Understanding and Use of Artificial Intelligence in Academic Feedback by Professors in the Undergraduate Programs of the Faculty of Education at UCEVA: Its Contribution to the Development of Critical Thinking.

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Dedicatoria

Gustavo Adolfo Almanza Lance

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Resumen

The objective of this research was to analyze how professors' perceptions of Generative Artificial Intelligence (GenAI) relate to its use in formative feedback practices aimed at developing critical thinking in undergraduate programs at the Faculty of Education of the Central University of Valle del Cauca (UCEVA). To this end, a convergent mixed-methods design was employed, integrating quantitative and qualitative data collected through a questionnaire based on the Unified Theory of Technology Acceptance and Use 2 (UTAUT2) and a set of open-ended questions. The study included the participation of professors from all four undergraduate programs of the Faculty of Education.

The results showed a generally favorable perception of GenAI, especially regarding its potential to improve the efficiency, personalization, and accessibility of formative feedback. The Performance Expectation and Effort Expectation dimensions emerged as the factors with the highest levels of acceptance among the participants. However, concerns were also identified regarding academic integrity, ethical implications, technological dependence, and the reliability of AI-generated content. Qualitative findings showed that most current uses of AI focus on instrumental feedback tasks, such as error correction and the improvement of academic products, while experiences aimed at promoting reflection, argumentation, and higher-order cognitive processes are less frequent. Furthermore, teacher training emerged as the most frequently mentioned condition for the meaningful integration of these technologies, along with the need for institutional guidelines, ethical frameworks, and technological support.

It is concluded that AI has significant potential to strengthen formative feedback and contribute to the development of critical thinking. However, its educational value depends on responsible pedagogical mediation, ongoing teacher training processes, and institutional policies that guarantee ethical implementation geared toward educational goals.

Keywords: Generative Artificial Intelligence, formative feedback, critical thinking, higher education, teacher perceptions

Abstract

El objetivo de esta investigación fue analizar cómo las percepciones de los profesores sobre la Inteligencia Artificial Generativa (GenAI) se relacionan con su uso en prácticas de retroalimentación formativa orientadas al desarrollo del pensamiento crítico en los programas de pregrado de la Facultad de Ciencias de la Educación de la Unidad Central del Valle del Cauca (UCEVA). Para alcanzar este propósito, se empleó un diseño de métodos mixtos convergente, integrando datos cuantitativos y cualitativos recolectados mediante un cuestionario basado en la Teoría Unificada de Aceptación y Uso de la Tecnología 2 (UTAUT2) y un conjunto de preguntas abiertas. El estudio contó con la participación de docentes pertenecientes a los cuatro programas de pregrado de la Facultad de Educación.

Los hallazgos revelaron una percepción generalmente positiva de la GenAI entre los docentes, especialmente en relación con su potencial para mejorar la eficiencia, la personalización y la accesibilidad de la retroalimentación formativa. La Expectativa de Desempeño y la Expectativa de Esfuerzo emergieron como las dimensiones con mayores niveles de aceptación en los diferentes programas académicos. Sin embargo, también se identificaron preocupaciones relacionadas con la integridad académica, las implicaciones éticas, la dependencia tecnológica y la confiabilidad de los contenidos generados por inteligencia artificial. Los resultados cualitativos mostraron que la mayoría de los usos actuales de la GenAI se centran en tareas instrumentales de retroalimentación, como la corrección de errores y la mejora de productos académicos, mientras que un menor número de experiencias evidenció su utilización para promover la reflexión, la argumentación y los procesos cognitivos de orden superior. Asimismo, la formación docente surgió como la condición más frecuentemente identificada para una integración significativa de estas tecnologías, acompañada de la necesidad de lineamientos institucionales, marcos éticos y apoyo tecnológico.

La investigación concluye que la GenAI posee un potencial significativo para fortalecer la retroalimentación formativa y contribuir al desarrollo del pensamiento crítico. No obstante, su valor educativo depende de una mediación pedagógica responsable, de procesos continuos de formación docente y de políticas institucionales que garanticen una implementación ética y orientada a propósitos educativos.

Palabras clave: Inteligencia Artificial Generativa, retroalimentación formativa, pensamiento crítico, educación superior, percepciones docentes.

Introduction

The rapid expansion of Generative Artificial Intelligence (GenAI) has transformed educational environments by introducing new possibilities for teaching, learning, and assessment. Since the public release of large language models such as ChatGPT, educators have increasingly explored the potential of AI to support instructional design, personalize learning experiences, and enhance assessment processes. At the same time, these technologies have generated important pedagogical and ethical debates concerning academic integrity, teacher autonomy, data privacy, and the role of critical thinking in an increasingly digital educational landscape. Rather than representing a purely technological innovation, GenAI challenges higher education institutions to reconsider how knowledge is constructed, assessed, and supported through meaningful pedagogical practices.

Among the educational processes most affected by these developments is academic feedback. Contemporary literature recognizes formative feedback as one of the most influential factors in promoting learning because it enables students to identify strengths, recognize areas for improvement, regulate their own learning, and develop higher-order cognitive skills such as analysis, reflection, and argumentation (Black & Wiliam, 1998; Hattie & Timperley, 2007). However, providing high-quality formative feedback remains a demanding task for university teachers due to increasing workloads, large class sizes, and limited opportunities for individualized support. Within this context, Generative Artificial Intelligence has emerged as a promising resource capable of assisting teachers by producing immediate and personalized feedback while allowing them to devote greater attention to pedagogical mediation and student learning.

Nevertheless, the educational benefits of GenAI do not depend exclusively on its technological capabilities. Its successful implementation requires teachers who are prepared to integrate these tools critically, ethically, and pedagogically into assessment practices. Previous research has shown that teachers' perceptions strongly influence the adoption and meaningful use of educational technologies, affecting not only their willingness to use them but also the ways in which they incorporate them into teaching and learning processes. Consequently, understanding

teachers' perceptions has become an essential step toward promoting effective and responsible AI integration in higher education.

In Colombia, interest in artificial intelligence has grown considerably in recent years, accompanied by institutional and governmental initiatives that encourage its educational use. Despite these advances, significant challenges remain regarding teacher training, institutional support, and the pedagogical integration of AI into assessment practices. These challenges are particularly relevant in teacher education programs, where future educators develop the professional competencies and assessment approaches that they will later reproduce in their own classrooms. Therefore, investigating how teacher educators perceive and use Generative Artificial Intelligence is fundamental for understanding its potential contribution to improving formative feedback and fostering critical thinking.

This study was conducted within the Faculty of Education at the Unidad Central del Valle del Cauca (UCEVA). It seeks to examine the relationship between professors' perceptions of Generative Artificial Intelligence and its use in academic feedback practices oriented toward the development of critical thinking. To achieve this purpose, the research adopts a convergent mixed-methods design, integrating quantitative and qualitative data collected through an adapted questionnaire based on the Unified Theory of Acceptance and Use of Technology (UTAUT2). This approach allows the study not only to identify patterns of technology acceptance but also to explore teachers' experiences, concerns, and pedagogical perspectives regarding AI-supported feedback.

The significance of this research lies in its contribution to an emerging area of educational research where formative assessment, critical thinking, and Generative Artificial Intelligence intersect. While previous studies have examined teachers' attitudes toward AI or the educational applications of intelligent technologies, fewer investigations have specifically explored how teachers' perceptions influence the pedagogical use of GenAI in formative feedback practices aimed at fostering critical thinking, particularly within undergraduate teacher education programs. By addressing this gap in the context of UCEVA, this study provides context-specific evidence that may inform institutional decision-making, teacher professional development initiatives, and future research on AI-mediated assessment practices in higher education.

This thesis is organized into five chapters. Chapter One presents the research problem, objectives, justification, and scope of the study. Chapter Two reviews the literature and theoretical foundations related to Generative Artificial Intelligence, formative feedback, critical thinking, teachers' perceptions, and the UTAUT2 framework. Chapter Three describes the methodological design, including the research approach, participants, instruments, data collection procedures, and methods of analysis. Chapter Four presents and discusses the findings obtained from both the quantitative and qualitative phases of the study. Finally, Chapter Five summarizes the main conclusions, discusses the implications of the findings, acknowledges the limitations of the research, and offers recommendations for future studies and educational practice.

Chapter I: Problem Statement

Problem description

Assessment constitutes an essential component of educational processes, to the point of determining not only the learning outcomes achieved by students but also the pedagogical dynamics that guide teaching (MEN, 2008). In higher education, assessment and feedback practices have been historically influenced by a positivist paradigm, in which summative assessment has been privileged as a mechanism for measurement and certification of achievement (Stufflebeam & Shinkfield, 2007). In contrast, formative assessment has emerged from constructivist and critical paradigms, oriented toward supporting the learning process, identifying progress, and fostering self-regulation (Black & Wiliam, 1998). Within this perspective, formative feedback becomes one of the central mechanisms through which assessment supports learning, enabling students to recognize their strengths, identify areas for improvement, and actively regulate their learning processes. Consequently, understanding how formative feedback can be enhanced through emerging technologies, such as generative artificial intelligence, has become an increasingly relevant concern in higher education.

This conceptual tension translates into practical challenges for teachers, who must materialize feedback that transcends mere grading and functions as a form of pedagogical mediation within the student's zone of proximal development (Vygotsky, 1978). Effective formative feedback requires teachers to move beyond identifying errors or assigning grades and instead provide specific guidance that helps students understand their current level of performance, recognize areas for improvement, and determine how to progress toward the expected learning outcomes. In this sense, feedback involves an ongoing process of interpreting students' work, identifying their learning needs, and providing timely and meaningful guidance that can promote reflection, self-regulation, and greater autonomy. However, implementing such feedback practices can be demanding, particularly when teachers are responsible for large numbers of students and have limited time to provide individualized support.

Despite its theoretical importance, the implementation of effective formative feedback faces persistent structural limitations: large class sizes, teacher overload, and restricted time for detailed, personalized follow-up. In this complex landscape, Artificial Intelligence (AI) has

increasingly been recognized as a resource capable of supporting assessment practices, particularly formative feedback. However, its educational value is not inherent to the technology itself; rather, it depends on how it is pedagogically integrated, institutionally supported, and ethically implemented within specific educational contexts. Unlike traditional digital tools, AI allows for the personalization of learning at scale, offering immediate responses that can alleviate teaching loads and create space for more reflective evaluative processes (Zou, Xie & Wang, 2023). In Colombia, the Ministry of National Education (2024) has begun to outline guidelines that view AI as a path toward equity and the reduction of evaluative bias; however, these principles have yet to translate into institutionalized practices, leaving a gap between public policy and classroom reality.

The national situation reveals a technological paradox: while 94% of university students report using AI tools in their academic activities (El Nuevo Siglo, 2024), only one in three universities in the country has formalized strategies for its pedagogical use. This asymmetry leads to "disjointed adoption," where technology is present but lacks a critical framework to ensure the development of intellectual autonomy. As the IA 4 You manifesto (2024) warns, effective integration requires not only technical access but also ethical and conscious training that allows teachers to act as guides, preventing AI from replacing critical thinking with algorithmic dependency.

This scenario of uncertainty is critically manifested at the Unidad Central del Valle del Cauca (UCEVA). Despite institutional efforts through the Escuela de Formación Docente (EFD), which has trained over 120 professors in the pedagogical use of AI since 2023 (Ferrer Franco, 2025), participation from the Faculty of Education has been notably low, with representation from its four undergraduate programs remaining limited relative to other academic units of the institution suggesting that a meaningful share of the faculty responsible for training the country's future educators may still be excluded from these key digital competencies.

This lack of specific qualification in the Faculty of Education creates a pedagogical gap: teachers are expected to guide students who are already frequent users of generative AI tools but may lack the pedagogical strategies needed to integrate these technologies into feedback processes that foster analysis and argumentation. Currently, there is no systematic evidence

regarding how this lack of training influences teachers' perceptions or their ability to use AI as a tool for critical mediation.

Consequently, the problem does not reside simply in the lack of technological tools, but in the disconnect between the transformative potential of AI and the reality of evaluative practices at UCEVA. There is an urgent need to investigate how the perceptions and levels of appropriation among teachers in the Faculty of Education condition the use of AI in academic feedback. Without structured knowledge of these dynamics, the institution risks maintaining obsolete assessment models that fail to respond to the demands of the digital society or the mission of fostering intellectual autonomy in its graduates. Although previous studies have explored teachers' perceptions of artificial intelligence in educational contexts, limited attention has been given to how these perceptions influence the pedagogical use of generative AI for formative feedback aimed at fostering critical thinking, particularly within teacher education programs. By addressing this intersection in the context of UCEVA, the present study seeks to contribute context-specific evidence that can inform both institutional decision-making and future research on AI-mediated assessment practices.

While *the Proyecto Educativo Institucional* (UCEVA, 2020) identifies formative assessment as a cornerstone for promoting reflection and learner autonomy, the effective integration of generative AI into these pedagogical processes remains an institutional challenge. Addressing this challenge requires a deeper understanding of how faculty members perceive and incorporate AI into formative feedback practices, particularly within teacher education programs, where future educators develop their own assessment approaches. By examining these perceptions and practices, this study seeks to generate context-specific evidence that can support institutional decision-making and contribute to the pedagogically meaningful integration of generative AI in undergraduate education at UCEVA.

In this context, the central question that will guide this study is the following:

Resarch question

How are professors' perceptions of generative artificial intelligence related to its use in academic feedback practices oriented toward the development of critical thinking in undergraduate programs of the Faculty of Education at UCEVA?

Objectives

General Objective:

To analyze professors' perceptions and uses of generative artificial intelligence in formative feedback practices aimed at fostering critical thinking in the undergraduate programs of the Faculty of Education at UCEVA

Specific Objectives:

1. To identify teachers' perceptions regarding the use of generative artificial intelligence in formative feedback practices, based on the dimensions of the UTAUT2 model
2. To describe the relationships between teachers' perceptions, institutional conditions, and the use of AI in feedback practices, as well as its orientation toward critical thinking, identifying descriptive patterns and variations according to academic program.
3. To interpret the experiences, expectations, and perceived barriers expressed in the open-ended questions of the questionnaire, in order to understand the meanings, ethical tensions, and opportunities that teachers attribute to the use of AI in formative feedback.

Rationale

This research is crucial because it addresses the need to investigate the pedagogical integration of Generative Artificial Intelligence (GenAI) within the specific context of higher education teacher training at the Faculty of Education of UCEVA. The urgency stems from the gap between the potential of these tools and the current pedagogical practices, which often remain centered on traditional teaching methods.

Theoretically, this study contributes by examining GenAI not merely as an administrative tool for efficiency, but as a pedagogical resource capable of mediating higher-order cognitive skills. It aligns with Vygotsky's concept of mediated teaching (Vygotsky, 1978), where technology acts as a cultural tool that can either enhance or limit cognitive development, depending on how it is integrated by the educator. The study is grounded in Hattie and Timperley's (2007) model of effective feedback, positing that the value of GenAI is not in its automated generation, but in how the teacher employs it to guide the student's thought process, fostering analysis, evaluation, and synthesis.

Practically, this research addresses an identified contradiction within UCEVA's Faculty of Education. While the institutional vision promotes innovation (PEI 2020), there is a "pedagogical deficit" where faculty members struggle to integrate GenAI effectively for formative purposes. This is partly due to a lack of specific professional development regarding the didactic applications of these tools. Consequently, there is a risk that the adoption of GenAI risks reinforcing the very vertical, teacher-centered paradigms that the PEI explicitly seeks to overcome (Selwyn, 2016). Understanding teachers' current perceptions and practices is the first step toward designing professional development programs that align technological use with the university's educational goals.

Disciplinarily and institutionally, this study holds relevance for the four undergraduate programs of the Faculty of Education at UCEVA, insofar as formative feedback and the development of critical thinking constitute shared pedagogical concerns across disciplinary fields, regardless of each program's specific subject matter. Furthermore, the mixed-methods methodological design, which combines a contextualized survey based on the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) selected for its capacity to explain both behavioral intention and use behavior through constructs such as performance expectancy, effort

expectancy, and facilitating conditions with qualitative interviews, provides a transferable research model. This methodological approach offers a replicable framework for other faculties within UCEVA and other higher education institutions facing similar challenges in technology integration.

Socially, the relevance of this research is concentrated at the institutional level of UCEVA's Faculty of Education, since understanding how its professors currently perceive and use generative AI in feedback processes provides the faculty with contextualized evidence to strengthen its own pedagogical practices around critical thinking. Rather than assuming a direct, measurable impact on students' critical thinking abilities which lies beyond the scope and objectives of this study, the research offers the faculty a diagnostic basis from which to design institutional strategies, training initiatives, and ethical guidelines for the responsible integration of GenAI in formative feedback.

With all of the above, this research is expected to provide robust evidence to inform institutional decision-making regarding the ethical and pedagogical integration of GenAI within UCEVA. Its primary scientific contribution lies in bridging the gap between general technology acceptance models (like UTAUT2) and specific pedagogical practices focused on developing critical thinking in teacher education, thereby enriching the institutional academic discourse on AI within UCEVA, and offering evidence that may be relevant to similar higher education contexts.

Chapter II: Referential Framework

This chapter presents the theoretical foundations that support the research problem and contextualize the study within previous academic contributions. Given the limited empirical evidence on how professors perceive and use GenAI in formative feedback practices within Colombian higher education, particularly in faculties of education, this review is necessary to situate the present study's contribution and to justify the theoretical constructs selected for its analysis. For this purpose, an analysis of international and national background studies on artificial intelligence (AI) in education is provided, with emphasis on perceptions, challenges, and benefits in assessment and feedback processes. This background review was conducted through a search of academic databases, including Scopus, SciELO, Google Scholar, and additional databases available through UCEVA's institutional library, using keywords such as "GenAI," "critical thinking," "formative feedback," "higher education," and "UTAUT2." The theoretical framework then addresses the main concepts and models related to the use of AI in higher education, including its role in fostering critical thinking and supporting formative assessment practices.

Background studies:

The construction of the state of the art for this research is based on a multi-scale analysis that identifies the current dynamics of Artificial Intelligence and its impact on pedagogical assessment. In this section, a rigorous selection of international, national, and local studies is presented, aiming to establish a comparative framework that supports the research problem. Rather than a mere chronological list, this background focuses on identifying successful experiences, recurring tensions, and unexplored gaps regarding the use of GenAI as a tool for academic feedback.

At the international level, the review focuses on studies that explore the transition from traditional feedback to AI-mediated dialogic processes. At the national level, the focus shifts to the Colombian educational policy landscape and the technological appropriation challenges faced by local universities. Finally, at the local level, the specific institutional context of UCEVA is examined, analyzing how regional teacher training programs are responding to the digital

transformation. Together, these three dimensions provide the necessary theoretical and empirical foundation to justify the relevance of this study and its contribution to the field of education sciences.

International background

From an international stance, Roe et al. (2024) prepared the article "Understanding Student and Academic Staff Perceptions of AI Use in Assessment and Feedback". aimed to explore the perceptions of students and academic staff at universities in Vietnam and Singapore on the use of GenAI in assessment and feedback, focusing on their familiarity, comfort level and experiences with AI-generated text detection tools. The methodology consisted of an online survey with Likert-scale and open-ended questions, applied to 317 participants (282 students and 35 faculty) from three universities. The data were analyzed using descriptive statistics and reflective thematic analysis.

The study by Roe et al. (2024) draws upon frameworks from the literature on AI-assisted assessment and feedback (Braun & Clarke, 2006; Swiecki et al., 2022), analyzing perceptions of students and teachers regarding the reliability and legitimacy of these tools. Their results reveal low familiarity with GenAI and general skepticism toward AI-only grading, although there is greater acceptance of hybrid models where technological feedback is complemented by teacher feedback. Likewise, their participants showed relative comfort with uses related to comprehension and participation monitoring, but expressed concerns about false positives in AI-generated text detectors, fairness in their application, and lack of clarity in institutional policies.

This study is highly relevant to our research because it highlights the perceptions and concerns of both students and academic staff regarding the integration of AI in assessment and feedback. Its international scope, focusing on universities in Vietnam and Singapore, provides a comparative perspective that enriches our understanding of how similar challenges may manifest in different educational contexts. The findings regarding skepticism towards fully AI-based grading and the preference for hybrid models directly inform our investigation, underscoring the importance of maintaining a balance between technological tools and human judgment.

Along the same lines, the study "Impact of artificial intelligence in educational assessment and feedback", prepared by Guijarro (2024), aimed to analyze the main trends, benefits and challenges associated with the implementation of artificial intelligence in educational assessment and feedback processes. To this end, the author used a systematic literature review methodology, in which 146 articles published between 2020 and 2024 were examined in databases such as Scopus and Web of Science, following the guidelines of Kitchenham and Charters (2007). The findings report a moderate positive impact on academic performance (effect size of 0.51) and a stronger impact on the development of critical thinking (0.68), in addition to improvements in efficiency (40% reduction in grading time, 30% increase in consistency) and student satisfaction (22% more). However, ethical challenges related to data privacy and the need for teacher training were also identified.

The systematic review was based on the guidelines of Kitchenham and Charters (2007), which allowed us to rigorously synthesize recent findings on AI in evaluation and feedback. The results show a moderate positive impact on academic performance ($d = 0.51$) and a stronger impact on the development of critical thinking ($d = 0.68$), in addition to improvements in efficiency and student satisfaction. However, challenges related to data privacy and the need for teacher training were also identified, highlighting that the adoption of AI requires not only technological support, but also a solid ethical and pedagogical framework.

The contribution of this study to our research lies in its systematic synthesis of global evidence on the impact of AI in assessment and feedback. By analyzing a wide range of recent publications, the study not only demonstrates measurable benefits in learning outcomes, particularly in critical thinking and academic performance, but also highlights efficiency gains and increased student satisfaction. These findings support the relevance of AI as a tool to enhance feedback practices, which directly aligns with our interest in promoting critical thinking through academic feedback. At the same time, the identification of ethical challenges, such as data privacy and the urgent need for teacher training, emphasizes the importance of addressing institutional and pedagogical readiness before large-scale adoption. This dual perspective of opportunities and challenges strengthens the theoretical foundation of our investigation by showing both the potential and the limitations of AI in educational contexts.

In Italy, Nirchi et al. (2024) conducted a qualitative research entitled "Exploratory Survey on Newly Recruited Teachers' Perceptions of the Use of Artificial Intelligence in Teaching: Strong Points, Obstacles and Perspectives.", which aimed to analyze the perceptions of newly recruited teachers and tutors regarding the use of artificial intelligence in teaching, identifying benefits, obstacles and perspectives for its integration into educational practice. The methodology consisted of an exploratory inquiry applied to 2,920 teachers (2,484 newly attached and 436 tutors), using the questionnaire "Teachers' trust in AI-based EdTech" (Nazaretsky *et al*., 2022), adapted and composed of 29 items organized in three dimensions: effectiveness of AI use in teaching, perceived limitations and level of knowledge about AI tools. Data were analyzed through descriptive statistics, exploratory factor analysis and mean difference tests (Student's t-test, ANOVA), complemented with thematic analysis of open-ended responses to identify perceived advantages and obstacles.

The study by Nazaretsky et al. (2022) was based on the Teachers' trust in AI-based EdTech questionnaire, which organizes teachers' perceptions around three dimensions: effectiveness of AI use, perceived limitations, and level of knowledge of the tools. Their results reveal that novice teachers value AI as a means to personalize learning, stimulate creativity and innovate teaching, while tutors conceive of it primarily as operational and administrative support. Nevertheless, significant obstacles emerge: novice teachers warn of risks of technological dependence and loss of critical thinking in students, while tutors point to barriers to access, resistance to change and training deficiencies. These differences suggest that the integration of AI into teaching practice depends to a large extent on both pedagogical preparation and teachers' beliefs and perceptions."

