of use, usually due to lack of training or lack of knowledge.

These results were enriched with qualitative data obtained through two open questions of the questionnaire, where common discursive patterns were identified. Most teachers value IAG for its ability to save time and facilitate planning, but express concern about its ethical use, the risk of technological dependency, and the urgent need for institutional regulation.

Finally, it was observed that teachers with less than five years of experience have a greater openness towards IAG and a more proactive attitude in its integration, in contrast to teachers with more experience, who tend to use it with caution or as a complement. This trend suggests that the new generations of teachers could lead the digital transformation of the university ecosystem if they are provided with the appropriate support.

4.2. Selected qualitative testimonies

The testimonies collected through the questionnaire's open-ended questions allowed us to capture deeper insights into the impact of generative artificial intelligence on teaching practice. Below are representative excerpts illustrating various approaches, levels of appropriation, and concerns among faculty:

"Using ChatGPT to co-design rubrics and activities has allowed me to save time and be more precise. Before, it took hours to formulate evaluation criteria; now I adjust them more clearly and quickly." (Teacher, Ecuador)

"I use it as support, but I always review the results; it is useful, but it does not replace professional judgment. It helps me organize ideas, but the pedagogical decision is still mine." (Teacher, Colombia)

"I find it a powerful tool to personalize content, especially in courses with students with different levels. Still, I fear that its unregulated use could encourage dependency or plagiarism." (Teacher, Peru)

"I've learned more about how to ask good questions from the suggestions the AI gives me. It has made me reflect on my own teaching approaches." (Teacher, Mexico)

"At my university there are still no clear guidelines on the use of these tools. Many teachers do not know if they can use them or how to do it ethically." (Teacher, Colombia)

The reports allow us to glimpse a progressive appropriation of AGI, characterized by curiosity, pedagogical exploration and a critical stance in relation to its limitations. While some teachers express

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enthusiasm for the opportunities for personalization and improvement of assessment, others express uncertainty due to the lack of regulations and the risk of trivialization of the pedagogical act.

Likewise, a high valuation of the IAG as a resource for didactic design and content organization was identified, particularly in careers where the teaching load is high. However, there is still an explicit demand for technical and ethical training, as well as collaborative spaces to share experiences among peers.

These qualitative findings reaffirm the need to accompany the process of integrating IAG with institutional continuing education programmes, guidance frameworks and communities of practice that favour conscious, creative and pedagogically relevant use.

5. Discussion The findings suggest that the use of IAG in higher education may act as a catalyst for teacher professional development. However, its impact depends on factors such as digital literacy, the institutional design of continuous training and the availability of technological resources. The need to strengthen institutional programs that promote the reflexive integration of technology, avoiding its merely instrumental use, is confirmed.

In addition, empirical evidence supports that it is not the type of tool that generates transformation, but the way in which it is integrated into the pedagogical ecosystem. The importance of institutional leadership to foster a culture of innovation based on the critical use of AI is underlined. It is also recommended that universities promote lines of research in AI-supported didactics as part of their commitment to educational innovation.

5.1. Proposal of an emerging conceptual model The CEDIAG Model (Context-Strategy-Teacher-Integration of Generative AI) is proposed, which articulates four levels of impact:

1. Access and technological availability.
2. Level of digital literacy of the teacher.
3. Consistency between the use of the IAG and the pedagogical objectives.
4. Institutional support and continuous training policies.

This model can be used as a basis for designing institutional training interventions and for assessing the degree of pedagogical integration of emerging technologies.

6. Conclusions and recommendations Generative artificial intelligence has the potential to strengthen teaching competencies in higher education, especially when integrated in a planned and thoughtful manner. The empirical evidence obtained shows positive effects in key areas such as planning, evaluation and production of educational resources.

It is recommended:

- Promote continuing teacher education programmes that include the critical and creative use of IAG tools.
- Establish clear institutional guidelines on the ethical use of AI in teaching.
- Foster communities of practice among teachers to share experiences and good practices.
- Implement systems for monitoring and evaluating the impact of technology on skills development.
- Incorporate ethics and critical thinking modules in relation to the use of AI in initial teacher training.

These actions will make it possible to move towards a higher education that is more innovative, inclusive and focused on meaningful student learning.

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References

[1] Fernández, A., & Ramírez, M. (2020). Digital Competencies in University Teachers: Challenges and Opportunities. Ibero-American Journal of Higher Education, 11(32), 15-30.

[2] Heffernan, N., De Boer, V., & Bull, S. (2023). AI in education: Opportunities and concerns. Computers & Education, 196, 104722.

[3] Mouza, C., & Lavigne, N. C. (2022). Preparing Teachers for Technology Integration: The Role of Formal Preparation and Situated Professional Learning. Contemporary Issues in Technology and Teacher Education, 22(1), 6-25.

[4] Redecker, C. (2017). European Framework for the Digital Competence of Educators: DigCompEdu. Publications Office of the European Union.

[5] UNESCO. (2019). ICT Teacher Competency Framework. García, J., & López, A. (2021). Teacher training and emerging technologies: scenarios for professional development. Education and Society, 39(1), 77-92.

[6] Ortega, M., Pérez, L., & Sosa, C. (2022). Challenges in the integration of artificial intelligence in university teaching. Journal of Open Education, 8(2), 55-70.

[7] Floridi, L., Cowls, J., Beltrametti, M., Chatila, R., Chazerand, P., Dignum, V., ... & Vayena, E. (2018). AI4People—An Ethical Framework for a Good AI Society: Opportunities, Risks, Principles, and Recommendations. Minds and Machines, 28, 689–707.

[8] Bender, E. M., & Koller, A. (2020). Climbing towards NLU: On Meaning, Form, and Understanding in the Age of Data. *Proceedings of the 58th Annual Meeting of the Association for Computational Linguistics*, 5185–5198.

[9] Holmes, W., Bialik, M., & Fadel, C. (2019). *Artificial Intelligence in Education: Promises and Implications for Teaching and Learning*. Center for Curriculum Redesign.

[10] Luckin, R. (2021). Towards Artificial Intelligence-based Assessment Systems. *Nature Human Behaviour*, 5(4), 415–417.

[11] Selwyn, N. (2019). Should Robots Replace Teachers? AI and the Future of Education. *Polity Press*.

[12] Zhao, Y., & Watterston, J. (2021). The Changes We Need: Education Post COVID-19. *Journal of Educational Change*, 22(1), 3–12.

[13] UNESCO. (2023). *Guidelines on the Ethics of Artificial Intelligence in Education*. United Nations Educational, Scientific and Cultural Organization.

[14] OECD. (2021). *AI and the Future of Skills, Volume 1: Capabilities and Assessments*. Organisation for Economic Co-operation and Development.