Shifting Educator Perspectives: Exploring Evolving Views on Generative AI

Shatha N. Alkhasawneh*, Davinia Hernández-Leo*, Frederic Guerrero-Solé and Francisco Pérez

Universitat Pompeu Fabra, Barcelona, Spain

Abstract

The integration of Generative Artificial Intelligence (GenAI) into education presents both promising opportunities and complex challenges for educators. This longitudinal mixed-methods study explores how school teachers and university professors in Spain perceive GenAI's role in teaching over time. Drawing on data from 134 participants collected at five intervals between April 2023 and April 2025, the study analyzes pre-training reflections through qualitative thematic analysis, quantitative rating comparisons, and an interpretive mapping guided by Zhai's (2024) teacher agency framework. Findings suggest a progressive shift in educator perceptions—from initial curiosity and ethical concern to more confident, pedagogically informed, and ethically reflective engagement. Educators consistently identified opportunities in content creation, task automation, and learner personalization, alongside concerns about academic integrity, misinformation, and student competence erosion. Quantitative analysis of plotted perceptions indicated a steady increase in perceived opportunities and a decline in perceived challenges by April 2025, potentially reflecting growing familiarity and confidence. Over time, participants' self-described intentions and discourses appeared to align increasingly with more active and reflective roles in GenAI integration. These results highlight the need for sustained, context-aware professional development and suggest future research should assess post-training perceptions, include learners' voices, and consider institutional and policy factors shaping GenAI's educational impact.

Keywords

generative AI, educators' perceptions, longitudinal study, teacher agency, opportunities, challenges

1. Introduction

The integration of technological breakthroughs such as Generative Artificial Intelligence (GenAI) in education is reshaping the landscape of teaching and learning [1, 2], presenting both promising opportunities and complex challenges for educators [3]. Various GenAI tools (e.g., ChatGPT, DeepSeek, and Copilot) are increasingly used to support personalized learning, streamline teaching design, and enhance student engagement through dynamic content generation and adaptive feedback mechanisms [4, 5]. These capabilities highlight GenAI's potential to alleviate routine teaching tasks—such as grading or creating teaching materials—thereby freeing up time for more complex, creative aspects of teaching, fostering innovation, and enriching educational practices [6, 7].

However, the effectiveness of GenAI integration depends on educators' understanding of its capabilities and ethical implications [8, 9]. Concerns persist regarding data privacy, academic integrity, intellectual property, and the potential erosion of student competencies such as critical thinking and autonomy [10, 11, 12]. Thus, understanding how educators perceive and engage with GenAI is vital for guiding effective and ethical integration strategies [13, 14].

Teachers' perceptions are shaped by their familiarity with the technology and their beliefs about its instructional value [9]. Positive perceptions often relate to GenAI's ability to enhance learning, improve teaching practices, and reduce workload, while negative perceptions stem from fears of deskilling,

ethical concerns, and the loss of teacher autonomy [14, 15]. These perceptions influence acceptance and actual practice—ranging from superficial use for content generation to deeper pedagogical integration. Teachers' knowledge of GenAI—including both technical understanding and pedagogical application—plays a crucial role in ensuring thoughtful and responsible use [16].

While traditional models such as Technological Pedagogical Content Knowledge (TPACK) offers valuable guidance for integrating digital tools into teaching, they are limited in addressing the fundamentally transformative nature of GenAI. In particular, they may not fully capture GenAI's capacity to co-create content, influence pedagogical decisions, and reshape teacher-student dynamics [17]. Unlike conventional technologies, GenAI is not simply a tool for supporting established methods; it collaborates in content generation, facilitates real-time interaction, and challenges the boundaries of pedagogical agency [18, 19]. Consequently, there is a need to reconceptualize teachers' roles—not merely as users of technology, but as adaptive agents navigating this evolving educational landscape.