The contribution of this study to our research is significant because it emphasizes the role of teachers’ perceptions in shaping the integration of AI into educational practice. Methodologically, its large-scale exploratory survey combining quantitative and qualitative techniques demonstrates the value of mixed approaches to capture both measurable trends and nuanced perspectives, an aspect that resonates with the convergent mixed-methods design of our own study. Substantively, the distinction between novice teachers and tutors highlights that the success of AI in academic processes depends not only on technological infrastructure but also on pedagogical readiness and professional experience. These findings are particularly important for

our focus on academic feedback and critical thinking, as they show that the benefits and risks of AI adoption vary across user groups, underscoring the need for differentiated training and institutional support to ensure equitable and effective use.

A key aspect in the study of artificial intelligence in education has been the voice of teachers, as shown in the article "Investigating teachers' perceptions of artificial intelligence tools in education: potential and difficulties" by Alwaqdani (2024), which aimed to analyze the perceptions of 1,101 teachers in Saudi Arabia on the potential and difficulties in integrating artificial intelligence tools in their educational practices. The research posed two central questions: (1) the potential of AI as a tool to improve teaching and (2) the difficulties encountered by teachers in using it. The methodology was quantitative, using a structured questionnaire with a Likert scale and closed questions, applied to teachers at different educational levels (primary, secondary and high school). The results show that most of them recognize that AI can save time, design enriching activities and personalize learning, but they also express concerns about insufficient training, possible reduction of creativity and critical thinking, technological dependence and fear of job substitution.

This study was supported by frameworks in the Artificial Intelligence in Education (AIED) literature, which highlight the potential of AI for personalization, feedback, and efficiency in teaching practices (Roll & Wylie, 2016; Luckin, 2018). The findings show that Saudi teachers recognize benefits such as time savings, the ability to design enriching activities, and personalization of learning, which is consistent with theories of adaptive learning and technology-mediated teaching. However, they also expressed concerns about lack of training, diminished creativity and critical thinking, technology dependence, and fear of job substitution, evidencing that teachers' perceptions oscillate between optimism about the opportunities of AI and caution about its pedagogical and ethical risks.

Alwaqdani's (2024) study is relevant to our research because it demonstrates, based on a large sample of more than a thousand teachers at different educational levels, how perceptions about artificial intelligence can be mapped in a representative and generalizable way. Beyond this methodological aspect, its finding that teachers' perceptions oscillate between optimism about AI's pedagogical benefits and caution about its ethical and cognitive risks provides a direct point

of reference for interpreting the ambivalence expected among UCEVA teachers, particularly regarding the tension between the efficiency gains attributed to GenAI-supported feedback and concerns about its potential impact on students' critical thinking and autonomy.

In the field of higher education, Khlaif et al. (2024) authored the article "University professors' opinions on the adoption and integration of generative AI tools for student assessment in higher education" aimed to examine the factors influencing the adoption and integration of GenAI tools in student assessment from the perspective of university professors in the Middle East, especially those considered early adopters.

This work was based on the UTAUT2 model (Venkatesh et al., 2012), which allowed us to analyze the factors that influence the adoption of generative AI tools in university assessment. The results show that performance expectancy, effort expectancy, social influence and hedonic motivation are determinants in the intention to use and effective integration of these technologies. At the same time, relevant concerns related to academic integrity, the possible impact on writing and critical thinking skills, as well as the need for clear institutional policies and teacher training programs were identified. These findings reflect the tension between the innovative potential of GenAI to streamline assessment and the ethical and pedagogical challenges that accompany its implementation.

The study by Khlaif *Et al.* (2024) constitutes a key methodological and conceptual reference for the present research, as it employs the UTAUT2 model to examine university teachers' adoption of generative AI in assessment practices. Similar to their study, the present research explores teachers' perceptions through the UTAUT2 constructs and analyzes the adoption of generative AI within a higher education context. However, unlike Khlaif et al. (2024), whose research focused on the general integration of GenAI into student assessment among early adopters in Middle Eastern universities, the present study specifically examines how teachers' perceptions are related to the use of generative AI in formative feedback practices aimed at fostering critical thinking within undergraduate programs in the Faculty of Education at UCEVA. Moreover, while the original instrument developed by Khlaif et al. served as the basis for this research, it was adapted to the Colombian educational context and aligned with the

specific objectives of the study, ensuring its contextual relevance and methodological consistency.

With a comparative approach between different levels of education, Delgado de Frutos et al. (2024) prepared the article *"Aplicación de la Inteligencia Artificial (IA) en Educación: Los beneficios y limitaciones de la IA percibidos por el profesorado de educación primaria, educación secundaria y educación superior"* aimed to identify the perceptions of active teachers at different stages about the benefits and limitations of the use of artificial intelligence in education, analyzing possible differences according to the level at which they work. The methodology was based on a cross-sectional design with a mixed approach, through an ad hoc questionnaire distributed online to 276 teachers in Spain, whose open-ended responses were subjected to an inductive qualitative analysis supported by grounded theory, followed by statistical analysis with SPSS to establish associations between perceived benefits and limitations at each educational level.

Regarding the theoretical frameworks, the study relies on grounded theory (Glaser & Strauss, 2017) for the analysis of the qualitative responses, which allowed generating emerging categories on benefits and limitations of AI in education from the data themselves. The results showed that, although teachers recognize benefits such as the automation of tasks, access to resources and personalization of learning, they also pointed out limitations related to the inappropriate use of the tool, the lack of critical review by students and the possible impact on the development of skills such as critical thinking. The study also shows differences between educational stages: in primary school, motivation and time savings were valued; in secondary school, the creation of materials and concern about inappropriate use; and in higher education, reflection on ethical, safety and teacher training aspects, which highlights the need for differentiated training according to academic level.

This study by Delgado de Frutos, Campo Carrasco, Sainz de la Maza, and Etxabe-Urbieta (2024) makes a relevant contribution to our research because it highlights how teachers' perceptions of AI use are not homogeneous but differ significantly according to the educational level. This is especially valuable for our study, as it confirms that when analyzing the role of generative AI in feedback aimed at fostering critical thinking, it is necessary to consider the

specific concerns and priorities of teachers in each academic stage. For instance, while primary teachers emphasize motivation and the creation of engaging materials, secondary teachers are more concerned about misuse and resource generation, and higher education teachers focus on ethics, safety, and continuous training. These differentiated perceptions provide us with a framework to understand how feedback supported by AI may require tailored approaches depending on the context, reinforcing the importance of teacher training that addresses both opportunities and risks for critical thinking development.

Overall, the international studies reviewed reveal a growing global interest in the integration of artificial intelligence into educational assessment and feedback processes, particularly in higher education contexts. Despite differences in methodologies ranging from systematic literature reviews and large-scale quantitative surveys to exploratory qualitative inquiries, the studies converge on several common trends.

First, teachers and students generally recognize the potential of AI to enhance personalization, efficiency, and feedback practices. Second, concerns consistently emerge regarding ethical issues, technological dependence, academic integrity, and the possible weakening of critical thinking skills. Furthermore, the literature highlights that the successful implementation of AI in education depends not only on technological availability but also on teacher training, institutional policies, and pedagogical readiness. At the same time, an important gap can be identified: although many studies examine perceptions of AI adoption broadly, fewer specifically analyze how teachers perceive the use of generative AI in formative feedback processes aimed at fostering critical thinking. This gap reinforces the relevance of the present study, particularly within teacher education programs in the Colombian higher education context.

National background

In the Colombian context, Bedoya Villa et al. (2024) developed the degree project entitled *"Percepciones, desafíos y beneficios de la inteligencia artificial en la educación superior"* at *Universidad El Bosque* (Bogotá), had the purpose of analyzing the perceptions, challenges and benefits associated with the use of artificial intelligence tools by teachers and students of the Bachelor's Degree in Literature and Spanish Language at a higher education institution in Medellín, in order to generate recommendations on their proper implementation. The research is

framed within a qualitative approach with a hermeneutic phenomenological design, applying Likert-type surveys, semi-structured interviews and focus groups to collect experiences and perceptions.

This work was based on hermeneutic phenomenology (Husserl, 1998; Van Manen, 2003), which allowed us to interpret the perceptions and experiences of teachers and students regarding the use of AI from their social and educational contexts. The findings show a positive disposition towards the incorporation of these tools, but also limitations marked by the lack of technological infrastructure, connectivity problems and lack of digital training. Likewise, teachers expressed concerns about the possible impact on critical thinking and student dependence, while recommendations point to the need for continuous training, curricular inclusion and institutional policies to ensure pedagogical and ethical integration of AI in higher education.

This study is relevant to our research because it explores the perceptions of both teachers and students in higher education regarding the opportunities and challenges of artificial intelligence. Its findings are particularly useful for our study since they reveal not only a positive disposition toward AI integration but also critical concerns about technological barriers, lack of digital literacy, and the potential risk of weakening students' critical thinking through overdependence on AI tools. These insights align with our research focus by highlighting that teacher training and institutional policies are essential to ensure that AI-supported feedback fosters rather than hinders critical thinking. Moreover, the phenomenological approach adopted in this study provides a deeper understanding of how social and educational contexts shape perceptions, which can guide us in interpreting the complexities of teacher perspectives when analyzing the use of generative AI for feedback in our own research.

Díaz Ramírez & Díaz Ramírez (2024) developed the article entitled "The organization of experiences in the incorporation of artificial intelligence in the context of English language teaching and learning: a systematic approach". The study, conducted in Colombian universities during the period 2020-2023, aimed to examine educational experiences related to the integration of AI in English language teaching, through an exploratory approach with content analysis, documentary review and Likert-type surveys applied to teachers and students of UNAD and Universidad Santo Tomás.

This work was based on content analysis (Fernández, 2002; Hernández et al., 2014), which allowed systematizing experiences of AI integration in English teaching in Colombian universities. The findings show that the use of tools such as chatbots, LMS, H5P, Quizlet, Turnitin or ChatGPT has favored strategies of self-learning, gamification and personalization of teaching, in line with active learning approaches and pedagogical mediation supported by technology. However, limitations were also identified, such as the scarcity of research in the area, the absence of clear institutional policies and the need to strengthen infrastructure and teacher training in order to reduce the digital divide and promote inclusive and sustainable education.

This work is really significant for our research because it provides a systematic overview of how artificial intelligence has been integrated into English language teaching in Colombian universities. Their findings show that tools such as chatbots, LMS platforms, Quizlet, Turnitin, and ChatGPT promote self-learning, gamification, and personalization, while also revealing important challenges such as the lack of institutional policies, limited research in the area, and the urgent need for teacher training and infrastructural strengthening. This perspective is highly relevant to our study since it highlights both the pedagogical opportunities and the risks that must be addressed to ensure that AI-supported feedback contributes to the development of critical thinking rather than merely automating tasks. Furthermore, by analyzing teachers' and students' perceptions, this work offers a contextualized understanding of how generative AI can be adopted in ways that are inclusive, sustainable, and aligned with active learning approaches, which directly informs the framework of our investigation.

Another significant contribution in the Colombian context is Cervantes de la Cruz et al.'s (2024) article "Impact of artificial intelligence in the American University Institution in the city of Barranquilla." This research, with a mixed approach and non-experimental cross-sectional design, aimed to examine the impact of AI on the academic processes of the institution, identifying opportunities, benefits and risks in its implementation. To this end, the authors relied on documentary analysis of secondary sources and the application of instruments to students, teachers and administrators, in order to collect perceptions about the impact of AI in the educational environment.

This study was supported by theoretical frameworks on the transformative potential of AI in higher education (UNESCO, 2020; Moreno, 2019), highlighting both its benefits and the risks associated with technological dependence. The results show that students, faculty and administrators positively perceive the incorporation of AI to improve educational quality, foster creativity, innovation and strengthen institutional research. However, concerns also emerged related to the loss of fundamental human skills, objectivity in automated decisions, and ethical challenges in its implementation. These tensions reflect the need to train academic and administrative staff and to establish clear policies to ensure responsible and equitable integration of AI into university processes.

This particular study offers valuable insights for our research as it highlights the transformative potential of AI in fostering creativity and innovation within higher education institutions. Their findings reveal that both students and teachers perceive AI as a positive force for improving educational quality and research, particularly in its capacity to enhance creative processes and collaborative learning. At the same time, the study underscores critical challenges, such as the pressing need to train and prepare academic and administrative staff, as well as to invest in adequate resources and establish clear protocols for a responsible adoption of AI. This contribution is especially relevant for our investigation, as it emphasizes that feedback supported by generative AI will only foster critical thinking if institutions guarantee appropriate training, infrastructure, and ethical frameworks. By addressing these conditions, the study provides a roadmap for understanding how teacher perceptions of AI can be shaped by institutional readiness and support systems, which are fundamental to achieving meaningful and sustainable integration.

In the Colombian context, the reviewed studies demonstrate that the incorporation of artificial intelligence into higher education is still in a developing stage, characterized by both optimism regarding its pedagogical potential and concern about its ethical and institutional implications. Although the studies differ in methodological orientation, including phenomenological approaches, documentary analyses, and mixed-methods designs, they coincide in identifying teacher training, technological infrastructure, and institutional policies as determining factors for successful AI integration. Likewise, the Colombian literature emphasizes the relevance of AI for fostering personalized learning, self-learning strategies, and innovation in

language education, while simultaneously warning about risks related to technological dependence and the possible reduction of critical thinking abilities. Compared to the international literature, national studies appear to place greater emphasis on contextual limitations such as digital divides and institutional preparedness. However, there remains limited research specifically focused on how university teachers perceive the use of generative AI in formative feedback practices designed to strengthen critical thinking, especially within faculties of education. Therefore, the present study seeks to contribute to this emerging field by examining, within a single Colombian faculty of education, how professors perceive and use GenAI specifically for formative feedback aimed at critical thinking, rather than for assessment or personalization in general as most reviewed studies do, and by combining perception data with an in-depth qualitative analysis of how teachers themselves distinguish between AI as a corrector of products and AI as a mediator of students' reasoning processes, a distinction that remains largely unexamined in both the international and the Colombian literature.

Local backgrond

At the local level, the article "*Impacto de la Retroalimentación Formativa en el Desarrollo del Pensamiento Crítico y Creativo en la Educación Superior: Condiciones de Posibilidad y Desafíos en el Contexto Colombiano*", developed by Fabio Nelson Giraldo Arcila and César Augusto Delgado García (2025) at the Unidad Central del Valle del Cauca (UCEVA), aimed to analyze the conditions that enable formative feedback to act as a catalyst for the development of critical and creative thinking in university students. The research adopted a qualitative approach grounded in grounded theory (Strauss & Corbin, 2008), triangulating data from semi-structured interviews with twelve high-impact international researchers, documentary analysis of their publications, and Likert-type scales evaluating perceptions on educational policies and institutional conditions.

This study was grounded in a confluence of socioconstructivist theory (Vygotsky, 1978), Piagetian cognitive development (Piaget, 1952, 1972), feedback models (Hattie & Timperley, 2007), and critical perspectives on power and evaluation (Foucault, 1975, 1982). The findings identified three categories of barriers: structural ones, such as teacher overload, high student-to-teacher ratios, and limited time for personalized feedback; cognitive ones, related to insufficient

teacher training in feedback techniques; and policy-related ones, stemming from an institutional and national emphasis on summative and quantifiable assessments. Conversely, facilitators such as the use of clear rubrics, peer feedback, Socratic questioning strategies, and the integration of digital technologies and artificial intelligence were identified as key enablers of formative feedback processes. The study also underscores that Colombian regulatory framework, including Ley 115 de 1994 and Decreto 1330 de 2019, while recognizing educational quality, tend in practice to reproduce power dynamics that restrict the transformative potential of feedback.

This study constitutes a direct and fundamental antecedent for our research, as it was conducted within the same institutional context UCEVA and addresses the relationship between formative feedback and the development of critical thinking in higher education. Its findings are especially relevant because they identify both the structural barriers and the facilitating conditions that shape feedback practices at the local level, providing a situated framework that informs our own investigation. Specifically, the identification of teacher overload, high student-to-teacher ratios, and the absence of institutional policies as critical constraints resonates directly with the challenges faced by faculty members in the undergraduate programs of the Faculty of Education.

Furthermore, the study's emphasis on the potential of emerging technologies, particularly artificial intelligence, to personalize and optimize feedback aligns closely with our focus on teachers' perceptions and uses of generative AI in formative feedback processes. In this sense, the work of Giraldo and Delgado (2025) not only strengthens the theoretical foundation of our investigation but also provides a concrete institutional reference point for understanding the conditions under which AI-supported feedback can genuinely contribute to fostering critical thinking at UCEVA.

At the local level, the reviewed study provides a particularly significant contribution because it situates the discussion of formative feedback and critical thinking within the institutional realities of UCEVA. Unlike broader international and national studies that focus mainly on perceptions of AI adoption, this research emphasizes the structural, pedagogical, and policy-related conditions that shape feedback practices in higher education. Its findings reveal that challenges such as teacher overload, limited time, and insufficient institutional support

directly affect the development of formative feedback processes, while the integration of digital technologies and AI emerges as a possible facilitator.

This local perspective establishes a direct connection with the present research, as it demonstrates that the implementation of AI-supported feedback cannot be understood exclusively from a technological standpoint, but rather as a phenomenon deeply influenced by institutional culture, teacher preparation, and educational policies. Consequently, the current study expands this discussion by specifically exploring teachers' perceptions regarding the use of generative AI in feedback practices aimed at fostering critical thinking within undergraduate teacher education programs.

Taken together, the reviewed international, national, and local studies reveal a clear expansion of research on the use of artificial intelligence in educational assessment, feedback, and teaching practices. Across contexts, there is a shared recognition that AI has the potential to enhance personalization, efficiency, creativity, and access to educational resources. However, the literature also consistently identifies tensions related to ethics, academic integrity, technological dependence, teacher preparedness, and the possible impact of AI on students' critical thinking abilities.

From a methodological perspective, the studies demonstrate considerable diversity, including quantitative surveys, mixed-methods designs, systematic reviews, grounded theory approaches, and phenomenological inquiries. This methodological plurality enriches the field by providing both measurable trends and in-depth understandings of teachers' and students' experiences. Nevertheless, many studies remain centered on general perceptions of AI adoption, without specifically examining how generative AI is being integrated into formative feedback processes aimed at strengthening critical thinking.

Likewise, important contextual differences emerge among the international, national, and local literature. International studies tend to focus on large-scale adoption patterns, technological acceptance, and ethical debates, whereas Colombian studies place greater emphasis on institutional limitations, digital divides, teacher training needs, and the challenges of contextual implementation. At the local level, the evidence highlights the structural and pedagogical realities that directly condition feedback practices within higher education institutions.

In this sense, a research gap becomes evident: there is still limited empirical research focused on teachers' perceptions of the use of generative AI in formative feedback processes specifically oriented toward the development of critical thinking in teacher education programs. Therefore, the present study seeks to contribute to the field by addressing this gap through a contextualized analysis within the Faculty of Education at UCEVA, integrating both the pedagogical and technological dimensions involved in AI-supported feedback practices.

Theoretical Framework

This section establishes the theoretical foundation that supports the research by presenting the key concepts and models that frame the study. It begins by examining GenAI and its emerging role in higher education, particularly in relation to formative feedback practices. Subsequently, it discusses formative feedback as a pedagogical strategy for promoting learning and fostering critical thinking, highlighting the role of teachers in mediating these processes. The chapter then examines teachers' perceptions through the Unified Theory of Acceptance and Use of Technology (UTAUT2), which provides the conceptual framework for understanding the factors influencing the adoption and use of GenAI in educational contexts. Finally, the integration of these concepts provides the theoretical basis for addressing the research question concerning the relationship between teachers' perceptions of GenAI and its use in formative feedback practices oriented toward the development of critical thinking within the Faculty of Education at UCEVA.

Critical thinking

Critical thinking has evolved as a central concept in philosophy, education, and psychology, consolidating itself as a cognitive skill, a reflective disposition, and a social practice aimed at analyzing, evaluating, and transforming information. Its comprehensive conceptualization is essential for the formation of autonomous and responsible students capable of addressing the challenges of an interconnected and complex world.

Historically, the origins of critical thinking can be traced back to classical philosophy. Socrates introduced the method of maieutics, a dialogical approach based on deep questioning designed to examine beliefs and promote rational reflection. Later, Aristotle established logic as a

valid and systematic tool of reasoning, laying the foundations for formal critical analysis. In modern philosophy, René Descartes emphasized *methodical doubt* as a means to attain certain knowledge, proposing that one should "reject as absolutely false everything in which an error could be supposed" (*Discourse on the Method*, 2006). Within this philosophical tradition, critical thinking was configured as the ability to question assumptions, detect fallacies, and justify judgments rationally, becoming an ethical and epistemological practice inseparable from autonomy (Lipman, 2003).

From a more contemporary perspective, the notion of critical thinking is also linked to issues of power and subjectivity. Michel Foucault (1975, 1982) analyzed evaluation practices as mechanisms of power that shape students' subjectivities, arguing that standardized and hierarchical assessments tend to produce docile subjects. However, if feedback is redefined as a formative and dialogical process, it can transform power relations in the classroom and foster autonomy. In this sense, critical thinking is not only about reasoning skills but also about the capacity to resist and question the structures in which knowledge is produced and legitimized.

In psychology and education, critical thinking has been addressed from a developmental and pedagogical perspective. Jean Piaget (1952, 1972) argued that learning occurs through the processes of assimilation and accommodation, in which individuals reorganize their cognitive schemes when confronted with new challenges. Critical thinking, therefore, emerges when learners face discrepancies between prior conceptions and new evidence, leading them to processes of re-equilibration and cognitive restructuring. Complementarily, Lev Vygotsky (1978) emphasized the sociocultural construction of knowledge, highlighting the role of interaction and mediation within the Zone of Proximal Development (ZPD).

From this perspective, critical thinking is enhanced through guided dialogue and formative feedback, which allow students to internalize new concepts and gradually develop autonomy and critical awareness. In educational evaluation, this idea has been further developed through feedback models. Hattie and Timperley (2007) proposed that effective feedback should answer three essential questions: *Where am I going? How am I doing? What is next?* These questions promote metacognitive reflection and self-regulation, enabling students to analyze their

strategies, identify areas for improvement, and plan further actions. In this way, feedback becomes a powerful tool for fostering critical thinking beyond mere error correction.

In recent years, the debate on critical thinking has been enriched by the integration of formative feedback and technology. Shute (2008) emphasized that feedback must be specific, clear, and timely in order to foster deep reflection and self-regulation. Similarly, Wiliam (2018) argued that feedback lies at the heart of formative assessment, though it only becomes effective when embedded in pedagogical practices that help students understand quality criteria, reflect on them, and improve autonomously. These contemporary perspectives highlight that critical thinking does not emerge from content knowledge alone, but rather through continuous formative processes that are increasingly supported by technology, personalization, and immediacy.

Within the framework of this research, critical thinking is understood as a cognitive, social, and political process particularly relevant in higher education. This definition integrates several dimensions: the restructuring of cognitive schemes in response to evidence (Piaget, 1952, 1972); the sociocultural and dialogical mediation of knowledge construction (Vygotsky, 1978); the metacognitive reflection and self-regulation enabled by formative feedback (Hattie & Timperley, 2007; Wiliam, 2018); and the capacity to challenge power structures in order to foster autonomy and emancipation (Foucault, 1975, 1982). This conception is further updated with the contributions of Shute (2008) and Wiliam (2018), who stress the importance of feedback that is formative, specific, and technologically mediated.

Consequently, critical thinking is defined as an essential competence for contemporary higher education, preparing students not only to analyze and solve problems but also to question and transform their educational and social contexts in an ethical and reflective manner.

Generative artificial intelligence (GenIA)

Artificial intelligence (AI) has evolved over more than six decades, from its first theoretical formulations to current applications that transform multiple areas of social and educational life. Its origins date back to the mid-20th century with the work of Alan Turing and his famous "Turing test" (1950), which raised the fundamental question of whether machines can think. Shortly afterwards, at the 1956 Dartmouth Conference, the term "Artificial Intelligence"

was coined and the foundations for formal research were laid. At this event, Allen Newell and Herbert A. Simon developed the Logic Theorist, the first AI program capable of proving mathematical theorems, demonstrating that machines could solve problems requiring cognitive abilities.

Artificial intelligence (AI) can be broadly defined as the field of computer science devoted to creating systems capable of performing tasks that typically require human intelligence such as reasoning, learning, perception, and language understanding (Russell & Norvig, 2021). Since its formal inception in the 1950s, AI has evolved through alternating periods of optimism and skepticism, often referred to as AI winters. A major turning point occurred in the 1990s with the development of machine learning, and later in the 2000s with deep learning, when the combination of improved algorithms, notably Geoffrey Hinton's backpropagation method, and the availability of vast data volumes enabled neural networks to achieve unprecedented predictive performance (Goodfellow, Bengio, & Courville, 2016). These milestones laid the groundwork for the emergence of generative AI models that currently reshape educational and feedback practices.

In conceptual terms, artificial intelligence can be defined as the capacity of a system to perceive its environment, learn from the information obtained and execute actions oriented to the fulfillment of specific objectives. Russell and Norvig (2021) propose that it is the design of intelligent agents capable of maximizing their chances of success in given tasks, while Kaplan and Haenlein (2019) understand it as the ability of a system to interpret external data, learn from them and use this learning to achieve specific goals. These definitions show that AI is not a univocal concept, but a dynamic field that admits different approaches and classifications, both in terms of its cognitive capacity and the technological approaches that support it.

A first classification distinguishes the types of AI according to their level of capability. In this sense, narrow artificial intelligence (ANI) corresponds to systems designed to perform specific tasks within a delimited domain, such as voice recognition, recommendation systems or virtual assistants (Nilsson, 2009). Their main advantage lies in the efficiency with which they can solve practical problems in defined contexts, which has enabled important advances in medicine, education and transportation (Kaplan & Haenlein, 2019).

However, its main limitation is the impossibility of transferring the acquired knowledge from one field to another, which restricts its applicability and prevents it from reaching a level of flexible reasoning comparable to the human one (Russell & Norvig, 2021). Despite this limitation, more advanced language models such as GPT-4 have begun to perform "multi-tasking", which has blurred the boundary of what was considered the exclusive domain of strong AI.

Artificial general intelligence (AGI), in contrast, is conceived as a more ambitious horizon that seeks the development of systems capable of reasoning, learning and adapting to different domains with a level similar to that of human beings (Goertzel, 2014). Its advocates claim that, if achieved, it would radically transform science and society by enabling full cognitive autonomy in machines. However, authors such as Bostrom (2014) warn that its realization remains in the realm of speculation, since there is still no empirical evidence demonstrating the technical feasibility of this type of intelligence.

Even more distant is the idea of a superintelligent artificial intelligence (SIA), defined as an entity that would surpass human intelligence in all fields (Bostrom, 2014). Those who defend it argue that it could solve global problems such as climate change or the cure of complex diseases. However, critics such as Yudkowsky (2015) emphasize the existential risks that such a system would entail, as it could generate a loss of human control in the face of technologies more advanced than ourselves.

From the technological point of view, the first significant approach was symbolic artificial intelligence, supported by the explicit representation of knowledge and the application of logical rules for problem solving (Poole & Mackworth, 2017). This paradigm made possible the creation of expert systems useful in fields such as medical diagnosis or legal advice. Even so, its rigidity soon became evident, since it could not learn from new data without constant reprogramming, which limited its scalability (Nilsson, 2009).

Subsequently, connectionist artificial intelligence, driven by the rise of neural networks and deep learning, marked a turning point in the discipline. Thanks to its ability to process large volumes of data and recognize complex patterns, it has enabled remarkable advances in image recognition, computer vision and natural language processing (LeCun, Bengio & Hinton, 2015).

Its strength lies in its versatility and predictive capacity, although several authors have pointed out that its "black box" nature makes it difficult to understand the internal processes that lead to a decision, which raises concerns about the lack of explainability and transparency (Lipton, 2018).

Finally, generative artificial intelligence has established itself as one of the most relevant developments in recent years. This type of AI focuses on the creation of original content whether text, images, music, code, or simulations from patterns learned from large databases (Goodfellow et al., 2014; Floridi & Chiriatti, 2020). As a category, generative AI encompasses a diverse and rapidly expanding ecosystem of applications, including large language models, image and audio generators, and multimodal systems, each built on the same underlying generative principle but differing in modality, architecture, and intended use. The fundamental architecture behind most modern generative language models is the Transformer, a neural network introduced by Google in 2017 that revolutionized natural language processing. The Transformer uses two key innovations: positional encoding, which integrates word order without processing words sequentially, and self-attention, which assigns a weight to each part of the input data according to its importance, allowing models to focus on the most relevant parts of a sequence. Together, these techniques have enabled the training of massive models with hundreds of billions of parameters on Internet-scale datasets, unlocking their ability to generate "human-like" content.

The public release of consumer-facing tools built on this architecture most notably OpenAI's ChatGPT in November 2022 accelerated the broader accessibility of generative AI and brought widespread public and institutional attention to its educational applications; however, such tools represent particular implementations of the generative AI paradigm rather than the concept itself, and the analytical focus of this study remains on generative AI as a technological category rather than on any specific commercial platform. Its potential is evident, as this category of technology enables new forms of personalized feedback, fosters creativity, and favors the construction of more interactive learning environments. However, recent research warns that generative AI systems can also reproduce biases, generate inaccurate information, and raise ethical dilemmas around authorship and veracity of knowledge (Bender et al., 2021).

Beyond its technical potential, the effective integration of artificial intelligence into higher education also requires the development of digital competence among teachers. According

to the European Framework for the Digital Competence of Educators (DigCompEdu) (Redecker, 2017), digital competence involves not only technical skills but also the pedagogical, ethical, and critical capacities necessary to integrate digital technologies meaningfully into teaching and assessment practices.

In the context of generative AI, digital competence includes the ability to critically evaluate AI-generated content, design pedagogically appropriate activities, ensure ethical and responsible use of technology, and foster students' critical thinking through digitally mediated learning environments. Therefore, the pedagogical integration of AI should not be understood as the simple incorporation of technological tools, but rather as a reflective process in which teachers adapt technologies according to educational objectives, disciplinary contexts, and students' learning needs.

Recent literature emphasizes that insufficient digital competence constitutes one of the principal barriers to AI adoption in education, particularly in contexts where institutional support and professional development opportunities remain limited (Holmes et al., 2022). This barrier is closely related to two dimensions examined empirically later in this study: teachers' perceived ease of use of GenAI tools (Effort Expectancy) and the institutional, technological, and training conditions that support their implementation (Facilitating Conditions). As will be shown in Chapter IV, teachers' self-reported digital competence and their perceptions of institutional support directly shape both their willingness to adopt generative AI and the depth of its pedagogical integration into feedback practices. Consequently, teacher training becomes essential to ensure that AI-supported feedback contributes to meaningful learning and critical thinking development instead of reinforcing superficial or mechanized educational practices, and this need is later reflected in teachers' own expressed demand for stronger institutional support and specialized pedagogical training.

Consequently, although the various classifications of artificial intelligence show the conceptual richness of the field, this paper focuses on the analysis of generative AI. The choice of this subconcept does not ignore the relevance of other forms of AI, but responds to the need to understand how these tools, as agents capable of producing new content, can have a direct impact

on academic feedback processes and the promotion of critical thinking in contemporary higher education.

Within the framework of this research, we adopt the definition of generative artificial intelligence proposed by Floridi and Chiriatti (2020), who understand it as the capacity of computational systems to produce new content, whether textual, visual or sound, based on the recognition of patterns in large volumes of data, without implying semantic understanding or genuine creativity in human terms.

This definition is particularly appropriate for analyzing academic feedback and critical thinking processes in higher education because it explicitly separates the technology's generative capacity from any claim of genuine understanding or reasoning on the part of the system. This distinction is analytically necessary for the present study: if GenAI is understood as merely reproducing learned patterns rather than genuinely understanding or reasoning about student work, then the pedagogical responsibility for ensuring that feedback promotes reflection, self-regulation, and critical thinking rather than superficial pattern-matching remains with the teacher who mediates its use, not with the technology itself. Adopting a definition that overstated the system's cognitive capacities would risk obscuring this pedagogical responsibility and could implicitly support the assumption that AI-generated feedback is inherently equivalent to human pedagogical judgment.

This positioning is therefore relevant because it allows us to recognize both the disruptive potential of these technologies in educational scenarios, as well as the critical tensions they raise in relation to authorship, veracity, and the formation of critical thinking. Thus, the analysis of generative AI in this paper is not limited to its technical foundations, but is oriented towards understanding its impact on academic feedback processes and on the construction of more reflective and interactive learning environments in higher education.

Formative Assessment

The concept of formative assessment has come a long way historically, to become consolidated as one of the central pillars of educational innovation. Its origins date back to the work of Scriven (1967), who first established the distinction between formative and summative

assessment. While summative assessment was conceived as a process of certification and measurement of learning outcomes, formative assessment was oriented towards supporting and improving teaching during its development. Shortly thereafter, Bloom (1969) emphasized that assessment should not be reduced to grading, but should function as a continuous mechanism for guiding learning, allowing both teachers and students to recognize progress and difficulties.

In the following decades, the concept evolved significantly. Sadler (1989) argued that formative assessment should not be limited to the delivery of corrective feedback, but should be understood as a process that allows the student to close the gap between his or her current performance and the expected level. This approach emphasized the essential role of feedback as a tool for self-regulation and critical reflection. Later, Black and Wiliam (1998), in their influential review Inside the Black Box, provided solid empirical evidence that showed that formative assessment produces substantial improvements in student achievement, especially among students from disadvantaged backgrounds. Their work solidified the idea that formative assessment was not simply a technique, but a pedagogical strategy with profound potential to promote equity and deep learning.

Given that this study is centrally concerned with feedback practices rather than with formative assessment as a whole, it is necessary to distinguish precisely among three related but non-equivalent concepts used throughout this research. Formative assessment refers to the broader pedagogical process of gathering and interpreting evidence about student learning in order to adjust teaching and support progress (Heritage, 2010; Black & Wiliam, 1998); it encompasses a wide range of practices, of which feedback is only one component.

Formative feedback, more specifically, refers to the information provided to learners about their performance or understanding, with the explicit purpose of closing the gap between current and desired performance and guiding subsequent learning actions (Sadler, 1989; Shute, 2008). Academic feedback, as used in this study, refers more broadly to any feedback exchanged within academic or institutional contexts including AI-generated feedback and does not necessarily carry the developmental, gap-closing intent that defines formative feedback specifically. Throughout this research, generative AI is examined primarily in its capacity to produce academic feedback, with particular attention to the conditions under which that feedback

functions formatively, that is, when it is used to support reflection, self-regulation, and critical thinking, rather than merely to correct or evaluate a finished product.

In conceptual terms, formative assessment has been defined from different perspectives. For Heritage (2010), it is a process that requires the systematic collection and interpretation of evidence on student learning in order to continuously adapt teaching. Popham (2008), on the other hand, emphasizes its practical dimension as a constant procedure that informs pedagogical decisions in real time. Andrade and Cizek (2010) add that formative assessment also involves active student participation through self- and co-assessment, which promotes agency and metacognitive awareness. These perspectives show that formative assessment is not a univocal concept, but a multidimensional practice that articulates teacher intervention, student engagement and curricular integration.

Throughout its development, the concept has also been criticized. Bennett (2011) warns that its implementation is often superficial, reduced to checklists or low-impact activities that do not generate a real feedback loop. Wiliam (2011) points out that formative assessment is not a single method, but a broad set of practices that require coherence and planning to unfold their true potential. Despite these tensions, the available evidence agrees that formative assessment contributes significantly both to academic improvement and to the development of critical thinking and autonomy.

In recent years, formative assessment has also been increasingly connected to concepts such as feedback literacy and self-regulated learning, especially within digitally mediated educational environments. Contemporary perspectives on formative assessment increasingly emphasize the importance of feedback literacy, understood as the capacity of students and teachers to interpret, process, and effectively use feedback to improve learning (Carless & Boud, 2018). Feedback literacy goes beyond the mere transmission of comments, as it involves the development of evaluative judgment, reflective capacities, and active engagement with feedback processes.

Closely related to this concept is self-regulated learning, which refers to learners' ability to monitor, control, and adapt their cognitive, motivational, and behavioral strategies in pursuit of academic goals (Zimmerman, 2002). Nicol and Macfarlane-Dick (2006) further argue that

formative feedback fulfills its developmental function only when it actively supports learners' capacity for self-regulation for instance, by helping students generate their own internal feedback, monitor their progress against clear goals, and take corrective action rather than functioning as a one-directional transmission of judgment from teacher to student. From this perspective, feedback becomes effective only when students are able to understand it, critically reflect upon it, and transform it into concrete actions for improvement.

In higher education, the integration of generative AI into feedback practices introduces new opportunities and challenges for feedback literacy and self-regulation. AI systems can provide immediate, personalized, and adaptive feedback; however, there is also the risk that students may become overly dependent on automated responses without engaging in deeper reflective or metacognitive processes. Consequently, the pedagogical value of AI-supported feedback depends largely on teachers' ability to design formative practices that promote autonomy, critical reflection, and meaningful engagement with feedback rather than passive reception of information.

In consideration of the various conceptualizations, this research adopts as its main reference the perspective of Black and Wiliam (1998), whose contribution constitutes a milestone in the understanding of formative assessment, complemented by the feedback-specific frameworks of Hattie and Timperley (2007) and Sadler (1989), which more precisely address the mechanisms through which feedback rather than assessment in general supports learning. Black and Wiliam's empirical review demonstrated that formative assessment has one of the most significant impacts on learning and educational equity, becoming a global reference in educational research and policy, while Hattie and Timperley's (2007) model of feedback specifically clarifies the conditions under which feedback effectively closes the gap between current and desired performance namely, by addressing three key questions ("Where am I going?", "How am I going?", and "Where to next?") that are directly relevant to evaluating the pedagogical quality of AI-generated feedback in this study.

Basing the analysis on this combined framework allows us to recognize formative assessment not only as a pedagogical technique, but also as a transformative practice that redefines the role of assessment within the teaching and learning process, while grounding the

analysis of feedback specifically in frameworks designed to explain how feedback functions as a mechanism for learning.

Teachers' Perceptions

Teachers' perceptions constitute a key element in the successful integration of educational technologies, since they directly influence attitudes, intentions, and pedagogical practices related to innovation. In educational research, perceptions are commonly understood as the set of beliefs, interpretations, expectations, and attitudes that individuals construct regarding a phenomenon based on their experiences and sociocultural contexts (Pajares, 1992). In the case of artificial intelligence, teachers' perceptions shape not only their willingness to adopt technological tools, but also the ways in which these tools are pedagogically integrated into assessment and feedback practices.

Research on educational technology adoption has consistently shown that teachers' beliefs about usefulness, ease of use, and pedagogical value strongly condition the implementation of innovations in the classroom (Ertmer, 2005). From this perspective, teachers are not passive users of technology but active agents who interpret, negotiate, and adapt technological tools according to their professional identities, institutional conditions, and educational goals.

One of the most influential frameworks for understanding technology adoption is the Technology Acceptance Model (TAM) proposed by Davis (1989), which establishes that perceived usefulness and perceived ease of use determine users' attitudes toward technological systems. Building upon this perspective, Venkatesh et al. (2012) developed the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2), a model that integrates multiple explanatory variables related to technology adoption, including performance expectancy, effort expectancy, social influence, facilitating conditions, hedonic motivation, habit, and behavioral intention.

The UTAUT2 model is particularly relevant to this research because it provides a theoretical framework for analyzing the factors that shape teachers' perceptions and intentions regarding the use of generative AI in academic feedback processes. Performance expectancy refers to the extent to which teachers believe that AI can improve feedback quality, efficiency, or

student learning outcomes. Effort expectancy addresses the perceived ease of integrating these technologies into pedagogical practices, while social influence highlights the role of colleagues, institutional culture, and educational trends in shaping adoption decisions. Facilitating conditions, in turn, emphasize the importance of institutional support, training opportunities, and technological infrastructure.

Recent studies on artificial intelligence in education demonstrate that teachers' perceptions toward AI are often characterized by tensions between optimism and caution. On the one hand, teachers recognize the potential of AI to personalize feedback, reduce workload, and enhance creativity and innovation in teaching practices (Luckin, 2018; Holmes et al., 2019). On the other hand, concerns emerge regarding ethical issues, academic integrity, technological dependence, data privacy, and the possible weakening of students' critical thinking skills (Bender et al., 2021; Crawford, 2021).

From a sociocultural perspective, teachers' perceptions are also mediated by contextual and professional factors such as teaching experience, disciplinary background, institutional policies, and access to digital resources. Ertmer (1999) distinguishes between first-order barriers, related to infrastructure and access, and second-order barriers, associated with teachers' beliefs, attitudes, and resistance to change. This distinction is particularly significant in higher education contexts, where the successful integration of AI depends not only on technological availability but also on teachers' pedagogical readiness and critical understanding of these tools.

Within the framework of this research, teachers' perceptions are understood as the set of beliefs, attitudes, expectations, and interpretations that faculty members construct regarding the use of generative artificial intelligence in formative feedback processes aimed at fostering critical thinking. This conception integrates technological, pedagogical, ethical, and institutional dimensions, recognizing that AI adoption in higher education is not merely a technical issue but also a sociocultural and educational phenomenon shaped by teachers' professional experiences and contextual realities.

Unified Theory of Acceptance and Use of Technology 2 (UTAUT2)

The Unified Theory of Acceptance and Use of Technology 2 (UTAUT2), proposed by Venkatesh et al. (2012), is one of the most widely recognized theoretical models for explaining individuals' acceptance and use of emerging technologies. Developed as an extension of the original Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003), UTAUT2 incorporates additional motivational constructs that enhance its explanatory capacity across different technological contexts. The model has been extensively applied in educational research to examine the factors that influence teachers' and students' adoption of digital technologies, including learning management systems, mobile learning, educational platforms, and, more recently, generative artificial intelligence (AI) (Dwivedi et al., 2023; Khlaif et al., 2024).

Within higher education, the growing incorporation of generative AI into teaching, learning, and assessment processes has increased the relevance of UTAUT2 as a framework for understanding the factors that influence educators' decisions to adopt these technologies. Rather than assuming that technology is adopted solely because it is available, the model recognizes that acceptance depends on a combination of cognitive, social, motivational, and contextual factors that shape teachers' behavioral intentions and actual use (Venkatesh et al., 2012). Consequently, UTAUT2 provides a robust theoretical basis for examining how university teachers perceive the potential of generative AI and the conditions under which they are willing to integrate it into formative feedback practices.

For the purposes of this study, the dimensions of UTAUT2 constitute the conceptual basis for analyzing teachers' perceptions of generative AI within the Faculty of Education at UCEVA. Each construct contributes to understanding different aspects of technology acceptance and pedagogical integration.

Performance Expectancy refers to the degree to which teachers believe that the use of generative AI can improve their professional performance. In this study, this construct is associated with the perceived ability of AI to enhance the quality, efficiency, and timeliness of formative feedback, as well as its potential to support students' learning and critical thinking development (Venkatesh et al., 2012).

Effort Expectancy refers to the perceived ease of learning and using generative AI tools in educational contexts. Teachers are more likely to adopt technologies that they perceive as intuitive, accessible, and compatible with their existing pedagogical practices (Venkatesh et al., 2012).

Social Influence describes the extent to which teachers perceive that important individuals or institutional environments encourage the adoption of generative AI. Colleagues, academic leaders, institutional policies, and broader educational trends may all contribute to shaping teachers' attitudes toward technological innovation (Venkatesh et al., 2012).

Facilitating Conditions refer to the organizational and technical resources that support technology adoption. These include institutional policies, professional development opportunities, technological infrastructure, and access to technical assistance, all of which influence teachers' capacity to integrate AI effectively into their teaching practices (Venkatesh et al., 2012).

Hedonic Motivation refers to the intrinsic enjoyment or satisfaction experienced when using a technology. Although originally associated with consumer technologies, this construct has also been applied in educational settings to explain how positive experiences with digital tools may encourage their continued pedagogical use (Venkatesh et al., 2012).

Price Value represents the user's evaluation of the relationship between the perceived benefits and the costs associated with technology use. In educational contexts, where generative AI applications often include both free and subscription-based services, this construct may involve teachers' perceptions regarding whether the pedagogical benefits justify the investment of time, effort, or financial resources required for implementation (Venkatesh et al., 2012).

Habit refers to the extent to which previous experience with a technology leads individuals to use it automatically as part of their regular professional practice. As teachers become increasingly familiar with generative AI, repeated use may contribute to its routine integration into instructional and feedback activities (Venkatesh et al., 2012).

Behavioral Intention reflects teachers' willingness and commitment to continue using generative AI in their pedagogical practices. According to UTAUT2, behavioral intention is one of the strongest predictors of future technology adoption and sustained use (Venkatesh et al., 2012).

Although ethical considerations are not included among the original constructs of UTAUT2, recent literature on generative AI emphasizes that issues such as academic integrity, transparency, privacy, algorithmic bias, and responsible use play an increasingly important role in teachers' acceptance of these technologies (UNESCO, 2023; Holmes et al., 2022). For this reason, the present study incorporated ethical considerations as a complementary analytical dimension within the research instrument. This addition acknowledges that decisions regarding the pedagogical use of generative AI are influenced not only by technological acceptance but also by educators' ethical judgments concerning its responsible implementation in formative feedback processes.

Chapter III: Methodological Framework

Approach

This research adopted a mixed-methods approach, combining the rigor of quantitative analysis with the interpretative depth of qualitative inquiry, given the complexity of a phenomenon that involves both measurable patterns in the use of GenAI for academic feedback and the subjective meanings teachers construct around this practice. This choice was grounded in the principle of complementarity proposed by Greene et al. (1989) and supported by Johnson and Onwuegbuzie (2004) and Creswell and Plano Clark (2018), who argue that combining methods is particularly suited to complex educational phenomena. In this study, complementarity was operationalized through a single instrument combining closed- and open-ended questions: the quantitative strand was necessary to capture the extent and patterns of GenAI use across the UTAUT2 dimensions, addressing the study's first and second specific objectives, while the qualitative strand was necessary to interpret the experiences, expectations, and perceived barriers that these patterns alone could not explain, addressing the third specific objective. The study was further guided by a pragmatic paradigm (Tashakkori & Teddlie, 2010, 2015; Johnson et al., 2007), which prioritized the practical demands of the research problem over allegiance to a single methodological stance, making the integration of both strands analytical rather than merely procedural, since each objective required a different type of evidence to be answered in full.

Methodological design

This study adopts a convergent mixed-methods design (Creswell & Plano Clark, 2018), which allows for the simultaneous collection of quantitative and qualitative data, their independent analysis, and subsequent integration. The selection of this design responds to the need to compare and relate both types of data in order to achieve a more robust interpretation of the phenomenon.