In response to this shift, recent research has proposed a nuanced framework (see Figure 1) conceptualizing four evolving teacher roles in the GenAI era – **Observer**, **Adopter**, **Collaborator**, and **Innovator** – each reflecting a distinct level of engagement and pedagogical agency [9]. Teachers as *Observers* display curiosity with limited engagement; *Adopters* experiment through trial and error; *Collaborators* meaningfully integrate GenAI into teaching design and student interaction; and *Innovators* lead the co-development of novel applications and pedagogical models. These roles provide a lens to interpret patterns of GenAI adoption and emphasize the need for sustained professional development and institutional support.
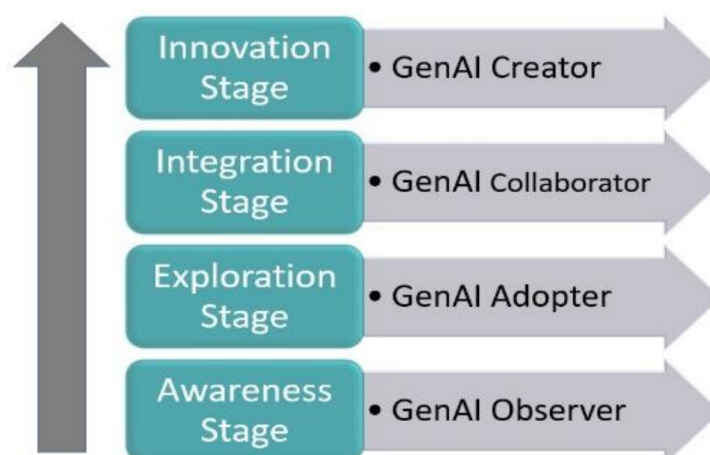

Figure 1: Teacher agency roles in the era of GenAI: Observer, Adopter, Collaborator, Innovator (adapted from [9]).

Despite extensive literature on GenAI's technical affordances and general acceptance, less attention has been paid to the human dimension—specifically how teachers adapt to these technologies, how GenAI reshapes pedagogical agency, and how perceptions evolve over time and across contexts [9]. Limited research has systematically examined this temporal evolution—from initial curiosity to hands-on experimentation and ultimately to pedagogical integration [19, 20]. Addressing this gap,the present study investigates educators' evolving views on GenAI, drawing on longitudinal data from open-discussion interviews conducted before professional development workshops. The analysis is guided by Zhai's [9] teacher agency framework, which is used interpretively to explore how educators' reflections align with different stages of engagement.

This study seeks to uncover recurring themes and the temporal evolution of educators' engagement with GenAI, offering a practitioner-informed understanding of its role in education. By examining conceptual and experiential dimensions of GenAI integration, this research contributes to understanding how teachers navigate this shift in practice, while also aligning with recent calls for reflection on the benefits and trade-offs of technology use in education [21]. Data was collected at five time points: April 2023, September 2023, December 2023, May 2024, and April 2025. As roles and technologies continue

to evolve, this knowledge lays the groundwork for future studies. This paper addresses the following research questions (RQs):

- **RQ1:** What are the perspectives of school teachers and university professors regarding the opportunities and challenges associated with incorporating GenAI in their teaching practices?
- **RQ2:** How do school teachers and university professors' viewpoints evolve over the time between April 2023 and April 2025?
- **RQ3:** What can be observed from the mean ratings of opportunities versus challenges, and what do these values imply about educators' perceptions over time?
- **RQ4:** How do educators' reflections on GenAI integration align with the evolving roles of *Observer*, *Adopter*, *Collaborator*, and *Innovator* as interpreted through Zhai's teacher agency framework?

2. Methodology

2.1. Study Design, Participants, Procedure and Data Analysis

This study investigates educators' perceptions of the opportunities and challenges associated with integrating GenAI into teaching practices and classroom environments. Data were collected over a two-year period (April 2023 to April 2025) through a series of open-discussion interviews conducted immediately prior to participants' voluntary enrollment in a professional development course on GenAI in education. These interviews took place at five distinct time points—April 2023, September 2023, December 2023, May 2024, and April 2025—with each session involving a different group of participants: Group 1 (n = 35), Group 2 (n = 25), Group 3 (n = 13), Group 4 (n = 24), and Group 5 (n = 37).

In total, 134 individuals from various educational institutions across Spain participated, including both pre-service school teachers and university professors. Participants represented a range of experience levels with educational technologies and GenAI tools such as ChatGPT, DeepSeek, and Copilot. Only data from individuals who provided informed consent to participate in the research were included in the study.

The professional development course was consistent across cohorts, with identical content, objectives, and facilitation by the same GenAI and educational technology expert. Upon completion, participants received an officially accredited teacher training certificate recognized by their respective universities or local education authorities.

The workshop introduced educators to the fundamentals of GenAI, its educational applications, and ethical considerations. Blending theory with practice, it promoted critical reflection on GenAI's role in teaching, assessment, and student engagement. Participants shared classroom experiences, identifying opportunities and challenges in real-world contexts—supporting the study's aim to explore evolving perceptions and readiness for GenAI adoption.

At the outset of each interview session, participants were informed of the study's aim: to explore their perceptions of GenAI's potential benefits and challenges in educational settings. The discussions were intentionally brief and focused, designed to elicit a wide range of perspectives across different educational roles and institutional contexts. By capturing participants' reflections prior to the training, the study aimed to identify early trends in conceptual and experiential engagement with GenAI and offer a practitioner-informed understanding of its evolving role in education.

To gather meaningful data, participants completed a two-part worksheet during the interviews. In the first section, they described the opportunities and challenges they perceived in integrating GenAI into their teaching practices and classroom settings. The second section involved a dot plot graph, where participants visually represented their perceptions: the x-axis denoted perceived opportunities and the y-axis denoted perceived challenges. Each participant plotted a point on the grid, generating a coordinate that reflected the intensity of their perceptions.

The data analysis was structured into three complementary components: (i) participants' qualitative descriptions of opportunities and challenges, (ii) quantitative analysis based on the dot plot ratings, and (iii) an interpretive mapping of educators' evolving perceptions to Zhai's [9] teacher agency framework.

For the qualitative component, participants' written reflections on the perceived opportunities and challenges of GenAI integration in education were systematically reviewed to identify recurring themes and evolving patterns across the five time points. This thematic analysis surfaced shared perceptions and shifts over time without imposing predefined categories. For the quantitative component, the coordinates from the dot plots were used to calculate mean values at each time point, enabling a comparative analysis of how educators' perceptions changed over the study period. For the interpretive mapping, participants' reflections at each time point were examined in relation to the conceptual dimensions of Zhai's framework (*Observer*, *Adopter*, *Collaborator*, *Innovator*). This process aimed to identify how educators' self-described intentions, awareness, and concerns aligned discursively with different stages of teacher agency. Importantly, these role alignments are not presented as fixed classifications or evidence of enacted practice, but rather as a conceptual lens through which evolving perceptions and aspirational orientations could be understood.

Two authors conducted the initial qualitative, quantitative, and interpretive analyses, with the remaining two reviewing all components to ensure accuracy, consistency, and agreement.

3. Results

3.1. Analysis of Perceived Opportunities in GenAI Integration Across Time

An analysis of educators' perceptions across five distinct time points (April 2023 to April 2025) reveals both recurrent themes and evolving insights regarding the opportunities associated with the integration of GenAI in educational settings

Recurrent Themes Across Time Periods. Several recurring themes emerged across all groups—Group 1 (April 2023), Group 2 (September 2023), Group 3 (December 2023), Group 4 (May 2024), and Group 5 (April 2025)—reflecting a consistent perception of GenAI's fundamental contributions to education. A key theme was the enhancement of teaching and learning processes, which encompassed empowering student engagement, refining teaching approaches, and fostering the development of learner competences. This was reflected in 83% of Group 1, 80% of Group 2, 67% of Group 3, 21% of Group 4, and 32% of Group 5, who identified GenAI as beneficial for improving teaching and learning practices. Percentages were calculated based on the number of participants in each group who mentioned a particular theme, relative to the total number of participants in that group. Similarly, the use of GenAI for generating educational materials—such as exercises, classroom resources, assessments, and academic content—was frequently emphasized, with 51% of Group 1, 28% of Group 2, 56% of Group 3, 25% of Group 4, and 24% of Group 5 highlighting this capability. These findings underscore educators' sustained interest in its potential as a tool for content creation.

Educators in Groups 1, 2, 4, and 5 also consistently highlighted GenAI's potential to enhance efficiency by automating routine or repetitive tasks. Specifically, 29% of Group 1, 72% of Group 2, 29% of Group 4, and 24% of Group 5 noted its value in streamlining pedagogically simple activities, citing these time-saving features as crucial support in daily teaching practices. Additionally, participants—particularly in Group 1 (23%), Group 2 (44%), and implicitly in Group 5 (27%)— recognized GenAI's usefulness in managing educational data, including facilitating structured information access and improving organizational efficiency.

Shifting Emphases and Evolving Perceptions. Despite these continuities, several notable differences were observed across the five time periods. In the initial phase (Group 1, April 2023), participants identified a broad spectrum of opportunities, encompassing pedagogical, logistical, and societal dimensions. This broader thematic diversity may reflect exploratory thinking during the early stages of GenAI adoption in education.

Subsequent groups demonstrated a progressive narrowing of focus. For example, Group 3 (December 2023) and Group 4 (May 2024) articulated more specific and practical affordances, such as idea generation,

content support, and technical task facilitation. This shift suggests a maturing understanding of GenAI's concrete utility in everyday educational practices.