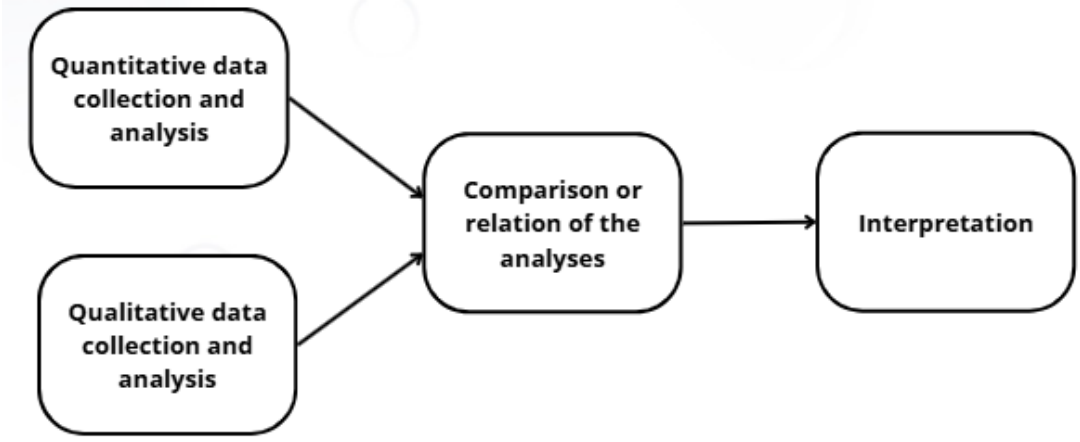
In particular, data triangulation plays a central role in this study, as it enables the convergence, complementarity, and validation of findings obtained through different methods. By comparing quantitative results (e.g., trends in AI use and perceptions) with qualitative evidence (e.g., teachers' experiences and reflections), the study strengthens the credibility and

depth of the analysis. This triangulation is especially valuable in relation to the research objectives, as it allows not only identifying patterns in the adoption of AI but also explaining the pedagogical reasoning and contextual factors that shape its use in fostering critical thinking.

As illustrated in Figure 1, this convergent design unfolded in three phases. In the first phase, quantitative and qualitative data were collected concurrently through a single instrument: the closed-ended UTAUT2-based items and the three open-ended questions described in the Instruments section above. In the second phase, each data type was analyzed independently and according to its own methodological logic the closed-ended responses through descriptive statistics organized by UTAUT2 dimension, and the open-ended responses through thematic analysis using the Categorization Matrix as detailed in the Data Analysis Process section of this chapter. In the third phase, the separate quantitative and qualitative results were integrated through convergence matrices and joint displays, allowing meta-inferences that connect teachers' self-reported patterns of use with the meanings and tensions expressed in their open-ended responses, as presented in the Discussion chapter.

Figure 1

Convergent parallel design



Source: Adapted from Creswell (2013, p. 209), cited in Andino Jaramillo (2022).

Scope

This study adopts a predominantly exploratory-descriptive scope. Following Hernández-Sampieri et al. (2014), exploratory studies are appropriate when a phenomenon has been insufficiently examined within a specific context, while descriptive studies aim to characterize its properties and manifestations as they occur. This study combines both because, although GenAI has received increasing attention in international educational research regarding its adoption, opportunities, and challenges in higher education (Dwivedi et al., 2023; Khlaif et al., 2024), little is known about how professors in the Faculty of Education at UCEVA perceive and integrate these technologies into formative feedback practices aimed at fostering critical thinking. The exploratory component therefore predominates because it addresses this specific contextual gap, while the descriptive component characterizes professors' perceptions, current practices, and levels of GenAI adoption. In addition, the study incorporates a relational, non-inferential layer, examining how the UTAUT2 constructs (performance expectancy, effort expectancy, social influence, facilitating conditions, hedonic motivation, price value, habit, and behavioral intention) are descriptively and interpretatively associated with professors' reported use of GenAI, consistent with the study's exploratory-descriptive scope and without inferential statistical testing.

As Yin (2018) argues, focusing on a single, bounded educational context enables a deeper understanding of complex phenomena as they unfold in real-world settings. The institutional delimitation of this study to the Faculty of Education at UCEVA, already described in the Context and Objectives, is therefore not merely a practical boundary but a methodological choice consistent with this exploratory-descriptive scope, aimed at generating contextualized evidence that may inform institutional decision-making on the pedagogically meaningful integration of GenAI into formative feedback practices.

In order to ensure methodological coherence between the research objectives, the theoretical constructs derived from the UTAUT2 model, and the data collection instrument, the operationalization matrix of the study is presented in Table 1, at the end of this chapter, once the instrument and the data analysis procedures have been described.

Population and sample

The target population of this study consists of the faculty members of the four undergraduate programs within the Faculty of Education at UCEVA. Due to the professional dynamics and varying levels of technological engagement among the faculty, a non-probability self-selection sampling technique was employed. This approach, as defined by Saunders et al. (2019), relies on the voluntary participation of individuals who identify with the research topic, ensuring that the collected data stems from professors with a genuine interest or direct experience in the use of Artificial Intelligence within their pedagogical practices. It is important to acknowledge that this sampling strategy carries an inherent risk of self-selection bias: faculty members with stronger interest in, or more favorable predispositions toward, generative AI may have been more likely to participate than their colleagues, which limits the extent to which the findings can be considered representative of the entire faculty population and should be interpreted as reflecting the perceptions of an engaged subset of teachers rather than the Faculty of Education as a whole.

For the quantitative component, the sample is composed of those faculty members who voluntarily accessed and completed the UTAUT2-based instrument, resulting in a final sample of 66 participants distributed across the four undergraduate programs of the Faculty of Education (see Table 1). This sampling method is justified in educational research when the goal is to obtain high-quality, reflective data from a specific professional group rather than a purely statistical generalization, as suggested by Sharma (2017).

To ensure the relevance of the participants, specific inclusion criteria were applied: (1) active teaching status in the Faculty of Education, and (2) explicit informed consent. Previous experience with generative AI was not established as an inclusion criterion; rather, both current users and non-users of GenAI were intentionally included in the sample, since capturing the perceptions of both groups was necessary to understand the full range of attitudes, barriers, and expectations toward AI-supported feedback across the faculty including the reasons underlying non-adoption. Conversely, exclusion criteria included faculty members with strictly administrative roles and participants who submitted incomplete instruments, ensuring the integrity of the data collected for analysis.

Regarding the qualitative component, the analysis includes the open-ended responses provided by all 66 self-selected participants who completed the questionnaire, without the application of additional selection criteria beyond those already described for the quantitative component; no responses were excluded from the thematic analysis on the basis of their content. The depth of this analysis is guided by the principle of theoretical saturation, as proposed by Patton (2015) and Guest et al. (2020)

In this study, saturation was considered to have been reached when the successive coding of open-ended responses ceased to generate new categories or codes within the categorization matrix described earlier in this chapter that is, when the last several responses reviewed could be fully accommodated within the existing categories, subcategories, and codes without requiring the creation of new ones. This ensures that the data collection continues until the emerging themes regarding AI perceptions and critical thinking reach a point of redundancy, providing a robust and authentic diagnostic of the faculty's current digital reality.

Table 1

Teachers enrolled in undergraduate programs at the Faculty of Education

Undergraduate Program	Total, Teaching Staff	Teaching staff excluding those belonging to various programmes
Licenciatura en Educación Física, Recreación y Deporte	23	19
Licenciatura en Lenguas Extranjeras con Énfasis en inglés	32	26
Licenciatura en Ciencias Sociales	8	5
Licenciatura en Educación Infantil	3	2
Total	**66**	**52**

Note. Source Oficina de Gestión Humana UCEVA (2025).

Instruments

UTAUT2 Questionnaire

A structured questionnaire was selected as the primary data collection instrument because it allows for the standardized, simultaneous collection of quantitative and qualitative data from a dispersed faculty population, consistent with the convergent mixed-methods design adopted in this study and with the operationalization of the UTAUT2 constructs. Accordingly, the primary data collection instrument for this study was an adapted questionnaire based on the instrument developed by Khlaif et al. (2024) in the study University Teachers' Views on the Adoption and Integration of Generative AI Tools for Student Assessment in Higher Education. The original instrument, grounded in the Unified Theory of Acceptance and Use of Technology (UTAUT2) (Venkatesh et al., 2012), was published as part of the original study and was therefore available for academic adaptation with appropriate acknowledgment of the source.

Given the specific objectives and context of the present research, the original questionnaire underwent a process of linguistic, contextual, and conceptual adaptation. Linguistically, several items were reworded to improve clarity and coherence for the target participants. Contextually, references to higher education in general were modified to reflect the institutional reality of the Faculty of Education at Unidad Central del Valle del Cauca (UCEVA). Conceptually, the instrument was refined to focus specifically on the use of generative artificial intelligence (GenAI) in formative feedback practices aimed at fostering critical thinking. As part of this adaptation, some items from the original questionnaire were removed because they were not aligned with the objectives of the study, while new items addressing formative feedback, critical thinking, and ethical considerations related to AI were incorporated. Consequently, although the original questionnaire contained 42 items, the adapted version included approximately 31 items, with minor variations resulting from the branching structure of the instrument.

The adapted questionnaire was subjected to a qualitative content validation process before its final administration. Six university professors holding master's and doctoral degrees

participated as expert judges. These experts were selected based on their academic background and professional experience in areas directly related to the study, including English language education, educational technology, pragmatics, and critical thinking. Each expert reviewed the instrument in terms of clarity, relevance, coherence, and contextual appropriateness, providing qualitative observations and recommendations for improving the wording and organization of the items (see Appendix 2 for the expert validation report and pilot test summary). Their feedback contributed to refining the final version of the questionnaire and ensuring its alignment with the research objectives and institutional context.

Following the expert review, the revised instrument was pilot-tested with ten professors from UCEVA who shared characteristics similar to those of the target population. The pilot study served to identify ambiguous wording, verify the logical sequence of the questions, and evaluate the overall comprehensibility of the instrument. Based on the participants' feedback and the recommendations obtained during the expert validation process, minor revisions were made to improve the clarity and contextual relevance of several items before the final application. Since the primary purpose of the adaptation process was to ensure contextual adequacy rather than psychometric validation, no statistical coefficients of validity or reliability were calculated.

The final questionnaire was organized into different sections that combined quantitative and qualitative data collection strategies. The first section gathered demographic and professional information about the participants. The second section consisted of Likert-type items structured according to the dimensions of the UTAUT2 model, while the third included multiple-choice and frequency questions regarding teachers' actual use of GenAI in formative feedback practices. Finally, three open-ended questions were incorporated to explore participants' experiences, expectations, ethical concerns, and perceived institutional needs related to AI-supported formative feedback. The questionnaire employed a five-point Likert response scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). An additional response option, Not Applicable, was included for participants who had not yet used generative AI but were able to express their expectations regarding its potential educational use.

Because the study followed a branching design, participants were directed to different sections depending on whether they reported previous experience using generative AI. This

structure allowed current users to answer questions based on their actual pedagogical practices, while participants without prior experience responded to items exploring their expectations, perceived barriers, and intentions regarding future adoption. Consequently, the instrument captured both existing practices and potential adoption perspectives without requiring respondents to answer questions that were not applicable to their experience.

The Likert-scale section of the questionnaire operationalized the constructs of the UTAUT2 model within the context of formative feedback supported by generative AI. Specifically, Performance Expectancy examined teachers' perceptions of the usefulness of GenAI for improving formative feedback; Effort Expectancy explored the perceived ease of learning and using these technologies; Social Influence assessed the extent to which colleagues and the institutional environment encouraged AI adoption; Facilitating Conditions evaluated the availability of institutional resources and technical support; Hedonic Motivation examined teachers' interest and enjoyment in using GenAI; Price Value explored the perceived balance between benefits and costs associated with AI adoption; Habit assessed the degree to which AI use had become integrated into teachers' regular pedagogical practices; and Behavioral Intention measured participants' willingness to continue incorporating GenAI into formative assessment activities. Complementary items addressing ethical issues, including bias, privacy, transparency, and responsible AI use, were also incorporated in accordance with recent international recommendations (MEN, 2024; OECD, 2021; UNESCO, 2023)

Collectively, the questionnaire addressed the first and second specific objectives of the study by identifying teachers' perceptions regarding the use of generative AI in formative feedback practices and describing the relationships between these perceptions, institutional conditions, and reported uses of AI in educational assessment.

To address the third specific objective, a complementary analytical instrument, namely a Categorization Matrix for Open-Ended Responses, was developed. Unlike the questionnaire, which generated quantitative information, this matrix was designed to support the systematic qualitative analysis of teachers' narratives obtained through the three open-ended questions. These questions were intended to explore dimensions that closed-ended items could not adequately capture: teachers' concrete experiences using GenAI to provide feedback and their

students' reactions (Question 1); the distinction between feedback focused on a specific product and feedback aimed at cognitive processes such as argumentation and reflection (Question 2); and the conditions considered necessary at UCEVA for GenAI-supported feedback to contribute to the development of critical and creative thinking (Question 3). The full wording of these questions is provided in *Appendix 1* The responses to these questions constitute the primary input for the qualitative analysis operationalized through the categorization matrix described below.

Ethical Considerations

This study adhered to the ethical principles required for research involving human participants. Prior to data collection, all participants received clear information about the purpose of the study, the voluntary nature of their participation, and their right to withdraw at any point without any academic or professional consequence, as presented in the introductory section of the virtual questionnaire (Figure 2). Explicit informed consent was obtained from each participant through the instrument itself, before access to the questionnaire items was granted.

To protect participants' confidentiality, the questionnaire was administered anonymously: no personally identifying information (such as names or institutional ID numbers) was collected, and responses were associated only with participants' academic program for the purposes of the comparative analysis presented in this chapter. Qualitative excerpts included in the results are identified only by an anonymized participant code (e.g., DLE#4, DEF#9), never by name. Data were stored securely and accessed only by the research team for purposes directly related to this study.

Participation was entirely voluntary, consistent with the non-probability self-selection sampling strategy described earlier in this chapter; no incentives were offered, and no faculty member was required or pressured to participate. Regarding data management, collected data were stored in Google Forms and were retained for 2 years, after which they will be securely deleted, in accordance with the data protection policies of UCEVA and applicable Colombian data protection legislation (Ley 1581 de 2012).

Data Analysis Process

The data were analyzed through a convergent mixed-methods design, in which quantitative and qualitative data were processed independently before being integrated, following an analytical sequence explicitly aligned with the study's three specific objectives.

For the first specific objective to describe teachers' perceptions and uses of generative AI in formative feedback across the dimensions of the UTAUT2 model the closed-ended items of the questionnaire were analyzed through descriptive statistics (means, standard deviations, and response-frequency distributions), calculated for each UTAUT2 dimension and reported both for the faculty as a whole and disaggregated by current use of GenAI (users and non-users), as presented in the results corresponding to Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions, Hedonic Motivation, Price Value, Habit, and Ethical Considerations and Perceived Risks.

For the second specific objective to identify differences in the use and perception of AI-supported feedback across academic programs the same closed-ended data were compared descriptively across the four undergraduate programs of the Faculty of Education by calculating and contrasting mean scores for each UTAUT2 dimension. No inferential statistical procedure (e.g., ANOVA or Kruskal-Wallis) was applied at this stage, given the markedly uneven distribution of participants across programs (ranging from n=3 to n=32), which would compromise the assumptions required for group-comparison testing; the analysis therefore remained descriptive in nature, as reported in the comparison of mean scores across programs.

For the third specific objective to interpret the experiences, expectations, and perceived barriers expressed in the open-ended questions of the questionnaire the qualitative responses were analyzed through thematic analysis, following the categorization matrix described earlier in this chapter, which combined deductive coding derived from the theoretical framework with inductive coding emerging from participants' responses, organized across the three analytical dimensions of Pedagogical Use of GenAI, Types of Feedback, and Necessary Conditions.

Finally, consistent with the convergent mixed-methods design adopted in this study, the quantitative and qualitative findings were integrated through convergence matrices and joint

displays, allowing for meta-inferences that connected teachers' self-reported patterns of use and perception with the meanings, tensions, and expectations expressed in their open-ended responses, an integration process presented in the discussion section of this chapter.

Table *2* synthesizes the operationalization of the study, linking each specific objective to its corresponding variables, dimensions, categories, indicators, instrument items, and the data analysis procedure applied to each, thereby ensuring full methodological traceability between the research design and its empirical execution.

Table 2

Operationalization matrix of the study variables

Dimension	**Category / Subcategory**	**Indicators**	**Instrument Items**	**Data Analysis**
SO1 Teachers' perceptions toward GenAI use in formative feedback (UTAUT2)				
Performance expectancy	Perceived usefulness of AI for feedback quality and efficiency	Degree to which teachers believe GenAI improves comment clarity, stimulates higher-order cognitive processes, and fosters critical thinking. Note: PE4 is reverse-coded.	Item 8; PE1 · PE2 · PE3 · PE4	Descriptive statistics (means, SD, frequency distributions)
Effort expectancy	Perceived ease of use and integration of GenAI	Level of difficulty teachers associate with learning, integrating, and understanding GenAI outputs. Note: EE4 is reverse-coded.	Item 9; EE1 · EE2 · EE3 · EE4	Descriptive statistics (means, SD, frequency distributions)
Social influence	Institutional and collegial pressure to adopt GenAI	Extent to which peers, leaders, and program culture encourage/discourage GenAI use	Items 10/21; IS1 · IS2 · IS3	Descriptive statistics (means, SD, frequency distributions)
Facilitating conditions	Institutional infrastructure and technical support	Availability of resources, compatibility with platforms, prior knowledge, adherence to ethical guidelines	Items 11/22; FC1 · FC2 · FC3 · FC4	Descriptive statistics (means, SD, frequency distributions)

Hedonic motivation	Enjoyment and discomfort perceived when using GenAI	Level of pleasure/discomfort using GenAI for critical-thinking feedback. Note: HM2 is reverse-coded.	Items 12/23; HM1 · HM2	Descriptive statistics (means, SD, frequency distributions)
Price value	Cost-benefit perception of GenAI tools	Whether pedagogical benefits justify time, money, and effort invested	Items 13/24; PV1 · PV2	Descriptive statistics (means, SD, frequency distributions)
Habit	Regularity and automaticity of GenAI use	Degree to which GenAI use is already routine, and willingness to continue. Note: H2 is reverse-coded.	Items 14/25; H1 · H2 · H3	Descriptive statistics (means, SD, frequency distributions)
Behavioral intention	Projected future use of GenAI in feedback	Willingness to integrate GenAI in the near future (via H3 as proxy)	Items 14/25; H3 (proxy)	Descriptive statistics (means, SD, frequency distributions)
Ethical and risk dimension	Awareness of risks: bias, privacy, accuracy	Perceived competence to detect bias, concern for privacy, verification of accuracy	Items 17/28; DER1 · DER2 · DER3	Descriptive statistics (means, SD, frequency distributions)
SO2 — Relationships between perceptions, institutional conditions, and GenAI use by program				
Type of use	Specific purposes of GenAI use in feedback	Flagging errors, correcting products, explaining concepts, detecting student errors, adapting to cognitive level	Items 15/26; TU1–TU5 (multiple choice)	Descriptive comparison of mean scores across academic programs
Frequency of use	Regularity of GenAI use for critical thinking	Self-reported: Never/Rarely/Sometimes/Frequently/Always	Items 16/27 (ordinal scale)	Descriptive comparison of mean scores across academic programs
Inter-program differences	Variation in perceptions and practices by program	Differences in UTAUT2 scores, adoption rates, feedback types across the four programs	Item 4 × items 8–17/21–28	Descriptive comparison of mean scores across academic programs

SO3 — Experiences, expectations, and perceived barriers (open-ended questions)				
Pedagogical use of GenAI	Type of use (UPG1), tool (UPG2), feedback type (UPG3), product/process focus (UPG4), student reactions (UPG5–7)	Concrete experiences and students' reported reactions	Items 18/29; Q1	Thematic analysis via the Categorization Matrix (deductive–inductive coding; Braun & Clarke, 2006, 2021)
Types of feedback	Product feedback (TR1–2), Process feedback (TR3–5), Role of AI: corrector/mediator (TR6–7)	Distinction between surface-error feedback and higher-order cognitive processes	Items 19/30; Q2	Thematic analysis via the Categorization Matrix (deductive–inductive coding; Braun & Clarke, 2006, 2021)
Necessary conditions	Institutional (CI1–2), Pedagogical (CI3–4), Ethical (CI5–6), Culture (CI7–8)	Conditions needed at UCEVA for GenAI-mediated feedback to foster critical/creative thinking	Items 20/31; Q3	Thematic analysis via the Categorization Matrix (deductive–inductive coding; Braun & Clarke, 2006, 2021)
Ethical tensions and opportunities	Tensions: dependency, bias, integrity; Opportunities: autonomy, dialogic feedback, reflective capacity	Ethical dilemmas and transformative potentials tied to students' intellectual autonomy	Items 18–20/29–31 + DER1–3	Thematic analysis via the Categorization Matrix (deductive–inductive coding; Braun & Clarke, 2006, 2021), triangulated with quantitative DER items

Note. The questionnaire uses branching logic: teachers who used GenAI (item 7 = yes) answer blocks 8–20; those who have not skip to item 21 and answer blocks 21–31. Both routes include the same UTAUT2 blocks (SI, FC, HM, PV, HA) and the same open-ended questions, enabling comparison between users and non-users. The PE and EE blocks (items 8 and 9) are exclusive to teachers who do use GenAI. Reverse-coded items (PE4, EE4, HM2, H2) require recoding prior to analysis.

Quantitative Analysis:

Quantitative data obtained through closed-ended items were analyzed using Microsoft Excel. The analysis plan was organized in two stages, consistent with the study's two specific quantitative objectives.

For the first objective, to describe participants' perceptions of AI-supported feedback, descriptive statistics were employed, including means, standard deviations, and frequencies, in order to identify patterns, tendencies, and variations in participants' responses. These descriptive measures were selected according to the ordinal/interval measurement level of the Likert-type items used in the questionnaire. Descriptive analyses were conducted separately for each of the UTAUT2 constructs represented in the questionnaire Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions, Hedonic Motivation, Price Value, and Habit as well as for the complementary variables addressing critical thinking and formative feedback incorporated into the instrument.

For the second objective, to identify patterns and variations in the use and perception of AI-supported feedback across variables and academic programs, a descriptive comparative analysis was carried out by examining differences in means, percentages, and frequency distributions across the four academic programs. Inferential statistical procedures (e.g., ANOVA, Kruskal-Wallis, Pearson's or Spearman's correlation) were deliberately not applied, for three converging reasons: (a) they would be inconsistent with the exploratory-descriptive scope declared for this study; (b) the disproportionate size of some academic-program subgroups (n = 3 and n = 8) would compromise the statistical validity and interpretability of any inferential test; and (c) the analytical software employed, Microsoft Excel, does not support the non-parametric inferential procedures that unequal, small-sized subgroups would require. Consequently, the

observed differences across programs are reported as descriptive tendencies rather than as statistically validated effects.

Together, these analyses allowed for an organized interpretation of the data, examining how participants perceived the incorporation of artificial intelligence in feedback practices oriented toward the development of critical thinking, and describing patterns and variations across the variables and programs under study. Consistent with the study's convergent design, these quantitative findings were subsequently integrated with the qualitative evidence, as detailed below.

Qualitative Analysis:

The open-ended responses from the questionnaire underwent a reflexive thematic analysis (Braun & Clarke, 2006, 2021), following six phases: (1) familiarization with the data, through repeated readings of the open-ended responses; (2) initial coding, in which meaningful segments of text were assigned descriptive codes; (3) searching for themes, grouping related codes into candidate categories and subcategories; (4) reviewing themes, in which candidate categories were checked against the coded extracts and refined for internal coherence; (5) defining and naming themes, resulting in the final categories, subcategories, and codes presented in the categorization matrix used in this study; and (6) producing the report, corresponding to the integration and presentation of these findings in the results and discussion sections of this study.