A further evolution is seen in Group 5 (April 2025), where participants framed opportunities in more strategic and pedagogically informed terms. Emphasis was placed on the structured retrieval of information, the adoption of new teaching methodologies, and support for innovation in lesson planning. Moreover, this group uniquely emphasized the importance of integrating GenAI through ethical, responsible, and informed practices—an aspect absents in earlier datasets. This development indicates a growing awareness of the socio-ethical implications of GenAI in education. Additionally, the role of GenAI as a source of creative inspiration and conceptual support, while emergent in earlier groups (notably Groups 2 and 3), became more pronounced in later responses. This reflects a gradual recognition of GenAI as a co-creative partner in the design of learning activities and pedagogical resources.

Finally, a shift toward more student-centered opportunities was observed. While earlier groups emphasized teacher-facing benefits, later datasets (Groups 4 and 5) highlighted the potential of GenAI to foster student autonomy, enhance critical thinking, and support personalized learning pathways. Table 1 below synthesizes the presence and evolution of key opportunity themes across time.

Table 1
The presence and evolution of key opportunity themes across time.

Thematic Category	Group 1	Group 2	Group 3	Group 4	Group 5	Observed Trends and Shifts
Teaching and learning enhancement	✓	✓	✓	✓	✓	Core and consistently emphasized theme
Educational content generation	✓	✓	✓	✓	✓	Recurrently acknowledged across all periods
Task efficiency and automation	✓	✓		✓	✓	Gradual refinement from process facilitation to time-saving
Data management and information use	✓	✓			✓[1]	Limited but consistently valued
Student skill and competence support	✓	✓		✓	✓	Increasing attention to higher-order and transversal skills
Creativity and ideation		✓	✓		✓	Growing recognition of GenAI as a co-creative tool
Ethical and responsible use					✓	Emergent concern reflecting maturity in pedagogical discourse

Overall, the analysis indicates a progression from general enthusiasm and broad expectations toward more grounded, nuanced, and ethically reflective understandings of GenAI's role in education. While foundational themes such as teaching support and resource generation remain constant, later groups demonstrate an increasing sophistication in articulating pedagogical, operational, and ethical dimensions of GenAI integration.

3.2. Analysis of Perceived Challenges in GenAI Integration Across Time

Conversely, while educators recognize the opportunities offered by GenAI, they also express concerns about the potential negative effects this rapidly evolving technology may have on the teaching and learning process. Therefore, gaining a clear understanding of the perceived challenges and barriers is essential as they navigate the complexities of integrating GenAI into educational practice.

Recurrent Themes Across Time Periods. Across all five data collection points (April 2023 to April 2025), several core challenges repeatedly emerged in educators' responses. Chief among these were

---

[1]This insight was not explicitly stated but was implicit in the original data.

ethical concerns—including issues related to accessibility, bias reproduction, inequality, copyright, and data privacy—which were especially dominant in early responses (e.g., 94% of educators in Group 1, 68% of responses in Group 2 and 56% in Group 3). A second persistent concern was the erosion of student competences, particularly in autonomy, critical thinking, and creativity—reported by 74% of educators in Group 1, 60% in Group 2 (citing limited reflection and critical engagement), 33% in Group 3, 71% in Group 4, and 24% in Group 5. This theme appeared in every group, reflecting ongoing apprehensions that the overuse or misapplication of GenAI might lead to surface-level learning and diminished student agency.

Plagiarism and authorship uncertainty were widely acknowledged, particularly among participants in the earlier and middle groups: 57% of Group 1, 44% of Group 2, 22% of Group 3, 12.5% of Group 4, and indirectly in Group 5 (e.g., through mentions of "unreferenced outputs" and "discouraging authentic content creation"). Educators expressed difficulty in distinguishing between student- and AI-generated work, raising concerns about academic integrity and the reliability of assessments. Additionally, the spread of imprecise or biased information was viewed as a significant and growing challenge. From Group 2 onward, educators increasingly noted that GenAI could produce false or misleading content, risking student misinformation and reproducing cultural or ideological biases in training data—an issue raised by 68% of Group 2 and 54% of Group 4.

Shifting Emphases and Evolving Perceptions. While the foundational concerns remained consistent, the nature and framing of these concerns evolved over time. Early groups (Groups 1–3) tended to focus on macro-level and systemic risks, such as sustainability, legal uncertainty, or job displacement. These broad reflections likely stem from limited prior exposure to GenAI in practical settings. Later groups (especially Groups 4 and 5) demonstrated greater pedagogical specificity. For instance, educators in Group 4 emphasized the need to rethink assessment practices, given GenAI's potential to obscure the origin of student work. Group 5 introduced more nuanced critiques, including concerns about GenAI's lack of emotional intelligence, its encouragement of minimal-effort mindsets, and its disruption of traditional homework practices. This shift from systemic to classroom- level challenges suggests a growing familiarity and hands-on engagement with GenAI. Teachers moved from abstract risk anticipation to articulating how GenAI concretely impacts classroom practices, professional workload, and student development. Table 2 below synthesizes the main challenge categories identified across the five educator groups.

Educators' perceptions of GenAI-related challenges have evolved significantly over time. While early

Table 2
The presence and evolution of key challenges themes across time.

Thematic Category	Group 1	Group 2	Group 3	Group 4	Group 5	Observed Trends and Shifts
Ethical concerns (bias, access, copyright)	✓	✓	✓	✓		Strongest early, later reframed with practical examples
Student competence loss	✓	✓	✓	✓	✓	Persistent across all periods
Misinformation and content reliability	✓	✓	✓	✓	✓	Grew in importance as use cases increased
Plagiarism and authorship	✓	✓	✓	✓		Highlighted need for new assessment approaches
Overuse and misuse of GenAI tools	✓	✓		✓		Concerns about addiction and task completion without engagement
Additional educator workload	✓				✓	Reappeared with emphasis on integration demands
Legal and systemic issues	✓	✓	✓			Declined in frequency over time
Emotional and pedagogical limitations					✓	Newly emerging, reflects deeper critical reflection

reflections emphasized ethical risks and systemic concerns, later insights became more pedagogically situated, focusing on assessment complexities, skill erosion, and the practical demands of GenAI implementation. Across all time periods, however, a shared concern remains: that unregulated or uncritical integration of GenAI may compromise core educational values.

These findings underscore the importance of responsive, evidence-based policies and ongoing professional development to equip educators with the skills, frameworks, and tools needed to integrate GenAI effectively and ethically. As educators move from awareness to active engagement, their evolving insights should inform future design, regulation, and training efforts aimed at sustaining equitable and pedagogically sound GenAI integration in education.

3.3. Mean Value Analysis of Educators' Perceptions on GenAI Integration

To better understand educators' perspectives on the integration of GenAI into educational practices, participants were asked to rate the perceived opportunities and challenges associated with its use. Numerical values were assigned to represent the degree of perceived benefits and difficulties. The resulting mean values offer valuable insights into how educators' views on GenAI are evolving over time. This comparative analysis examines whether GenAI is seen more as an opportunity or a challenge, providing a nuanced view of educators' attitudes toward incorporating this technology into their teaching. Figure 2 below illustrates these perceptions, highlighting shifts in views over time through the comparisons of mean values for each study period.

The data analysis reveals a meaningful evolution in how educators appear to perceive the integration of GenAI into teaching. In April 2023, educators approached GenAI with caution, as perceived challenges (mean = 10.24) slightly outweighed opportunities (mean = 9.29), possibly reflecting early concerns about its implications. By September 2023, both values declined significantly (opportunities: mean = 5.29; challenges: mean = 5.67), likely indicating limited engagement, uncertainty, or a lack of practical experience at that stage.

A turning point seemingly emerged in December 2023, with a sharp rise in both opportunities (mean = 11.6) and challenges (mean = 12.4), suggesting that educators may have been actively exploring GenAI's potential while simultaneously encountering its complexities. By May 2024, perceptions became more balanced—opportunities remained high (mean = 11.85), while challenges slightly declined (mean = 11.4)—indicating a probable increase in confidence and an improved ability to navigate implementation hurdles.
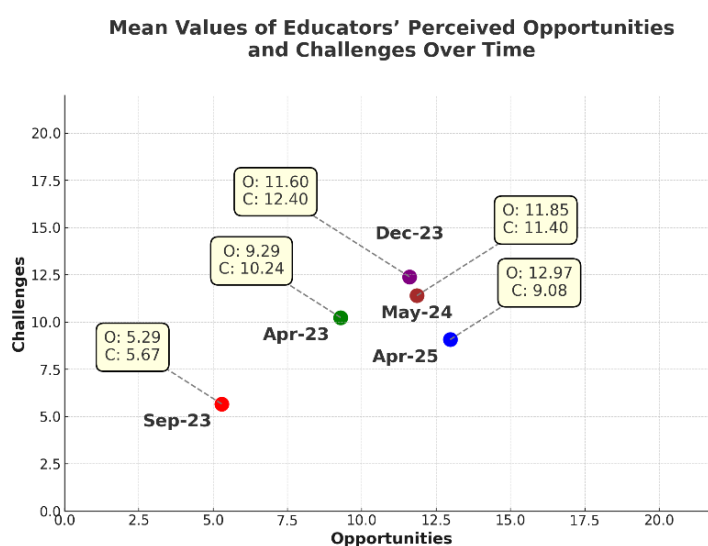

Figure 2: Mean values of perceived opportunities and challenges in GenAI integration across five time points (April 2023–April 2025).