Consistent with the categorization matrix described earlier, coding combined deductive and inductive strategies rather than proceeding through purely inductive coding. The initial set of categories and dimensions (Pedagogical Use of GenAI, Types of Feedback, and Necessary Conditions) was established deductively from the study's theoretical framework, while the specific subcategories and codes within each dimension emerged inductively through the coding phases described above. This hybrid procedure ensured transparency and rigor according to the criteria of credibility, dependability, and confirmability established by Lincoln and Guba (1985), and was further supported through researcher triangulation and explicit traceability between textual excerpts and their corresponding interpretations.

Analytical Instrument: Categorization Matrix for Open-Ended Responses

The second, complementary instrument is an analytical tool: a categorization matrix developed by the research team to systematically organize, classify, and interpret the qualitative data derived from the three open-ended questions included in the questionnaire. This matrix directly serves the third specific objective of the study: to interpret the experiences, expectations, and perceived barriers expressed in the open-ended questions of the questionnaire, in order to understand the meanings, ethical tensions, and opportunities that teachers attribute to the use of AI in formative feedback.

The matrix was constructed following the thematic analysis approach proposed by Braun and Clarke (2006, 2021), integrating deductive and inductive coding as suggested by Flick (2018). The deductive component was established a priori from the theoretical framework underpinning the study, namely the UTAUT2 model and the formative feedback literature, which provided the initial dimensions (Pedagogical Use of GenAI, Types of Feedback, Necessary Conditions) and several of their categories.

The inductive component emerged from repeated readings of the teachers' responses, giving rise to specific subcategories and codes (e.g., the distinction between corrector and mediator roles, and the subcategories describing student reactions) that were not anticipated in the original framework. This hybrid procedure is consistent with the predominantly inductive orientation adopted in the qualitative analysis presented later in this study: the deductive dimensions functioned as an organizing structure, while the substantive interpretation of meanings, tensions, and codes followed an inductive logic grounded in the data, allowing both theoretically expected themes and context-specific meanings to be identified.

Finally, consistent with the convergent mixed-methods design adopted in this research, the quantitative and qualitative data were collected simultaneously through the same questionnaire but analyzed independently according to their respective methodological procedures. The findings were subsequently integrated during the interpretation phase through triangulation, allowing quantitative patterns to be contrasted and enriched with participants' narratives. This integration facilitated a more comprehensive understanding of teachers'

perceptions, experiences, and uses of generative AI in formative feedback practices aimed at fostering critical thinking.

The categorization matrix was organized into three deductive dimensions, each corresponding to one of the open-ended questions of the questionnaire: Pedagogical Use of GenAI (Question 1), Types of Feedback (Question 2), and Necessary Conditions (Question 3). Within each dimension, categories and subcategories were defined to capture both the practices reported by teachers and, where relevant, an inductively derived interpretive layer. For instance, in the Types of Feedback dimension, the distinction between Product and Process Feedback draws on Hattie and Timperley (2007) and Shute (2008), who frame feedback as either corrective or developmental; complementarily, the Role of AI category (corrector vs. mediator) was coded operationally according to whether the AI-generated response merely identified an error or prompted the student to reconsider, argue, or reflect on their own reasoning. Similarly, in the Pedagogical Use of GenAI dimension, student-related responses were coded as an independent category, Impact on Students, rather than as indicators of teachers' practices, since they reflect the teacher's perception of an outcome in the student, a distinct analytical unit from the practice itself. The complete set of dimensions, categories, subcategories, and codes is presented in Table 3.

Table 3

Dimensions, Categories, and Codes of the Categorization Matrix for Open-Ended Responses

Dimension	Category	Subcategory / Code
Pedagogical Use of GenAI (Q1)	Pedagogical Use of GenAI	Type of use (UPG1); Tool employed (UPG2)
	Feedback	Type of response (UPG3); Product/process focus (UPG4)
	Impact on Students	Student reactions (UPG5); Comprehension (UPG6); Motivation (UPG7)

Types of Feedback (Q2)	Product Feedback	Error correction (TR1); Product improvement (TR2)
	Process Feedback	Argumentation (TR3); Reflection (TR4); Critical thinking (TR5)
	Role of AI	Corrector (TR6); Mediator (TR7)
Necessary Conditions (Q3)	Institutional Conditions	Technological infrastructure (CI1); Access to tools (CI2)
	Pedagogical Conditions	Teacher training (CI3); Didactic strategies (CI4)
	Ethical Conditions	Responsible AI use (CI5); Academic integrity (CI6)
	Institutional Culture	Teacher attitudes (CI7); Educational innovation (CI8)

Note. UPG = Pedagogical Use of GenAI; TR = Types of Feedback; CI = Necessary Conditions. Codes were derived through a hybrid coding process combining deductive categories from the UTAUT2 model and the formative feedback literature with categories inductively generated from participants' narratives (Braun & Clarke, 2006, 2021; Flick, 2018).

The matrix was applied across the four undergraduate programs of the Faculty of Education. Coding was conducted through an initial global process across the full set of responses, which allowed the categories, subcategories, and codes described above to stabilize; this global coding was subsequently disaggregated by program to identify both cross-cutting patterns and discipline-specific particularities. In terms of validity, the instrument's content validity and internal consistency were supported through expert review and peer debriefing of the categorization scheme prior to its full application (Hernández-Sampieri et al., 2014), rather than resulting automatically from the construction of the matrix itself; likewise, the qualitative rigor criteria of credibility and confirmability (Lincoln & Guba, 1985) were reinforced through the analytical strategies applied during the qualitative analysis, including researcher triangulation and explicit traceability between textual excerpts and their corresponding interpretations.

Together, the questionnaire and the categorization matrix fulfill complementary and distinct methodological functions: the former served as the data collection instrument for the first and second specific objectives, while the latter served as the analytical instrument through which the qualitative data addressing the third specific objective were systematized and interpreted. This distinction ensures methodological coherence between the research objectives and the data collected, enabling a comprehensive and contextually grounded analysis of teachers' perceptions and uses of generative AI in academic feedback at UCEVA. This coherence is further demonstrated in the data analysis stage through the integration of quantitative and qualitative findings by means of joint displays, convergence matrices, and meta-inferences, which establish a direct analytical link between the categorization procedures described here and the study's final interpretive conclusions.

Figure 2

Categorization Matrix for Open-ended responses.

Institución: Unidad Central del Valle del Cauca								
Facultad: Ciencias de la Educación								
Programa: Licenciatura en Lenguas Extranjeras con énfasis en Inglés								
Proyecto: Understanding and Use of Artificial Intelligence in Academic Feedback by Professors in the Undergraduate Programs of the Faculty of Education at UCEVA: Its Contribution to the Development of Critical Thinking.								
Matriz de Clasificación Respuestas abiertas								
Pregunta	**Categoría**	**Subcategoría**	**Código**	**Fragmento textual**				**Interpretación**
				Licenciatura en Educación Infantil	**Licenciatura en lenguas Extranjeras**	**Licenciatura en Educación física**	**Licenciatura en Ciencias sociales**	
Describa una experiencia concreta en la que haya utilizado GenAI para retroalimentar: ¿qué devoluciones generó y cómo reaccionaron sus estudiantes?	Uso pedagógico de GenAI	Tipo de uso	UPG1					
		Herramienta Utilizada	UPG2					
	Retroalimentación	Tipo de devolución	UPG3					
		Enfoque (producto/proceso)	UPG4					
	Impacto en estudiantes	Reacción estudiantil	UPG5					
		Comprensión	UPG6					
		Motivación	UPG7					
Describa un ejemplo en el que la IA generativa haya retroalimentado un producto puntual (ej. señalar error) y un ejemplo en el que haya retroalimentado un proceso cognitivo (ej. ayudar a argumentar o reflexionar)	Retroalimentación de producto	Corrección de errores	TR1					
		Mejora del producto final	TR2					
	Retroalimentación de proceso	Argumentación	TR3					
		Reflexión	TR4					
		Pensamiento crítico	TR5					
	Rol de la IA	IA como corrector	TR6					
		IA como mediador	TR7					
¿Qué condiciones considera necesarias en la UCEVA para que el uso de GenAI en la retroalimentación contribuya al desarrollo del pensamiento crítico y creativo?	Condiciones institucionales	Infraestructura tecnológica	CI1					
		Acceso a herramientas	CI2					
	Condiciones pedagógicas	Formación docente	CI3					
		Estrategias didácticas	CI4					
	Condiciones éticas	Uso responsable de IA	CI5					
		Integridad académica	CI6					
	Cultura institucional	Actitud docente	CI7					
		Innovación educativa	CI8					

Note. UPG = Pedagogical Use of GenAI; TR = Types of Feedback; CI = Necessary Conditions. For each subcategory, the matrix records representative textual fragments per academic program, followed by the corresponding interpretive analysis.

Integration of Quantitative and Qualitative Results:

The open-ended responses from the questionnaire underwent a reflexive thematic analysis (Braun & Clarke, 2006, 2021),following six phases: (1) familiarization with the data, through repeated readings of the open-ended responses; (2) initial coding, in which meaningful segments of text were assigned descriptive codes; (3) searching for themes, grouping related codes into candidate categories and subcategories; (4) reviewing themes, in which candidate categories were checked against the coded extracts and refined for internal coherence; (5) defining and naming themes, resulting in the final categories, subcategories, and codes presented in the categorization matrix described earlier in this chapter; and (6) producing the report, corresponding to the integration and presentation of these findings in the results and discussion sections of this study.

The integration of quantitative and qualitative data was conducted at the final stage of the analytical process through the development of joint displays (Fetters, Curry, & Creswell, 2013). Each joint display was organized around one of the three qualitative dimensions of the categorization matrix (Pedagogical Use of GenAI, Types of Feedback, and Necessary Conditions), cross-referencing it with its corresponding UTAUT2 construct. For example, quantitative scores on Performance Expectancy were examined alongside the qualitative distinction between the AI's role as a corrector (TR6) or a mediator (TR7), in order to determine whether professors' reported usefulness of GenAI corresponded to product-focused or process-focused feedback practices. Similarly, quantitative scores on Facilitating Conditions were contrasted with the institutional, pedagogical, and ethical barriers identified under the Necessary Conditions category (CI1–CI8).

This procedure led to the generation of meta-inferences interpretations combining both approaches to provide an integrated response to the research question which were organized in a summary table with four columns: the UTAUT2 dimension, the corresponding quantitative finding, the related qualitative category, and the resulting meta-inference. This integration strategy was Planned in advance as part of the study's methodological protocol, consistent with the convergent mixed-methods design adopted from the outset of the research.

Chapter IV: Analysis and discussion of results

This chapter presents the analysis and discussion of the results obtained through the questionnaire administered to professors from the undergraduate programs of the Faculty of Education at UCEVA. The purpose of this analysis is to examine teachers' perceptions and uses of generative artificial intelligence in formative feedback practices oriented toward the development of critical thinking.

The analysis was conducted within a convergent mixed-methods design, in which quantitative and qualitative data collected through Likert-scale items and open-ended questions, respectively, were analyzed independently and subsequently integrated through a joint interpretation. The quantitative component addresses the first and second specific objectives of the study, focusing on identifying the predominant tendencies, perceptions, and attitudes expressed by participants regarding the pedagogical integration of generative AI into assessment and feedback processes, as well as the associations and differences among variables and academic programs. The qualitative component addresses the third specific objective, seeking to interpret the experiences, expectations, concerns, and reflections expressed by teachers concerning the opportunities and challenges associated with AI-supported feedback practices.

Rather than reducing the findings to isolated numerical descriptions, the results are analyzed in relation to the theoretical categories established in the referential framework, particularly the dimensions of the UTAUT2 model, formative assessment, critical thinking, pedagogical mediation, and teachers' perceptions toward educational technologies. Likewise, the qualitative findings contribute to deepening the understanding of the meanings and tensions underlying teachers' responses, allowing for a more contextualized and interpretative analysis of the phenomenon under study.

Consistent with the convergent mixed-methods design adopted in this study, the chapter is organized into three sequential stages: quantitative analysis, qualitative analysis, and the integration of both components through meta-inferences. The first section presents the quantitative analysis according to the dimensions explored in the instrument, including performance expectancy, effort expectancy, social influence, facilitating conditions, and the

relationship between AI-supported feedback and critical thinking development. The second section addresses the qualitative findings derived from the open-ended questions, focusing on teachers' experiences, ethical concerns, perceived barriers, and pedagogical expectations regarding the use of generative artificial intelligence in formative feedback practices. Finally, the chapter concludes with an integration stage, in which quantitative and qualitative findings are brought together through convergence matrices, joint displays, and meta-inferences a defining feature of the convergent design presented in the methodology, rather than a simple juxtaposition of two independent analyses.

Through this process, the chapter seeks not only to describe teachers' perceptions regarding generative artificial intelligence, but also to critically analyze the pedagogical, ethical, and institutional tensions that emerge from its integration into formative feedback practices within higher education contexts.

Analysis of the Quantitative Data

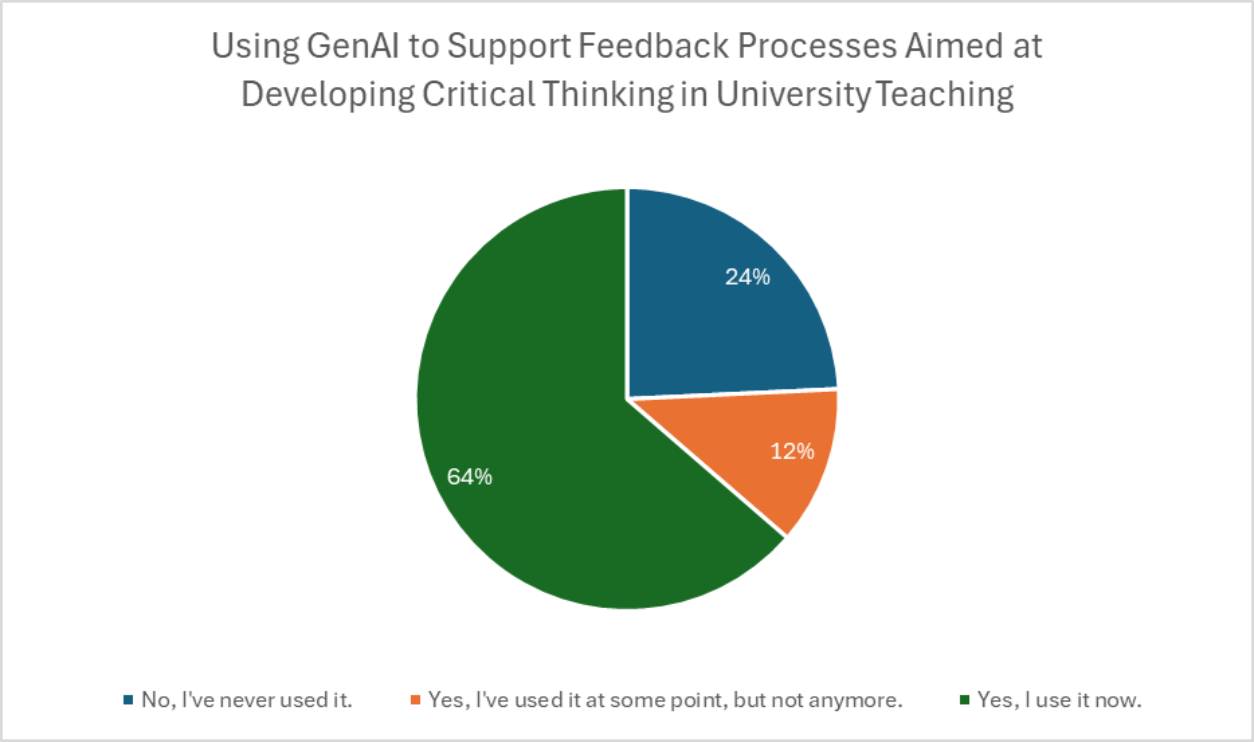
This section presents the quantitative results, organized according to the UTAUT2 dimensions described in the Instruments section above, together with the ethical and risk dimension incorporated into the questionnaire.

A total of 66 responses were collected from professors affiliated with the undergraduate programs of the Faculty of Education at UCEVA. The first question of the questionnaire explored participants' previous experience with generative artificial intelligence in feedback practices intended to support the development of critical thinking.

The results indicate that 42 teachers (63.6%) reported currently using generative AI tools in their professional practice. Additionally, 8 participants (12.1%) indicated that they had used these technologies in the past but no longer do so. In contrast, 16 respondents (24.2%) reported that they have never used generative AI for feedback-related purposes.

Figure 3

Distribution of teachers according to their reported use of GenAI in feedback practices.



Note. This figure presents the percentage distribution of teachers according to their experience with generative artificial intelligence, distinguishing between current users, former users, and participants who have never used AI tools in educational contexts.

These findings suggest that generative AI has already achieved a significant presence within the pedagogical practices of many faculty members. Nearly two-thirds of the participants reported currently incorporating AI tools into activities related to teaching and feedback. However, the results also indicate that adoption remains heterogeneous, as a considerable proportion of teachers either discontinued their use of these technologies or have not yet integrated them into their educational practices.

The questionnaire incorporated a branching structure that differentiated participants according to their reported experience with generative AI. Based on their responses to the initial question, teachers were directed to different sections of the survey designed to capture

experiences, perceptions, and expectations appropriate to their level of engagement with AI technologies.

The questionnaire incorporated a branching structure that differentiated participants according to their reported experience with generative AI: those who reported current use completed items related to direct experience with these technologies, including constructs such as effort expectancy, facilitating conditions, habit, frequency of use, and pedagogical applications, while participants who reported not currently using AI. including both former users and teachers who had never used these technologies, responded to questions focused on perceptions of usefulness, social influence, potential barriers, ethical concerns, and expectations regarding future adoption. As a result, the number of responses varies across some dimensions of the UTAUT2 model and related categories, allowing the instrument to capture both the experiences of current users and the perceptions of non-users, and thereby providing a more comprehensive understanding of the factors that facilitate, hinder, or shape the adoption of generative artificial intelligence in formative feedback practices.

The following sections present the results according to each analytical dimension, highlighting the similarities and differences observed among participants and examining how these perceptions contribute to understanding the current role of generative AI within teacher education programs.

Performance Expectancy

Performance Expectancy captures teachers' perceptions regarding the extent to which generative AI could enhance efficiency, personalize feedback, and strengthen critical thinking processes among students at UCEVA's Faculty of Education.

Figure 4

Results of the Performance Expectancy dimension among teachers who reported current use of GenAI.

Note. This graph shows the results of the survey items corresponding to the Performance Expectancy construct of the UTAUT2 model, among teachers who reported current use of GenAI.

The results revealed a predominantly favorable perception regarding the usefulness of generative AI in academic feedback processes. As shown in Figure 4, an average of approximately 80% of participants who reported current use of GenAI selected *"agree" or "I completely agree"* across items PE1 to PE3, indicating that most participants agreed with statements associated with the potential of AI tools to optimize assessment dynamics, facilitate feedback delivery, and support teaching practices through faster and more accessible responses.

A significant proportion of professors (86%, item PE1) recognized that generative AI may contribute to reducing the time invested in repetitive assessment tasks by helping them redact clear and useful comments on students' work, which is especially relevant in higher education contexts characterized by teacher overload and large student groups. In this sense, participants

perceived AI not only as a technological innovation, but also as a practical support mechanism capable of improving the efficiency of formative feedback practices this finding suggests that professors' initial entry point into GenAI use is primarily efficiency-driven rather than pedagogically-driven, which raises a relevant tension for the study's central concern: an emphasis on time-saving and error-correction may favor a corrector-oriented use of AI (focused on the product) over a mediator-oriented use (focused on the student's cognitive process), the latter being more directly aligned with the development of critical thinking.

Similarly, 74.5% of respondents (item PE2) considered that AI tools could facilitate more personalized feedback processes oriented toward fostering critical thinking, while 78% (item RE3) believed GenAI helped generate feedback that stimulates processes of analysis, evaluation, or creation in students the three highest-order cognitive processes in Bloom's revised taxonomy (Anderson & Krathwohl, 2001), widely regarded as indicators of critical thinking development. This perception is also consistent with Hattie and Timperley's (2007) conceptualization of high-quality feedback as feedback that operates beyond the task level, addressing the learning process and self-regulation rather than merely correcting the product. Taken together, these findings suggest that participants associated AI-supported feedback not only with improved communication and interaction within the assessment process, but with the potential to activate higher-order thinking processes central to critical thinking development.

However, despite the generally positive tendency, a considerable proportion of participants maintained neutral or cautious positions regarding the direct contribution of AI to the development of critical thinking. This is reflected in the response distribution for item PE4 (a reverse-coded item), in which 30% of participants agreed that GenAI *"solo permite señalar errores o aciertos sin profundizar en procesos cognitivos del estudiante,"* while 42% disagreed with this statement and 24% remained neutral. Although teachers recognized the operational advantages of these technologies, this pattern suggests emerging concerns regarding the possibility that excessive dependence on automated systems could weaken students' reflective capacities, autonomy, and argumentative processes.

These findings are consistent with the study conducted by Khlaif et al. (2024), specifically regarding their identification of perceived usefulness as one of the principal factors

influencing teachers' intention to adopt generative AI in educational contexts. Likewise, the results align with the perspectives of Hattie and Timperley (2007), who emphasize that feedback acquires pedagogical value only when it promotes reflection, self-regulation, and active engagement in learning processes.

From a pedagogical perspective, the findings suggest that teachers perceive AI as a potentially valuable tool for supporting formative assessment practices. Nevertheless, the results also reveal an important tension between technological efficiency and pedagogical depth. While participants value the capacity of AI to optimize academic processes, they simultaneously recognize the need to preserve reflective and dialogical dimensions within feedback practices a tension relevant to this study's overall objective, which is concerned not only with the perceived usefulness of AI, but with its potential to strengthen formative feedback practices oriented toward the development of critical thinking.

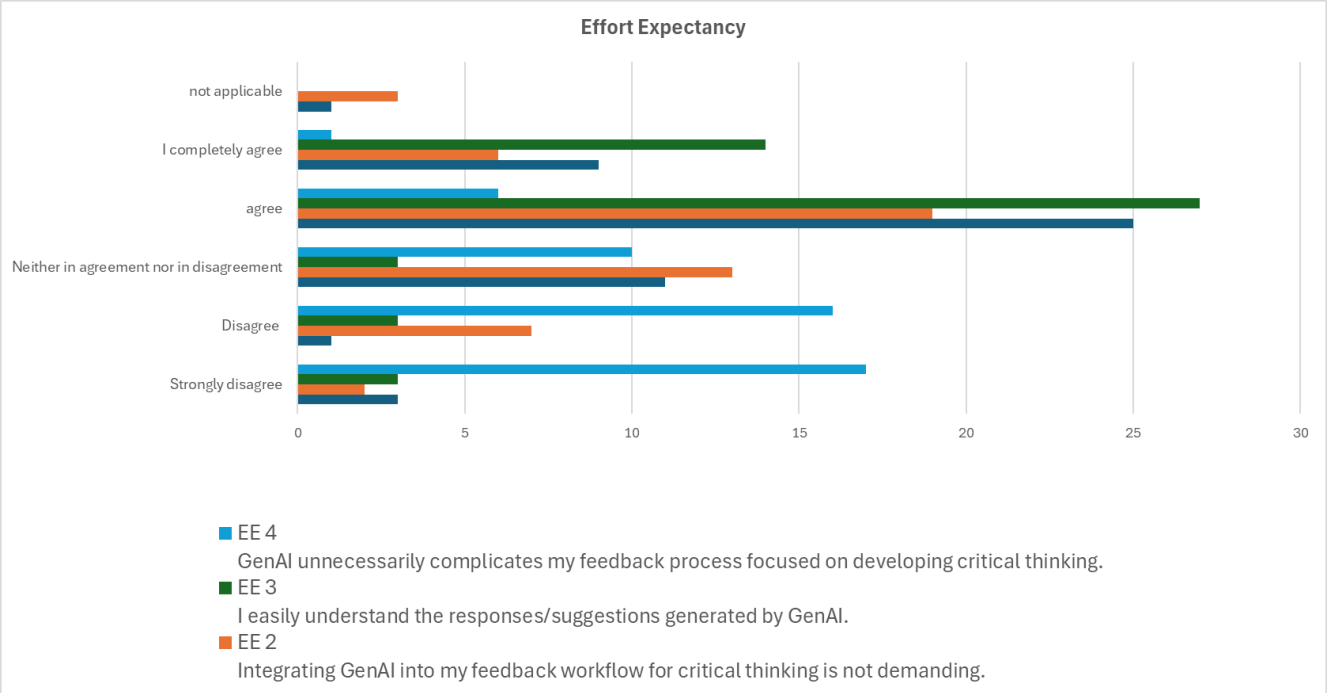
A critical reading of this tension, however, suggests that an efficiency-driven adoption of GenAI carries an inherent risk: if feedback is reduced to a fast, technically correct response, it may quietly displace the dialogical mediation that Vygotsky (1978) considered essential to knowledge construction, and weaken the emancipatory dimension that Foucault (1975, 1982) attributes to critical thinking namely, the student's capacity to question, rather than merely receive, evaluative judgments. In other words, the same feature that professors value most in GenAI, its capacity to optimize processes, is precisely what could undermine the reflective, dialogical conditions that this study identifies as necessary for critical thinking to develop. This suggests that the pedagogical value of GenAI-supported feedback does not depend on the technology itself, but on whether its use is deliberately oriented toward sustaining dialogue and reflection rather than merely accelerating response times.