In April 2025, a notable shift occurred: perceived opportunities peaked at 12.97, while challenges dropped to 9.08, marking the apparently most optimistic point in the timeline. This suggests that educators had likely become more experienced, better supported, and increasingly confident in leveraging GenAI in their teaching. Overall, the trend appears to reflect a progression from initial caution to informed and confident adoption.

3.4. Mapping Educator Perceptions to Teacher Agency Framework

To address RQ4, educators' evolving reflections across the five time points were interpretively analyzed using Zhai's [9] framework of teacher agency in the GenAI context – *Observer*, *Adopter*, *Collaborator*, and *Innovator*. While the study did not directly measure behavioral outcomes, patterns in participants' discourse and perceptions appeared to suggest a shifting pedagogical stance and gradually increasing awareness of what is required to engage meaningfully with GenAI.

In April 2023, most educators could likely be described as *Observers* – curious but cautious – appearing to express strong concerns about ethics (e.g., 94% of educators in Group 1, 68% of responses in Group 2, and 56% in Group 3) and competence loss (74% in Group 1, 60% in Group 2, 33% in Group 3, 71% in Group 4, and 24% in Group 5), along with generally abstract understandings of GenAI's potential and a perceived imbalance favoring challenges over opportunities. By September and December 2023, many educators seemed to exhibit *Adopter* characteristics, tentatively experimenting with GenAI for tasks like writing support and idea generation, while still expressing concerns about misinformation and critical thinking. In May 2024, *Collaborator* traits began to emerge, with a noticeable shift toward pedagogical integration, assessment redesign, and student - centered applications. Confidence appeared to increase as perceived opportunities began to outweigh challenges. By April 2025, a subset of educators appeared to articulate a more strategic and ethically informed vision of GenAI use, aligning to some extent with the *Innovator* role. They emphasized responsible integration, raised nuanced critiques (e.g., emotional limitations, learner overreliance), and expressed the highest levels of optimism—possibly reflecting intentions toward transformative practice, though not necessarily its full realization.

Table 3 presents an interpretive mapping of these evolving mindsets, drawing on Zhai's [9] educator role framework as a conceptual lens. Based on self-reported perceptions and language patterns—rather than observed behaviors or practices—these roles should be understood as indicative of how educators made sense of their relationship with GenAI over time. While the categories suggest a progression in articulated intentions and concerns, they do not represent a definitive classification of participants. Rather, they highlight aspirational orientations and a likely increase in awareness of the pedagogical and ethical dimensions of GenAI integration.

Table 3
Interpretive mapping of educators' perceived role progression based on Zhai's framework.

Time Period	Role Interpretation	Key Mindset Indicators	Supporting Evidence
April 2023	Observer (Conceptual)	High caution, low familiarity, abstract curiosity	Ethical concerns dominate, abstract benefits noted
Sep-Dec 2023	Adopter (Emergent)	Tool-focused interest, trial-and-error use	Mention of task automation, creativity support
May 2024	Collaborator (Aspirational)	Student-centered applications, pedagogical intent	References to assessment redesign, critical thinking
April 2025	Innovator (Aspirational)	Strategic integration, ethical awareness	Responsible use, emotional/pedagogical critique

4. Discussion and Conclusion

This longitudinal study suggests that educators' perceptions of GenAI integration into teaching may evolve over time, reflecting a dynamic balance between emerging opportunities and ongoing challenges. The findings appear to align with prior research on GenAI's dual role as a potential catalyst for pedagogical innovation and a possible source of ethical and instructional uncertainty [1, 2, 3, 6]. Qualitative data indicate a likely progression from initial enthusiasm and curiosity toward more informed, experience-based understandings of GenAI's educational implications.

Across the five phases, educators frequently acknowledged GenAI's perceived value in content creation, automation, and personalized learning—highlighting its potential to reduce workload and enhance innovation [4, 5, 6]. By the final stage, many participants also described GenAI as a co-creative and ethically significant partner, supporting calls in the literature to reconceptualize teacher roles and promote informed, reflective, and responsible use [9, 13, 18, 19]. This perspective aligns with emerging research advocating for value-sensitive reflections by teachers on the cost–benefit dynamics of technology integration in educational practices [21].

Educators' evolving perceptions were analyzed using Zhai's [9] teacher agency framework as a conceptual guide rather than a rigid classification. Early participants aligned with the *Observer* role – curious yet cautious, especially regarding ethics and competence. As familiarity increased, many adopted GenAI for planning and resource creation, reflecting the *Adopter* role. Some progressed toward the *Collaborator* role, emphasizing student-centered integration. By the study's end, a subset expressed *Innovator* traits, marked by strategic, ethical, and critical engagement. These shifts suggest growing awareness of GenAI's pedagogical and ethical dimensions, though not necessarily their full enactment.

The challenges reported by participants reaffirmed earlier concerns noted in the literature about ethics, student competence erosion, and misinformation [10, 12]. Educators consistently expressed concern regarding GenAI's potential impact on students' critical thinking, autonomy, and creativity, echoing broader debates about overreliance on AI [11]. These concerns seemed to shift from abstract risks in earlier phases to more practical, classroom-level issues—such as assessment integrity, workload redistribution, and student disengagement—mirroring an evolution aligned with the conceptual roles of *Collaborator* and *Innovator*.

The quantitative data suggest a gradual increase in optimism. Initial caution—reflected in higher challenge ratings—appears to have given way to greater confidence over time. By April 2025, a notable rise in perceived opportunities (mean = 12.97) and a reduction in perceived challenges (mean = 9.08) may indicate growing technical familiarity and pedagogical confidence. These trends support the interpretive mapping and suggest a readiness among some participants to engage more meaningfully with GenAI, though this may not equate to widespread implementation of advanced roles.

Despite its longitudinal, mixed-methods design, this study has limitations. Different participants were involved at each data collection point; therefore, the analysis captures group-level trends rather than individual longitudinal trajectories. Stratification or subgroup analysis based on demographic or professional characteristics was not conducted, as the study aimed to identify overarching patterns in evolving educator perceptions. This interpretive approach, while valuable for capturing collective shifts, may limit the specificity of findings. Furthermore, the sample was limited to educators in Spain, which may affect the generalizability of the results to other educational contexts.

Demographic details such as participants' discipline, experience, or digital skills were not collected. While these factors may influence perceptions of GenAI, the study focused on capturing evolving discourse across the teaching community rather than linking views to individual backgrounds. Data were based on pre-training interviews and self-reported reflections, which may be shaped by prior exposure or social desirability bias. Learner perspectives were not included, limiting classroom-level insight. Given the rapid evolution of GenAI, future research should incorporate more frequent data collection, classroom observations, post-training follow-ups, and consider institutional, policy, and student perspectives for a more comprehensive understanding.

In sum, this study offers a nuanced, time-sensitive account of how educators' perceptions of GenAI may evolve—from initial caution toward more confident, critical, and intentional engagement. These

findings highlight the importance of sustained, context-aware professional development that positions educators as active agents in the responsible integration of GenAI into teaching and learning.

Acknowledgments

Declaration on Generative AI

ChatGPT-4 was used to improve grammar, clarity, and structure. All ideas, analyses, and conclusions are solely those of the authors, who take full responsibility for the content.

References

[1] A.-J. Moreno-Guerrero, J.-A. Marín-Marín, P. Dúo-Terrón, J. López-Belmonte, Chatbots in Education: A Systematic Review of the Science Literature, in: Artificial Intelligence in Higher Education, CRC Press, 2022, p. 14.

[2] V. Taecharungroj, "What Can ChatGPT Do?" Analyzing Early Reactions to the Innovative AI Chatbot on Twitter, Big Data and Cognitive Computing 7 (2023) 35. doi:10.3390/bdcc7010035.

[3] M. Giannakos, R. Azevedo, P. Brusilovsky, M. Cukurova, Y. Dimitriadis, D. Hernandez-Leo, S. Järvelä, M. Mavrikis, B. Rienties, The promise and challenges of generative AI in education, Behaviour & Information Technology 44 (2025) 2518–2544. doi:10.1080/0144929X.2024.2394886.

[4] T. K. Chiu, Q. Xia, X. Zhou, C. S. Chai, M. Cheng, Systematic literature review on opportunities, challenges, and future research recommendations of artificial intelligence in education, Computers and Education: Artificial Intelligence 4 (2023) 100118. doi:10.1016/j.caeai.2022.100118.

[5] L. Ouyang, J. Wu, X. Jiang, D. Almeida, C. L. Wainwright, P. Mishkin, C. Zhang, S. Agarwal, K. Slama, A. Ray, J. Schulman, J. Hilton, F. Kelton, L. Miller, M. Simens, A. Askell, P. Welinder, P. Christiano, J. Leike, R. Lowe, Training language models to follow instructions with human feedback, 2022. doi:10.48550/arXiv.2203.02155.