Effort Expectancy

This dimension examined teachers’ perceptions regarding the ease of use and accessibility of generative artificial intelligence tools within formative feedback practices.

Figure 5

Results of the Effort Expectancy dimension among teachers who reported current use of GenAI.



Note. This graph shows the results of the survey items corresponding to the Effort Expectancy construct of the UTAUT2 model, among teachers who reported current use of GenAI. Own elaboration, based on data collected for this study.

The findings indicate that most participants perceive generative AI tools as relatively accessible and manageable within educational contexts. As shown in Figure 5, 68% of participants agreed or strongly agreed that learning to use GenAI for critical-thinking-oriented feedback was easy (item EE1), and 82% agreed or strongly agreed that they easily understood the responses and suggestions generated by GenAI (item EE3). This positive tendency is further reinforced by item EE4 (a reverse-coded item), in which 66% of participants disagreed or strongly disagreed with the statement that GenAI unnecessarily complicates their feedback process, while only 14% agreed with it. Many teachers expressed agreement with statements related to the ease of interacting with AI systems, understanding their functions, and incorporating them into academic activities associated with feedback and assessment.

Several participants reported that current AI platforms provide intuitive interfaces that facilitate their pedagogical use without requiring highly specialized technical knowledge. This perception suggests that accessibility constitutes an important factor influencing teachers' willingness to experiment with AI-supported feedback practices.

Nevertheless, some participants expressed uncertainty regarding the complexity of effectively integrating these technologies into pedagogical processes. This is particularly evident in item EE2, where only 50% of participants agreed that integrating GenAI into their feedback workflow was not demanding, while 26% remained neutral and 18% disagreed a notably lower level of agreement than the ease-of-learning, ease-of-comprehension, and non-complication items (EE1, EE3, and EE4). In particular, these responses reflected concerns related to the need for additional training, digital competence development, and the adaptation of traditional feedback strategies to technologically mediated environments.

This tendency reveals that although AI tools are frequently perceived as easy to access, easy to understand, and non-disruptive to existing routines consistent with the ease-of-use component of effort expectancy proposed by Venkatesh et al. (2012) their pedagogical appropriation requires more than technical familiarity. Effective integration also depends on teachers' capacity to critically evaluate AI-generated content and align technological tools with educational objectives and formative assessment principles.

The findings support the arguments proposed by Venkatesh et al. (2012), specifically regarding perceived ease of use as a determining factor in technology adoption processes, distinct from the deeper question of workflow integration reflected in item EE2. Likewise, the results coincide with the perspectives of Redecker (2017) and Holmes et al. (2022), who emphasize that digital competence involves not only technical abilities but also pedagogical and ethical capacities necessary for meaningful technology integration.

Within the context of this research, the results suggest that ease of use alone does not guarantee pedagogically effective implementation. This distinction is clearly supported by the contrast between the high agreement observed for perceived ease of use, comprehension, and absence of complication (EE1: 68%; EE3: 82%; EE4: 66% disagreement with complication) and the comparatively lower agreement regarding effortless integration into feedback workflows

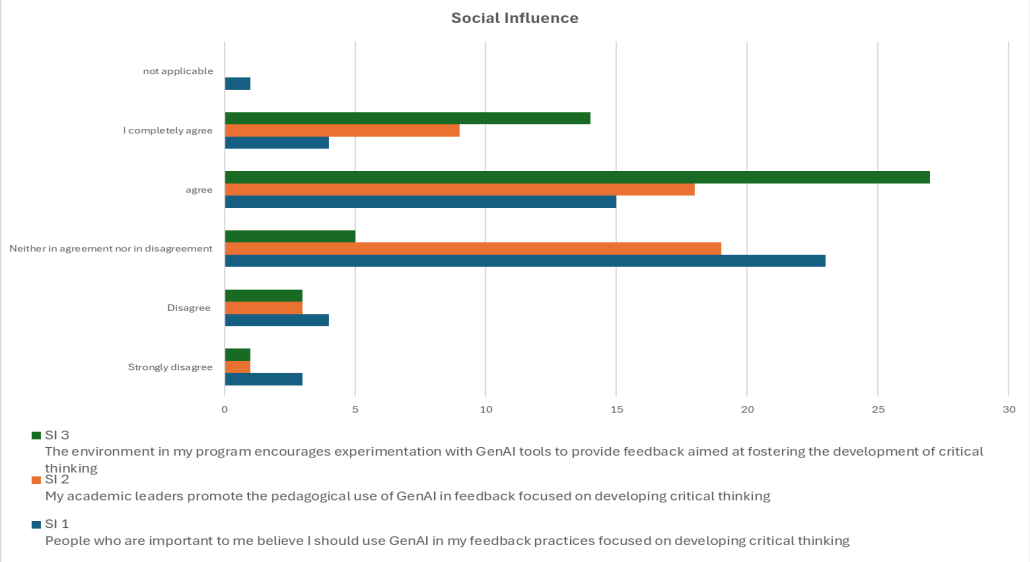
(EE2: 50%). Instead, successful integration of AI into formative feedback practices requires reflective appropriation processes that enable teachers to connect technological possibilities with critical and dialogical educational practices.

Social Influence

This dimension explored the extent to which institutional culture, colleagues, academic tendencies, and social environments influence teachers' perceptions and intentions regarding the use of generative artificial intelligence in formative feedback processes.

Figure 6

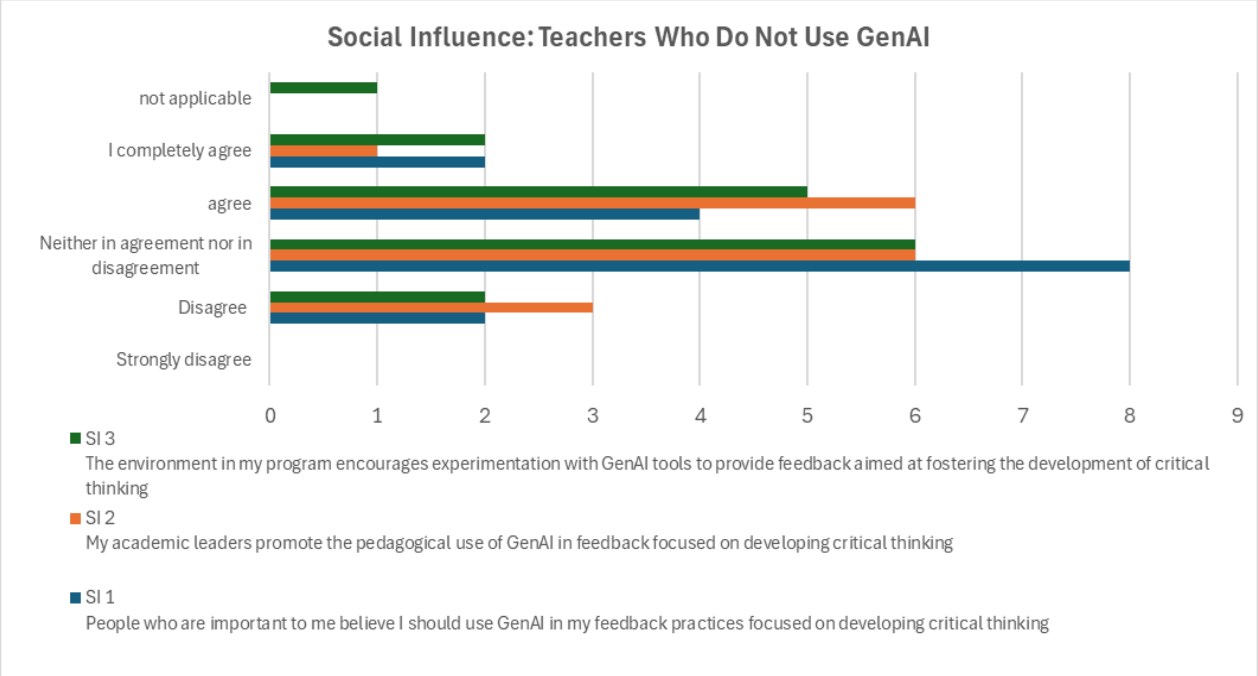
Results of the Social Influence dimension among teachers who reported current use GenAI.



Note. This graph shows the results of the survey items corresponding to the Social Influence construct of the UTAUT2 model, among teachers who reported current use of GenAI. Own elaboration, based on data collected for this study.

Figure 7

Results of the Social Influence dimension among teachers who reported not currently using GenAI.



Note. This graph shows the results of the survey items corresponding to the Social Influence construct of the UTAUT2 model, among teachers who reported not currently using GenAI. Own elaboration, based on data collected for this study.

Teachers who use generative AI generally acknowledge that the growing presence of AI in academic environments has positively influenced their interest in exploring these tools within formative feedback practices. As shown in Figure 6, 82% of AI-using participants agreed or strongly agreed that their program's environment favors experimentation with GenAI tools (item SI3), and 54% agreed that their academic leaders promote the pedagogical use of GenAI (item SI2). Many participants indicated that exposure to technological trends, interactions with colleagues, and increasing student familiarity with AI systems motivated them to experiment with these technologies in educational settings.

In contrast, some participants who do not use AI recognized that institutional and social dynamics have increased awareness regarding the relevance of understanding these technologies, even when they remain hesitant about their pedagogical implementation. This is reflected in item

SI2, where 43.75% of non-users agreed that academic leaders promote the pedagogical use of GenAI, and in item SI1, where 37.5% agreed that people important to them think they should use GenAI figures comparable to those of the AI-using group on this specific item, even though non-users have not translated that awareness into adoption. For several non-users, the rapid expansion of AI generated uncertainty concerning its educational implications, ethical use, and compatibility with traditional teaching practices.

Likewise, many respondents emphasized that discussions with colleagues and exposure to institutional debates have contributed to broader conversations about the role of AI in education. Nevertheless, while AI users tended to interpret these discussions as opportunities for pedagogical innovation, several non-users associated them with institutional pressure and concerns regarding the accelerated incorporation of technologies without sufficient pedagogical reflection. The most notable difference between groups emerges in item IS3, where 82% of users, compared to only 43.75% of non-users, agreed that their program's environment favors experimentation with GenAI suggesting that direct exposure to a supportive environment, more than institutional discourse alone, distinguishes users from non-users.

At the same time, participants from both groups expressed uncertainty regarding the absence of clear institutional orientations about the ethical and pedagogical use of AI in assessment and feedback practices. This suggests that although social influence may encourage interest in AI adoption, institutional ambiguity appears to limit teachers' confidence and consistency in its implementation.

These findings are consistent with the UTAUT2 model proposed by Venkatesh et al. (2012), particularly regarding the influence that social environments and institutional cultures exert on technological adoption processes. Likewise, the findings coincide with studies highlighting that AI integration in higher education is strongly conditioned by institutional policies, collaborative professional cultures, and opportunities for pedagogical dialogue.

From a pedagogical perspective, the findings reveal that teachers' perceptions of AI are collectively constructed through institutional interactions, professional experiences, and shared academic practices. Consequently, the integration of generative AI into formative feedback

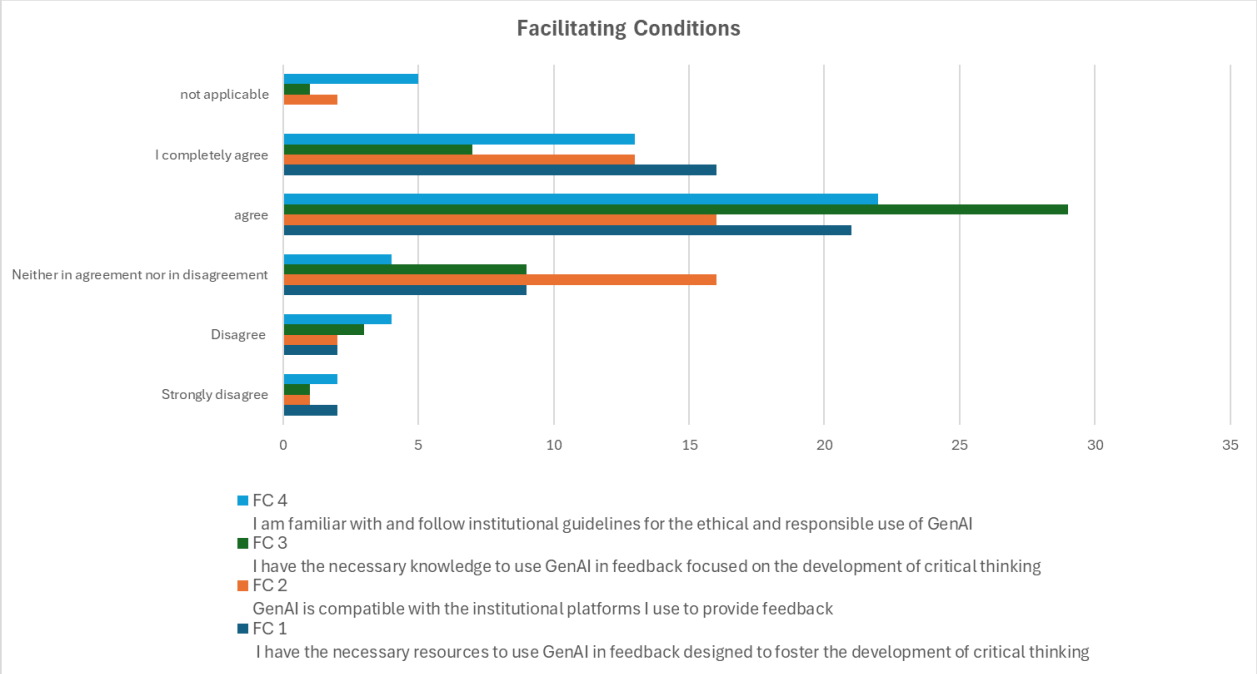
processes cannot be understood solely as an individual technological decision, but rather as a phenomenon mediated by institutional culture, social influence, and pedagogical beliefs.

Facilitating Conditions

This dimension examined participants' perceptions regarding the institutional, technological, and training conditions that support the implementation of generative artificial intelligence in formative feedback practices.

Figure 8

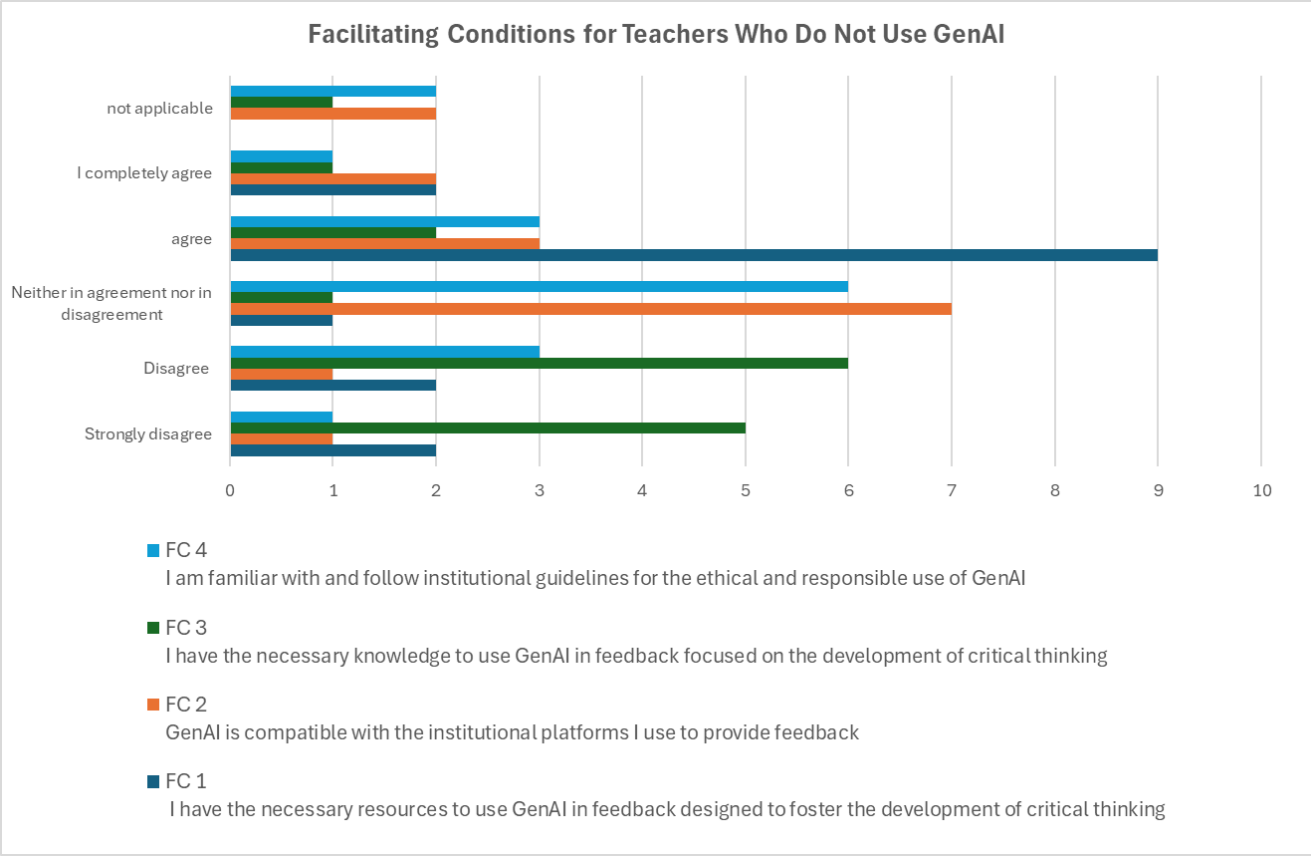
Results of the Facilitating Conditions dimension among teachers who reported current use of GenAI.



Note. This graph shows the results of the survey items corresponding to the Facilitating Conditions construct of the UTAUT2 model, among teachers who reported current use of GenAI. Own elaboration, based on data collected for this study.

Figure 9

Results of the Facilitating Conditions dimension among teachers who reported not currently using GenAI.



Note. This graph shows the results of the survey items corresponding to the Facilitating Conditions construct of the UTAUT2 model, among teachers who reported not currently using GenAI. Own elaboration, based on data collected for this study.

The findings showed that facilitating conditions constitute one of the principal challenges for the pedagogical integration of generative AI within the Faculty of Education at UCEVA. As shown in Figures 8 and 9, this challenge is most clearly evidenced in item FC3 (possessing the necessary knowledge to use GenAI), where 72% of AI-using participants agreed they had the required knowledge, compared to only 18.75% of non-users with 68.75% of non-users explicitly disagreeing. A similar, though less pronounced, gap appears in item FC4 (knowledge of institutional ethical guidelines), where 70% of users agreed they knew and followed institutional

guidelines, compared to only 25% of non-users. Although many participants expressed interest in AI technologies, these important differences emerged between teachers who actively use these tools and those who do not incorporate them into their pedagogical practices.

Participants who reported using generative AI generally emphasized the need for stronger institutional support, more specialized pedagogical training, and clearer ethical guidelines regarding AI-assisted feedback processes. This is notable given that, despite reporting relatively high perceived knowledge (FC3: 72%) and resource availability (FC1: 74%), agreement dropped to 58% regarding the compatibility of GenAI with institutional platforms (item FC2) suggesting that, despite already integrating AI into certain academic activities, several teachers continue learning autonomously due to the limited availability of formal institutional preparation programs and infrastructure.

Similarly, many AI users expressed concerns regarding academic integrity, reliability of AI-generated content, and the absence of institutional protocols regulating responsible uses of these technologies within assessment contexts. These responses suggest that technological adoption frequently occurs through individual experimentation rather than through structured pedagogical initiatives supported by the institution.

In contrast, participants who do not use generative AI often associated their non-adoption with insufficient training opportunities, lack of confidence in using these technologies, and uncertainty regarding their pedagogical relevance. This is empirically supported by item FC3, where 68.75% of non-users disagreed with possessing the necessary knowledge to use GenAI for feedback, the clearest quantitative indicator of the confidence gap between groups. Several non-users indicated that limited preparation and absence of institutional orientation contribute to feelings of insecurity about integrating AI into formative assessment processes.

Additionally, some non-users expressed concerns regarding ethical implications, possible student dependence on automated systems, and the potential weakening of reflective learning processes. This is consistent with item FC4, where only 25% of non-users agreed that they knew and followed institutional guidelines for ethical AI use, and 37.5% remained neutral reflecting not necessarily disagreement, but a lack of clarity regarding institutional expectations. For these

participants, the absence of institutional frameworks and pedagogical guidance reinforced their cautious position toward AI implementation.

These findings are consistent with the perspectives proposed by Ertmer (1999), who distinguishes between infrastructural barriers and pedagogical barriers influencing educational technology adoption. Likewise, the results align with Holmes et al. (2022), who emphasize that meaningful AI integration in higher education depends not only on technological availability, but also on teacher preparation, institutional support, and ethical guidance.

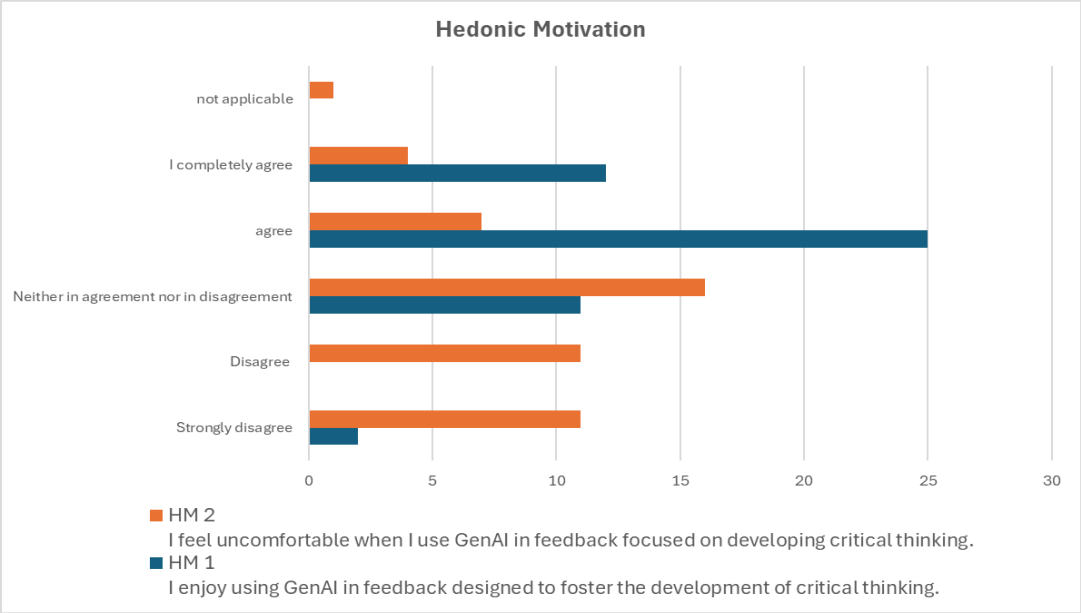
Within the institutional context of UCEVA, the findings suggest that AI adoption is occurring within a transitional scenario characterized by growing technological presence but insufficient pedagogical structuring. Empirically, this is reflected in the combination of relatively high perceived resource availability among users (FC1: 74%) with a marked knowledge gap between users and non-users (FC3: 72% vs. 18.75%) and inconsistent awareness of institutional ethical guidelines across both groups (FC4: 70% vs. 25%). Analytically, these patterns suggest rather than empirically confirm that AI integration is advancing faster than the institutional structures needed to support it. Consequently, the results highlight the necessity of strengthening professional development initiatives, establishing institutional policies, and creating ethical frameworks capable of supporting reflective and responsible uses of AI in formative feedback practices.

Hedonic Motivation

This dimension explored the degree to which teachers experience interest, enjoyment, curiosity, and personal satisfaction when interacting with generative artificial intelligence technologies in educational contexts.

Figure 10

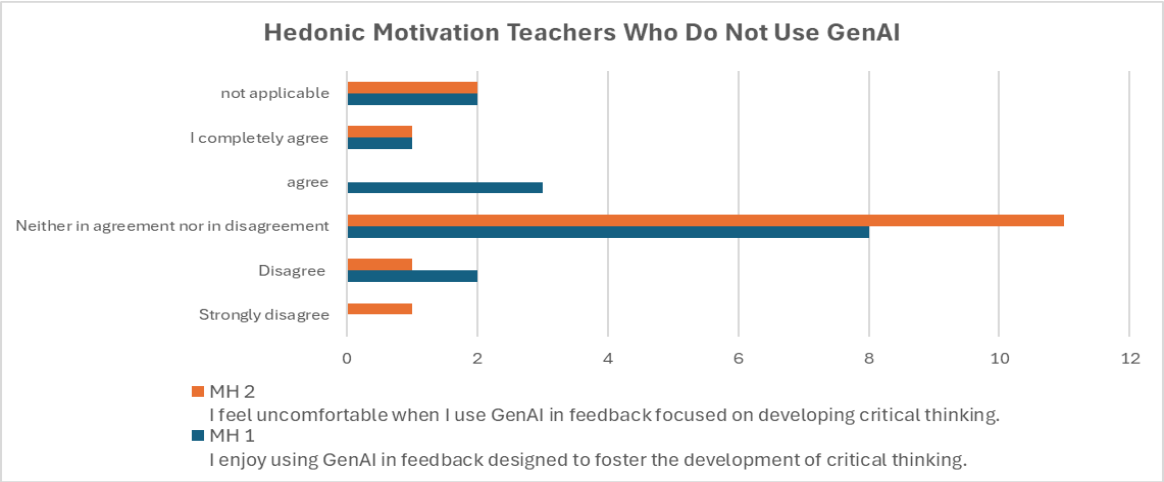
Results of the Hedonic Motivation dimension among teachers who reported current use of GenAI.



Note. This graph shows the results of the survey items corresponding to the Hedonic Motivation construct of the UTAUT2 model, among teachers who reported current use of GenAI. Own elaboration, based on data collected for this study.

Figure 11

Results of the Hedonic Motivation dimension among teachers who reported not currently using GenAI.



Note. This graph shows the results of the survey items corresponding to the Hedonic Motivation construct of the UTAUT2 model, among teachers who reported not currently using GenAI. Own elaboration, based on data collected for this study.

The findings indicate that hedonic motivation plays an important role in shaping teachers' attitudes toward the adoption of generative AI in educational settings. As shown in Figure 10, 74% of AI-using participants agreed or strongly agreed that using GenAI for critical-thinking-oriented feedback felt enjoyable (item HM1), while only 22% agreed with the reverse-coded item HM2 ("I feel uncomfortable when using GenAI"), with 44% actively disagreeing. However, notable differences emerged between participants who actively use AI and those who do not: among non-users, only 25% agreed that using GenAI would feel enjoyable (item HM1), and half remained neutral, a pattern that reflects unfamiliarity with the experience of use, rather than active rejection.

Teachers who reported using generative AI frequently associated these technologies with feelings of curiosity and personal enjoyment rather than discomfort or apprehension. Many participants expressed that exploring AI tools allowed them to experience a sense of novelty in their professional practice, distinct from the instrumental value of the tool discussed in relation to efficiency and effectiveness. For these respondents, the pleasurable and stimulating quality of the interaction itself rather than its functional outcomes contributed to maintaining motivation and engagement.

Several participants also highlighted the satisfaction derived from experimenting with emerging technologies, consistent with the low proportion (22%) reporting discomfort in item HM2. This suggests that, beyond their functional value, AI tools may also stimulate intrinsic motivation by encouraging curiosity, enjoyment, and playful exploration in professional practice.

In contrast, participants who do not use AI tended to report lower levels of enthusiasm regarding these technologies, reflected in the considerably higher proportion of neutral responses in both HM1 (50%) and HM2 (68.75%). While some non-users may recognize the potential of AI in the abstract, the predominance of neutral, rather than negative, responses suggests indifference or lack of direct experience rather than active rejection or discomfort. For these respondents, this absence of a pleasurable or stimulating first experience combined with the effort required to learn

and implement the technology appears to limit their motivation to incorporate such tools into their teaching practices.

These findings are consistent with the UTAUT2 framework proposed by Venkatesh et al. (2012), which identifies hedonic motivation as a factor that can positively influence technology adoption. The results suggest that enjoyment, curiosity, and personal interest may encourage teachers to explore and experiment with AI tools, thereby facilitating their initial engagement with educational contexts. However, as observed in the previous discussion of Facilitating Conditions and Performance Expectancy, this initial enjoyment does not by itself guarantee effective pedagogical integration: teachers who found the experience pleasurable (HM1: 74%) still reported comparatively lower confidence in institutional platform compatibility (Facilitating Conditions, FC2: 58%) and a marked knowledge gap relative to non-users (FC3: 72% vs. 18.75%). Hedonic motivation may therefore function as an initial driver that sustains teachers' willingness to experiment with GenAI, while institutional and pedagogical conditions remain the determining factors for its meaningful integration into formative feedback practices.

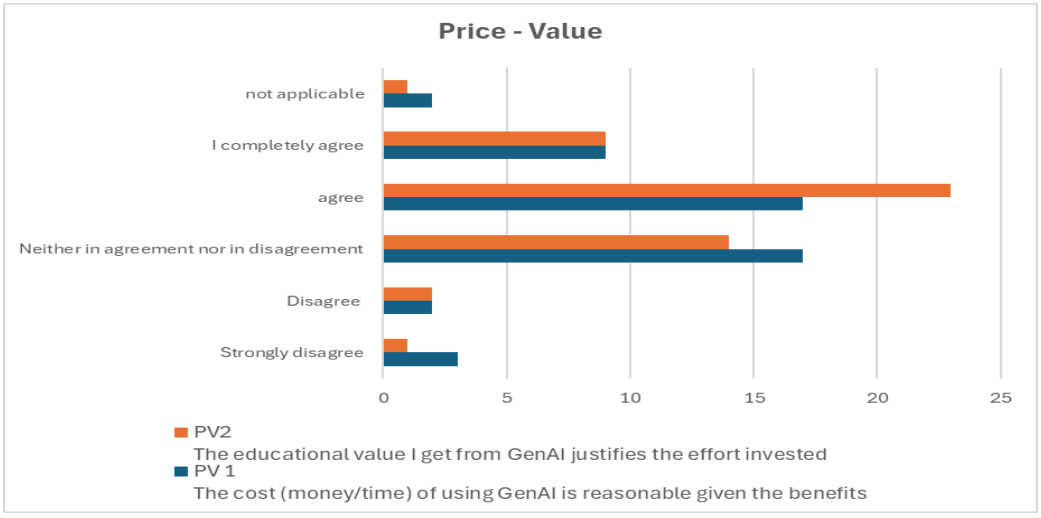
From a pedagogical perspective, the findings indicate that motivation extends beyond technical considerations and includes emotional and experiential dimensions. Consequently, fostering positive and meaningful experiences with AI may contribute to greater teacher engagement and openness toward innovative educational practices, provided such experiences are accompanied by the institutional support and pedagogical training necessary to translate initial enjoyment into sustained, effective use.

Price - Value

This dimension examined teachers’ perceptions regarding the balance between the benefits offered by generative AI technologies and the costs associated with their use, including financial, temporal, and professional investment.

Figure 12

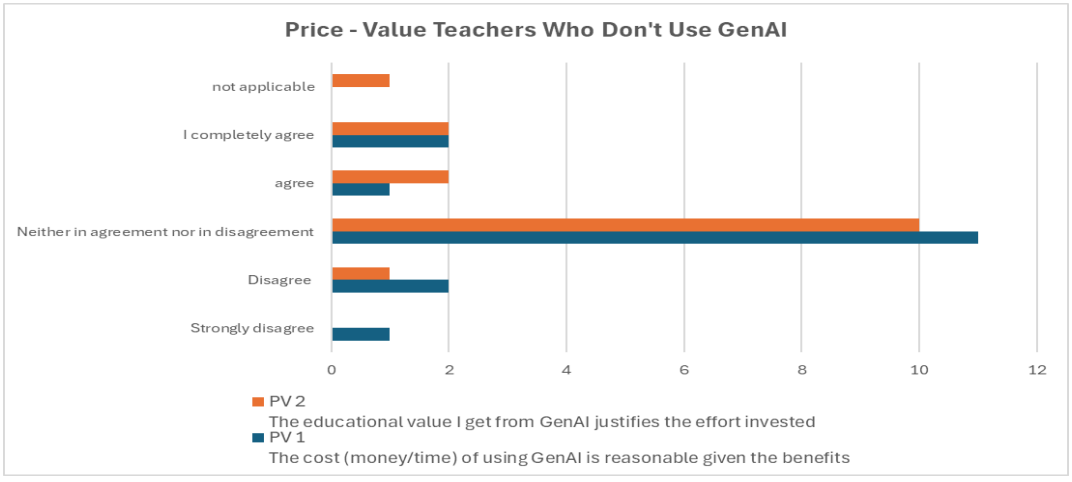
Results of the Price-Value dimension among teachers who reported current use of GenAI.



Note. This graph shows the results of the survey items corresponding to the Price Value construct of the UTAUT2 model, among teachers who reported current use of GenAI. Own elaboration, based on data collected for this study.

Figure 13

Results of the Price-Value dimension among teachers who reported not currently using GenAI.



Note. This graph shows the results of the survey items corresponding to the Price Value construct of the UTAUT2 model, among teachers who reported not currently using GenAI. Own elaboration, based on data collected for this study.

The findings revealed that teachers evaluate generative AI not only in terms of its pedagogical potential but also through an explicit weighing of effort, time, and cost against perceived benefits. As shown in Figure 12, 52% of AI-using participants agreed or strongly agreed that the cost understood jointly as money and time of using GenAI was reasonable relative to its benefits (item PV1), while 64% agreed that the pedagogical value obtained justified the effort invested (item PV2). Notably, item PV1 explicitly frames cost in temporal as well as financial terms, indicating that participants weighed not only monetary expense but also the time required to learn, adapt, and supervise the use of these tools a dimension that, in higher education contexts marked by heavy teaching loads, can weigh as heavily on this cost–benefit balance as any financial consideration.

Participants who use AI generally considered that the benefits obtained from these technologies justify the time and effort invested in learning and applying them, with roughly one in ten AI-using participants (10%) disagreeing that the cost was reasonable suggesting that even among adopters, the time investment required is not universally perceived as proportionate to the benefits gained. Several participants also noted that the availability of free or low-cost AI applications has facilitated experimentation and adoption within educational contexts. Nevertheless, some users expressed concerns regarding subscription fees, limited access to advanced functionalities, and the potential dependence on commercial platforms concerns that, together with the temporal cost already noted, complicate an otherwise favorable cost–benefit balance.

Conversely, participants who do not use AI frequently associated non-adoption with uncertainty regarding the actual benefits that these technologies could provide in relation to the investment required. As shown in Figure 13, the predominant response among non-users was neutrality rather than outright rejection: 64.7% remained neutral on whether the cost was reasonable (item PV1, n=17), and 62.5% remained neutral on whether the pedagogical value would justify the effort (item PV2, n=16) suggesting that non-users are less able to weigh this cost–benefit balance concretely, precisely because they lack direct experience against which to measure the time or effort required. Some respondents questioned whether the pedagogical advantages justified the time needed for training and adaptation, particularly in contexts where institutional support remains limited.

The findings suggest that perceptions of value are closely linked to previous experiences with AI. Teachers who have already incorporated these tools tend to weigh a concrete cost–benefit balance grounded in direct experience including the real time invested in learning and supervising the tool whereas non-users often evaluate this same balance through expectations, assumptions, or unresolved uncertainty regarding the effort such an investment would require.

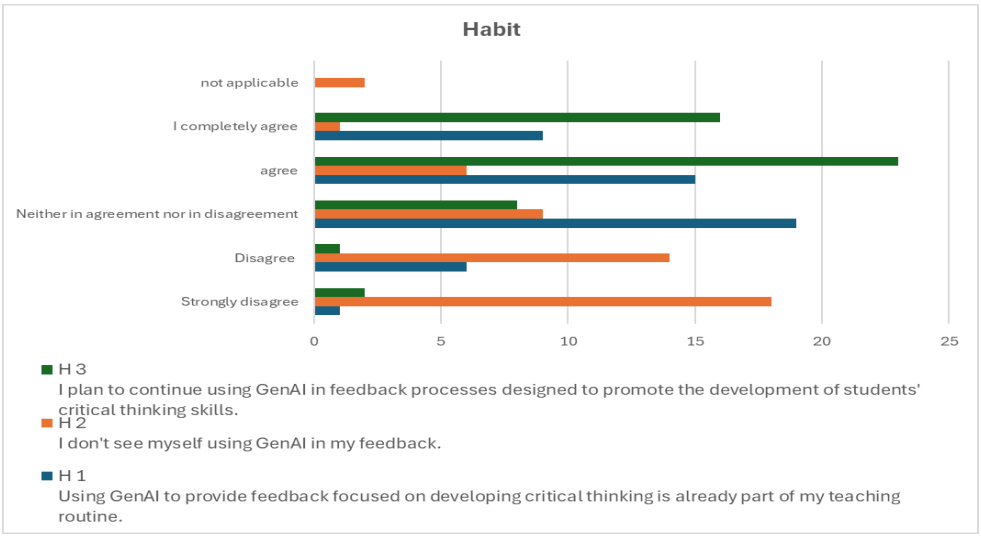
These results align with the UTAUT2 model, which proposes that users are more likely to adopt technologies when perceived benefits outweigh associated costs. In educational settings, this cost–benefit calculation appears to be determined not only by economic factors but also by the time and professional effort required, alongside perceptions of pedagogical effectiveness and institutional support.

Habit

This dimension explored the extent to which teachers have incorporated generative artificial intelligence into their regular professional practices and the degree to which its use has become routine within educational activities. Within the UTAUT2 model, Habit is understood as a strong predictor of continued technology use, reflecting the extent to which behavior has become automatic through repeated experience (Venkatesh et al., 2012). In the context of this study, this dimension is particularly relevant for distinguishing between teachers who have progressively normalized GenAI as part of their feedback practices and those for whom its use remains occasional or exploratory, a distinction that helps illuminate how consolidated the integration of GenAI currently is within the Faculty of Education.

Figure 14

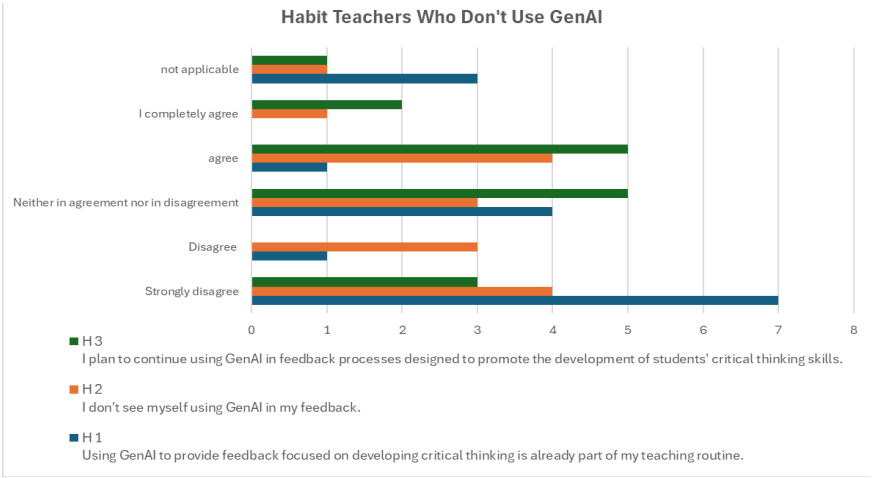
Results of the Habit dimension among teachers who reported current use of GenAI.



Note. This graph shows the results of the survey items corresponding to the Habit construct of the UTAUT2 model, among teachers who reported current use of GenAI. Own elaboration, based on data collected for this study.

Figure 15

Results of the Habit dimension among teachers who reported not currently using GenAI.



Note. This graph shows the results of the survey items corresponding to the Habit construct of the UTAUT2 model, among teachers who reported not currently using GenAI. Own elaboration, based on data collected for this study.

The results indicate descriptive differences between participants who use AI and those who do not regarding the development of habitual technology use. As shown in Figures 14 and 16, 48% of AI-using participants agreed that using GenAI is already part of their teaching routine (item H1), compared to only 6.25% of non-users. This gap widens further in item H3, where 78% of users agreed they plan to continue using GenAI in feedback processes aimed at fostering critical thinking, compared to 43.75% of non-users. These are descriptive rather than statistically tested differences, given the exploratory-descriptive scope of this study.

Among teachers who reported using AI, several participants indicated that these technologies have gradually become integrated into specific academic activities, including lesson planning, content generation, feedback preparation, and information organization. This is further supported by item H2 (a reverse-coded item), where 64% of users disagreed with the statement "I do not see myself using GenAI" indicating that most AI-using participants anticipate continued, rather than occasional, use. For these respondents, AI use has evolved from occasional experimentation to a more frequent component of their professional practice.

Many AI users reported increasing familiarity and confidence when interacting with these technologies, suggesting the emergence of habitual patterns of use. This tendency indicates that repeated exposure and successful experiences may contribute to the normalization of AI within educational contexts. In contrast, participants who do not use AI reported little or no habitual interaction with these technologies, evidenced by the low agreement with item H1 (6.25%) and the comparatively higher proportion of disagreement (50%). For many of these respondents, AI remains an unfamiliar or peripheral tool rather than an integrated component of teaching practice. Consequently, opportunities for developing confidence and routine use remain limited.

The findings are consistent with the theoretical proposition that habit functions both as a consequence and a predictor of technological adoption, as proposed within the UTAUT2 framework. Given the cross-sectional descriptive design of this study, however, these results cannot empirically establish a predictive relationship between habit and future use; rather, participants who report repeatedly engaging with AI also tend to report continued intention to use it (item H3), while non-users report comparatively lower familiarity and weaker intentions to adopt it in the future.

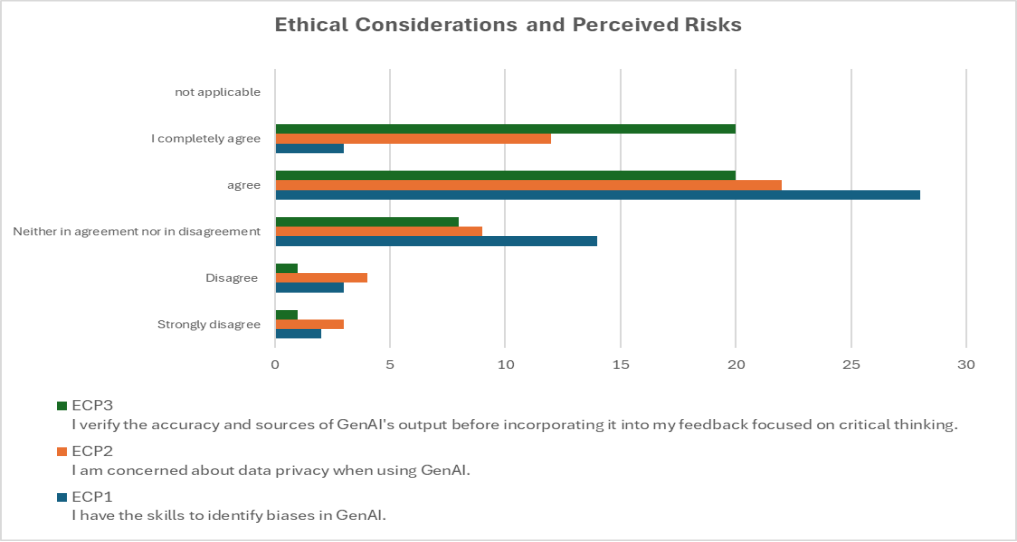
These results are consistent with the UTAUT2 framework, which conceptualizes habit as a significant predictor of technology use behavior. Within the institutional context of UCEVA, the findings highlight the importance of providing opportunities for sustained interaction and practical experimentation for example, through teacher training programs, communities of practice among faculty from the different undergraduate programs, and institutional support strategies that allow teachers to develop confidence and routine engagement with AI technologies.

Ethical Considerations and Perceived Risks

This dimension explored teachers' perceptions regarding the ethical implications, challenges, and potential risks associated with the use of generative artificial intelligence in formative feedback and higher education contexts.

Figure 16

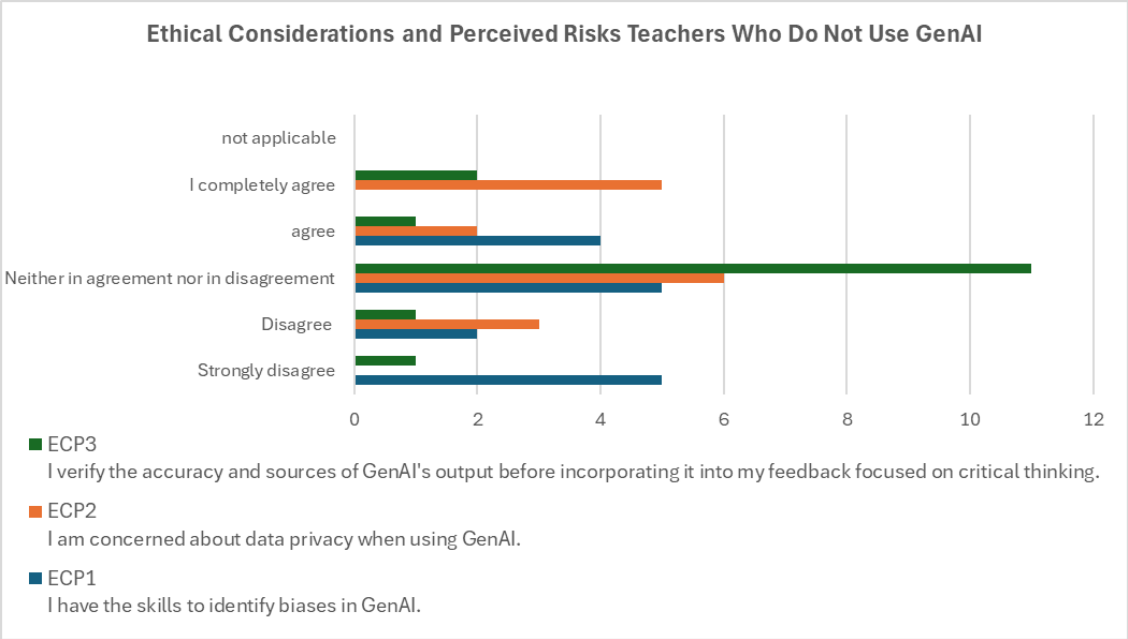
Results of the Ethical Considerations and Perceived Risks dimension among teachers who reported current use of GenAI.