[6] K.-J. Laak, J. Aru, Generative AI in K-12: Opportunities for Learning and Utility for Teachers, in: A. M. Olney, I.-A. Chounta, Z. Liu, O. C. Santos, I. I. Bittencourt (Eds.), Artificial Intelligence in Education. Posters and Late Breaking Results, Workshops and Tutorials, Industry and Innovation Tracks, Practitioners, Doctoral Consortium and Blue Sky, volume 2150, Springer Nature Switzerland, Cham, 2024, pp. 502–509. doi:10.1007/978-3-031-64315-6_49.

[7] W. M. Lim, A. Gunasekara, J. L. Pallant, J. I. Pallant, E. Pechenkina, Generative AI and the future of education: Ragnarök or reformation? A paradoxical perspective from management educators, The International Journal of Management Education 21 (2023) 100790. doi:10.1016/j.ijme.2023.100790.

[8] S. Haroud, N. Saqri, Generative AI in Higher Education: Teachers' and Students' Perspectives on Support, Replacement, and Digital Literacy, Education Sciences 15 (2025) 396. doi:10.3390/educsci15040396.

[9] X. Zhai, Transforming Teachers' Roles and Agencies in the Era of Generative AI: Perceptions, Acceptance, Knowledge, and Practices, 2024. doi:10.48550/arXiv.2410.03018.

[10] D. R. E. Cotton, P. A. Cotton, J. R. Shipway, Chatting and cheating: Ensuring academic integrity in the era of ChatGPT, Innovations in Education and Teaching International 61 (2024) 228–239. doi:10.1080/14703297.2023.2190148.

[11] M. Farrokhnia, S. K. Banihashem, O. Noroozi, A. Wals, A SWOT analysis of ChatGPT: Implications for educational practice and research, Innovations in Education and Teaching International 61 (2024) 460–474. doi:`10.1080/14703297.2023.2195846`.

[12] F. W. Putra, I. B. Rangka, S. Aminah, M. H. R. Aditama, ChatGPT in the higher education environment: perspectives from the theory of high order thinking skills, Journal of Public Health 45 (2023) 840–841. doi:`10.1093/pubmed/fdad120`.

[13] D. Hernández-Leo, ChatGPT and generative AI in higher education: User-centered perspectives and implications for learning, in: Proceedings of the Learning Analytics Summer Institute Spain 2023 (LASI Spain 2023), volume 3542, CEUR-WS, Madrid, Spain, 2023.

[14] R. J. Collie, A. J. Martin, Teachers' motivation and engagement to harness generative AI for teaching and learning: The role of contextual, occupational, and background factors, Computers and Education: Artificial Intelligence 6 (2024) 100224. doi:`10.1016/j.caeai.2024.100224`.

[15] R. Kaplan-Rakowski, K. Grotewold, P. Hartwick, K. Papin, Generative AI and Teachers' Perspectives on Its Implementation in Education, Journal of Interactive Learning Research 34 (2023) 313–338. doi:`10.70725/815246mfssgp`.

[16] Y. Feldman-Maggor, R. Blonder, G. Alexandron, Perspectives of Generative AI in Chemistry Education Within the TPACK Framework, Journal of Science Education and Technology 34 (2025) 1–12. doi:`10.1007/s10956-024-10147-3`.

[17] J. M. Rosenberg, M. J. Koehler, Context and Technological Pedagogical Content Knowledge (TPACK): A Systematic Review, Journal of Research on Technology in Education 47 (2015) 186–210. doi:`10.1080/15391523.2015.1052663`.

[18] I. Celik, Towards Intelligent-TPACK: An empirical study on teachers' professional knowledge to ethically integrate artificial intelligence (AI)-based tools into education, Computers in Human Behavior 138 (2023) 107468. doi:`10.1016/j.chb.2022.107468`.

[19] P. Mishra, M. Warr, R. Islam, TPACK in the age of ChatGPT and Generative AI, Journal of Digital Learning in Teacher Education 39 (2023) 235–251. doi:`10.1080/21532974.2023.2247480`.

[20] G.-G. Lee, X. Zhai, Using ChatGPT for Science Learning: A Study on Pre-service Teachers' Lesson Planning, IEEE Transactions on Learning Technologies 17 (2024) 1643–1660. doi:`10.1109/TLT.2024.3401457`.

[21] D. Hernández-Leo, K. Ginoyan, Supporting teachers' value-sensitive reflections on the cost–benefit dynamics of technology in educational practices, British Journal of Educational Technology 56 (2025) 1350–1369. doi:`10.1111/bjet.13592`.

A. Appendices

Additional tables detailing perceived GenAI opportunities and challenges across five phases are accessible [here].