Note. This graph shows the results of the survey items corresponding to the Ethical Considerations and Perceived Risks dimension included in the questionnaire, among teachers who reported current use of GenAI. Own elaboration, based on data collected for this study.

Figure 17

Results of the Ethical Considerations and Perceived Risks dimension among teachers who reported not currently using GenAI.



Note. This graph shows the results of the survey items corresponding to the Ethical Considerations and Perceived Risks dimension included in the questionnaire, among teachers who reported not currently using GenAI. Own elaboration, based on data collected for this study.

The findings revealed that ethical considerations and perceived risks constitute one of the most significant areas of concern among participants, regardless of whether they currently use generative AI. As shown in Figures 16 and 17, 68% of AI-using participants agreed or strongly agreed that they are concerned about information privacy when using GenAI (item ECP2), and 80% agreed that they verify the accuracy and sources of AI-generated content before incorporating it into their feedback practices (item ECP3) the highest level of agreement observed across the ethical dimension. However, differences emerged regarding the nature and intensity of these concerns: while AI-using participants expressed concern accompanied by active verification practices, non-users expressed comparatively higher uncertainty, with 68.75% remaining neutral on item ECP3, likely reflecting their lack of direct experience verifying AI-generated content rather than an absence of concern.

Teachers who use AI generally acknowledged the educational potential of these technologies while simultaneously recognizing the importance of addressing ethical challenges. Many participants expressed concerns related to academic integrity, transparency, reliability of AI-generated content, data privacy, and the responsible use of automated systems within assessment processes. This is reflected in item ECP1, where 62% of users agreed they possess the competencies needed to detect bias in GenAI-generated content indicating that, among users, ethical vigilance is generally accompanied by a degree of confidence in their own capacity to exercise it critically.

Several AI users emphasized that the educational benefits of these technologies depend on critical and ethical implementation. From their perspective, AI should function as a support mechanism rather than a substitute for professional judgment, pedagogical decision-making, or human interaction.

Participants who do not use AI frequently expressed stronger concerns regarding potential risks, though these concerns coexisted with considerably lower confidence in their own ability to manage them: only 25% of non-users agreed they possess competencies to detect bias in GenAI (item ECP1), compared to 62% of users. Many respondents associated AI with threats to academic honesty, excessive student dependence, superficial learning, and possible reductions in critical and reflective thinking. Some participants also questioned the reliability of AI-generated information and the implications of delegating educational responsibilities to automated systems.

Across both groups, participants emphasized the necessity of establishing ethical guidelines, institutional policies, and professional development initiatives capable of supporting responsible AI integration. These findings suggested that ethical concerns are not merely obstacles to adoption but fundamental considerations that shape teachers' perceptions and decisions regarding AI use. This suggested that responsible AI adoption at UCEVA cannot be approached solely as a matter of technological access or training (facilitating conditions), but must also address the institutional and ethical conditions already identified in the qualitative categorization matrix (CI5, CI6),that determine whether AI use in feedback is experienced as empowering or as a threat to academic integrity and professional judgment. In this sense, the demand for institutional guidelines is not a peripheral concern but a precondition for AI to be

adopted in ways that genuinely support, rather than undermine, the critical and reflective dimension of formative feedback central to this study.

The results are consistent with contemporary discussions in the educational technology literature regarding transparency and explainability (Lipton, 2018) and the risks of bias, accountability gaps, and authorship ambiguity inherent to generative AI systems (Bender et al., 2021), which participants echoed in their concerns about academic integrity and reliability. Likewise, the findings support the argument that ethical literacy should be considered a core component of digital competence in higher education, consistent with the ethical dimension explicitly included in the DigCompEdu framework (Redecker, 2017).

From a pedagogical perspective, the findings suggested that the integration of generative AI cannot be separated from ethical reflection. Rather than focusing exclusively on technological capabilities, educational institutions must also address questions concerning responsibility, equity, autonomy, and the preservation of meaningful learning processes. Consequently, ethical considerations emerge not as peripheral concerns but as central dimensions in the sustainable and pedagogically responsible adoption of artificial intelligence in higher education.

Acceptance of Generative AI Across Academic Programs

To examine possible variations in teachers' perceptions according to their academic program, the mean scores for each UTAUT2 dimension were calculated and compared across the four undergraduate programs of the Faculty of Education. This comparison is purely descriptive in nature; no inferential statistical procedure (e.g., ANOVA or Kruskal-Wallis) was conducted at this stage to test whether the observed differences in mean scores are statistically significant, and the interpretations offered below should be read as observed patterns in the descriptive data rather than confirmed statistical effects. Figure 19 presents the grouped bar chart illustrating these comparisons across all eight dimensions of the instrument.

Overall, the descriptive comparison suggests that *Licenciatura en Lenguas Extranjeras con Énfasis en Inglés* (n=32) and *Licenciatura en Educación Física, Recreación y Deporte* (n=23) showed the most favorable and consistent mean scores across dimensions, ranging between 3.53 and 3.97 a pattern that, within a descriptive rather than inferential framework,

points toward a moderate-to-high level of acceptance toward the use of generative AI in formative feedback practices. *Lenguas Extranjeras* obtained its highest mean scores in Effort Expectancy (M=3.97) and Performance Expectancy (M=3.93), while *Educación Física* obtained its highest score in Performance Expectancy (M=3.86), followed by Habit (M=3.78), Social Influence (M=3.74), and Ethical Considerations and Perceived Risks (M=3.74). In contrast, *Licenciatura en Ciencias Sociales* (n=8) showed comparatively lower mean scores across most dimensions, particularly in Effort Expectancy (M=3.12) and Price Value (M=3.00), which approach the neutral midpoint of the scale a pattern that may reflect greater perceived difficulty in integrating GenAI tools into feedback practices, and a more cautious valuation of their cost-benefit relationship, though this interpretation remains tentative given the absence of statistical testing.

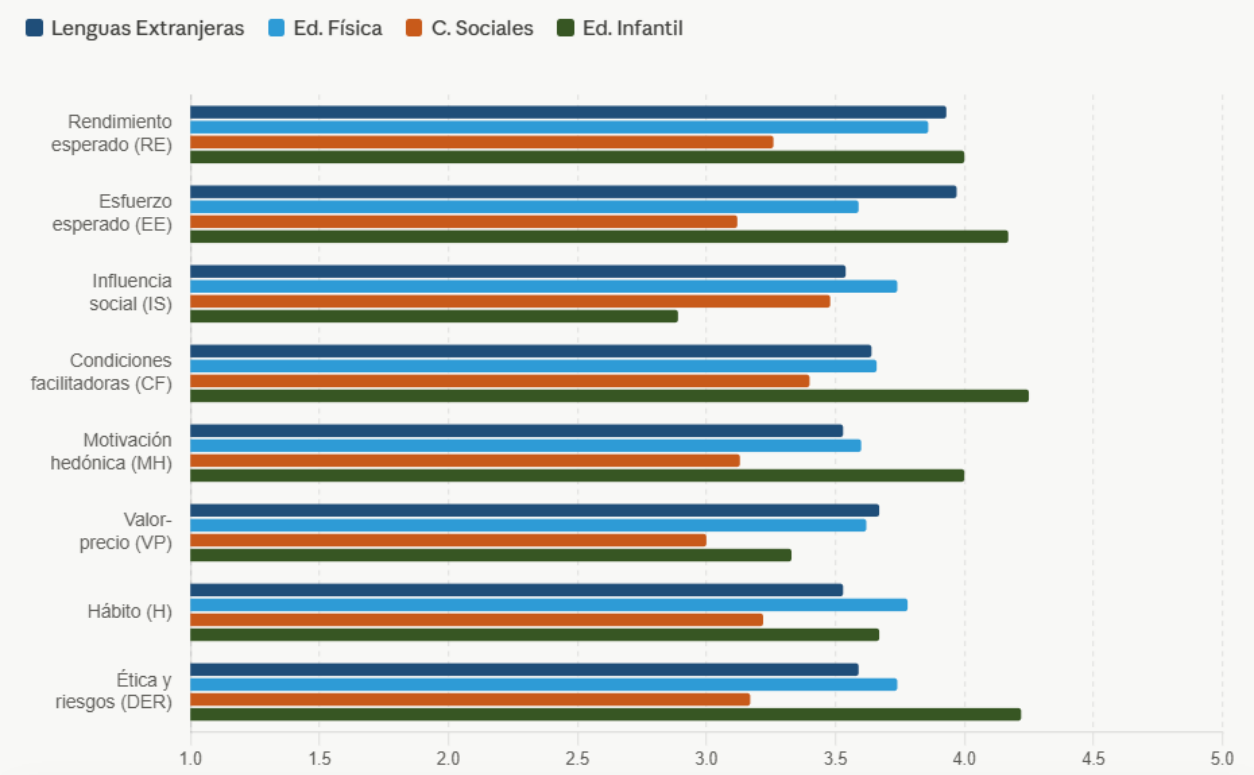
Regarding *Licenciatura en Educación Infantil* (n=3), the results must be interpreted with particular caution given the markedly reduced sample size. Nevertheless, this program showed notably high mean scores in Facilitating Conditions (M=4.25), Ethics and Risks (M=4.22), and Effort Expectancy (M=4.17), which may point toward a positive disposition toward institutional support and responsible use of AI. Conversely, it showed the lowest mean score in Social Influence (M=2.89), which may suggest that teachers in this program perceive limited encouragement from colleagues or institutional leaders regarding AI adoption.

Across all programs, Performance Expectancy and Effort Expectancy were the dimensions most consistently associated with comparatively favorable mean scores, while Social Influence and Habit showed more variable results between programs. These descriptive patterns are consistent with previous research employing the UTAUT2 model in higher education contexts (Khlaif et al., 2024; Venkatesh et al., 2012), which has identified performance and effort expectancy as key factors associated with technology adoption intentions among faculty members. As noted above, however, these inter-program patterns were not tested for statistical significance. A formal significance test (e.g., Kruskal-Wallis) was deliberately not conducted at this stage: with a subgroup as small as n=3 (Educación Infantil), such a test would have negligible statistical power to detect a true difference even if one existed, so a non-significant result would be uninformative rather than reassuring, and a significant one would be highly unstable. Consequently, these inter-program comparisons are presented strictly as descriptive

patterns, intended to complement rather than substitute for the qualitative findings on disciplinary particularities discussed later in this chapter.

Figure 18

Comparative Mean Scores per UTAUT2 Dimension by Undergraduate Program



Note. A Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Reversed negatively worded items (RE4, EE4, MH2, H2).

Analysis of the Qualitative Data

The results presented below correspond to the qualitative analysis of the open-ended responses from the questionnaire applied to faculty members of the four undergraduate programs at the Faculty of Education of the Unidad Central del Valle del Cauca (UCEVA). Consistent with the data analysis process described in Chapter III, this analysis was conducted through thematic analysis, combining deductive coding derived from the theoretical framework with inductive coding emerging from participants' responses, organized across the three analytical dimensions established in the categorization matrix: *Pedagogical Use of GenAI*, *Types of Feedback*, and

Necessary Conditions. This combined deductive-inductive procedure allowed textual fragments to be classified according to theoretically grounded categories while remaining open to the identification of emerging patterns and meanings arising directly from the data.

The three open-ended questions that guide this analysis correspond to specific objectives of the research: (P1) concrete experiences of using GenAI in feedback, aligned with the first specific objective; (P2) differentiated examples of product feedback versus cognitive process feedback, aligned with the second specific objective; and (P3) institutional, pedagogical, and ethical conditions necessary for such use to contribute to the development of critical and creative thinking at UCEVA, aligned with the third specific objective. The results are organized by academic program, which allows for evidence of both transversal patterns and the disciplinary particularities of each degree program. While this organization primarily addresses the second specific objective, the qualitative analysis as a whole also contributes to the understanding of the first and third objectives, given the complementary nature of the three guiding questions.

It is relevant to note that, of the total participants, 30 responses were classified as "Unclassified" in the analysis matrix (Foreign Languages: 8; Physical Education: 4; Social Sciences: 1; Early Childhood Education: 1, plus the additional "Not applicable" responses in P3), corresponding to participants who explicitly declared not having used GenAI tools for feedback ('Not applicable', 'N/A', 'I haven't used it'). These responses were not excluded from the analysis but are interpreted as direct evidence of the technological adoption gap documented in the quantitative component, constituting a result in itself that enriches the understanding of the phenomenon studied and reinforces the study's credibility and dependability (Lincoln & Guba, 1985). In this sense, the qualitative analysis presented in this chapter not only deepens and contextualizes the quantitative findings previously reported, but also identifies emerging categories and explores the meanings that participants themselves attribute to the use of GenAI in feedback processes, providing the interpretive framework that guides the discussion developed throughout this chapter.

Perceptions towards the use of GenAI in academic feedback

The first specific objective sought to describe faculty perceptions towards the use of generative artificial intelligence in academic feedback, based on the dimensions of the UTAUT2 model. The quantitative results reported in the previous section evidenced positive trends in the dimensions of performance expectancy and hedonic motivation. The qualitative data allow for a deeper exploration of the content of these perceptions, revealing both the pedagogical potential that faculty attribute to GenAI and the tensions and reservations that accompany its appropriation.

Degree in Foreign Languages with Emphasis in English

Foreign Language faculty constitute the group with the greatest diversity of qualitative perceptions regarding the use of GenAI, as evidenced by the wide range of categories and subcategories identified in this program (11 categories and 23 subcategories), the highest among the four undergraduate programs, spanning from performance-related benefits and reflective pedagogical uses to ethical and institutional concerns, as well as explicit declarations of non-use. On one hand, some participants (approximately 5 of the 20 Foreign Language faculty) expressed positive assessments linked to performance expectancy, highlighting the tool's capacity to scale the quality of feedback without sacrificing time or personalization. One professor described their experience in the following terms:

"Implementé GenAI como copiloto pedagógico para retroalimentar producciones escritas. El objetivo era escalar la calidad del feedback sin sacrificar tiempo ni personalización." (DLE#4)

This perspective reflects a perception of GenAI as a strategic support tool, consistent with the UTAUT2 model's performance expectancy dimension, in which the professor anticipates tangible benefits for their pedagogical practice. Complementarily, another participant noted that AI allows them to "adapt the feedback to the student's particular level," which evidences a perception oriented towards the personalization of formative feedback. This finding can be further interpreted through the lens of formative feedback theory: by adjusting feedback to each student's specific level, GenAI is perceived not merely as an efficiency tool, but as a means of supporting self-regulated learning, insofar as personalized feedback allows students to identify

their own gaps and take ownership of their learning process a condition considered foundational for the development of critical thinking.

However, more cautious perceptions also emerged. Some professors indicated having observed erroneous or partial responses generated by the tool, conditioning its use to a permanent critical review:

"Para retroalimentar escritos de mis estudiantes, generó algunas respuestas erróneas, pero en su mayoría información pertinente y acertada." (DLE#10)

This tension between utility and reliability is consistent with the findings of Roe et al. (2024), who reported general skepticism towards evaluation models exclusively mediated by AI, with a preference for hybrid approaches that combine technological and professor judgment. This suggested that, for these participants, performance expectancy is not unconditional but mediated by professional judgment, in which the professor retains an active evaluative role rather than delegating it entirely to the tool. Likewise, a participant who declared not having used GenAI for feedback stated:

"No he utilizado Gen IA para retroalimentar. Solo para búsqueda de información." (DLE#7)

Beyond signaling simple non-use, this response can be interpreted as evidence of the gradual and uneven technology adoption process previously identified in the quantitative component of this study, in which professors engage with GenAI selectively in this case, for information retrieval, but not yet for feedback-related tasks. This convergence between the qualitative testimony and the quantitative adoption patterns strengthens the integration between both methodological strands of the study, illustrating how partial or exploratory use may precede a fuller pedagogical appropriation of the tool. This type of response, along with the "Not applicable" declarations registered by several participants in the program, suggests that performance expectancy, while present in those who already use the tool, has not yet managed to translate into pedagogical adoption for a significant segment of the faculty.

In sum, the qualitative evidence gathered from Foreign Language faculty reveals a coexistence of enthusiasm and caution: participants who have adopted GenAI tend to value it as a

means of personalizing feedback and optimizing time without compromising pedagogical quality, while those who remain hesitant or have not yet adopted it point to concerns about the reliability of AI-generated responses and to a still-emerging familiarity with the tool. Rather than reflecting contradictory positions, these perceptions appear to represent different stages of a shared adoption trajectory, in which performance expectancy is progressively negotiated as professors gain experience and confidence in integrating GenAI into their feedback practices.

Degree in Physical Education, Recreation, and Sports

In the Physical Education program, qualitative perceptions reveal a more pragmatic use of GenAI, oriented mainly towards the review of written products and support in evaluative processes. This orientation is evidenced by the classification of responses to the second open-ended question, in which the majority of contributions from this program (12 of 19 classified responses) were grouped under the category *Product Feedback*, encompassing error correction, writing quality, and adherence to formal citation standards, compared to only three responses classified under *Process Feedback*. This concentration contrasts with the pattern observed in Foreign Languages, where process-oriented responses predominated, suggesting that Physical Education faculty tend to engage with GenAI primarily as a tool for verifying formal or technical aspects of written work rather than as a mediator of students' reasoning processes. Consistent with this pattern, performance expectancy is expressed in terms of efficiency and time savings, with comparatively fewer references to the tool's pedagogical potential for fostering critical thinking an emphasis reflected in the narrower range of reflective vocabulary (e.g., argumentation, questioning, reasoning) present in this program's responses compared to those of Foreign Languages faculty.

One of the most developed accounts from the program comes from a professor who articulated the use of AI with criteria of methodological coherence in didactic design:

"La IA generativa se utilizó como apoyo para identificar inconsistencias entre los objetivos de aprendizaje y las tareas propuestas. En varios casos, los objetivos planteaban el desarrollo de la toma de decisiones en situaciones de juego, mientras que la actividad diseñada se limitaba a ejercicios técnicos repetitivos sin oposición ni toma de decisiones real." (DEF#9)

This account evidences a pedagogically informed appropriation that goes beyond the instrumental use of AI observed elsewhere in the program. Rather than using GenAI merely to correct or format written products, this professor mobilizes the tool as an analytical resource to examine curricular alignment, that is, the coherence between stated learning objectives and the cognitive demands actually embedded in instructional tasks. This use reflects a form of pedagogical reflection in which AI supports the professor's own critical judgment about instructional design, positioning GenAI not as a substitute for pedagogical reasoning but as a resource that reinforces it.

However, other participants in the same program expressed more limited perceptions. Some professors (e.g., those describing the use of AI mainly to "make pertinent comments in evaluations" or to "evaluate written work") did not elaborate further on its implications for the development of critical or creative thinking, referring instead to procedural or administrative aspects of the evaluative process. This more restricted framing suggests that, for these participants, GenAI is appropriated primarily as an efficiency tool for grading and formal review, rather than as a resource intentionally mobilized to deepen students' reasoning a distinction that becomes central for interpreting the conditions discussed later in this chapter.

It is also worth noting the critical perception of a professor who observed counterproductive effects in their students when using AI without pedagogical mediation:

"Trabajos escritos sobre temas relacionados a mis asignaturas y no fueron argumentados por los estudiantes de la mejor manera pues se guiaron solo por la IA y no dieron sus conceptos personales, la reacción fue de sorpresa." (DEF#1)

This observation connects with the warnings of Nirchi et al. (2024) regarding the risk of technological dependency and loss of critical thinking when AI is incorporated without intentional pedagogical design. Beyond illustrating a risk associated with AI use, this testimony provides direct empirical support for the need of the professor's role as a critical mediator between GenAI and student learning, a category that, as will be shown, emerges as one of the central findings of this study, since it is precisely the absence of such mediation that appears to produce the counterproductive effects described here.

In sum, the qualitative evidence from Physical Education faculty reveals three coexisting positions: an instrumental use focused on efficiency and formal correction of written products; a more elaborated pedagogical appropriation, exemplified by the alignment of learning objectives and instructional tasks; and a critical awareness of the risks of unmediated AI use, particularly regarding students' argumentative autonomy. Together, these positions suggest that, within this program, the pedagogical value of GenAI is perceived as contingent on the degree of intentional mediation exercised by the professor, rather than as an inherent property of the tool itself.

Degree in Early Childhood Education

The Early Childhood Education program, despite having the smallest number of participants in the sample, presents the most elaborate and theoretically grounded qualitative accounts regarding the use of GenAI. This conclusion is supported by two convergent analytical criteria: first, the density of elaboration, given that the two active participants in this program produced 25 classified responses (12.5 responses per participant), markedly higher than the average of approximately three responses per participant observed in the other three programs; and second, the conceptual integration evidenced across these responses, which span nearly the full range of analytical categories considered in this study from the type of feedback provided, to the role of AI as a critical mediator, to the pedagogical and ethical conditions required for its appropriate use rather than concentrating on a single dimension of the phenomenon.

One professor explicitly articulated the use of the tool with a metacognitive approach, connecting the feedback generated by AI with processes of learning self-regulation:

"Para que el uso de la GenAI en la retroalimentación contribuya al desarrollo del pensamiento crítico y creativo en la UCEVA, es necesario que su implementación esté alineada con un enfoque metacognitivo del aprendizaje." (DEI#1)

This finding constitutes one of the most significant of the entire study, as it makes explicit the theoretical mechanism connecting GenAI-mediated feedback with the development of critical thinking. Self-regulated learning implies that students are able to monitor, evaluate, and adjust their own learning processes; when formative feedback is designed to prompt this kind of monitoring rather than simply indicating what is correct or incorrect it moves students from

passively receiving corrections toward actively reflecting on their own reasoning. In this sense, the professor's emphasis on a metacognitive approach suggests that GenAI's contribution to critical thinking is not automatic, but depends on feedback being intentionally structured to activate these self-regulatory processes. This perception reflects a sophisticated understanding of performance expectancy, which transcends operational efficiency to place GenAI in the service of developing specific higher-order skills central to this study namely, critical thinking, creative thinking, and metacognitive self-regulation.

Another professor in the program described in greater detail the type of feedback they generated and their students' reaction, highlighting the role of guiding questions as a mechanism to foster critical thinking:

"Las devoluciones se centraron en comentarios y preguntas orientadoras que invitaban a los estudiantes a cuestionarse si aquello que describían era realmente relevante para las categorías de análisis propuestas." (DEI#1)

This testimony constitutes one of the strongest pieces of empirical evidence gathered in this study, as it illustrates concretely how the development of critical thinking is achieved. It is important to emphasize that GenAI does not generate critical thinking directly; rather, it functions as a resource within a teacher-mediated strategy, in which the professor designs and curates guiding questions aimed at prompting students to evaluate the relevance and coherence of their own work. The critical outcome, in other words, results from the pedagogical intentionality with which the professor mobilizes the tool, not from an inherent capacity of GenAI itself — reinforcing the broader finding of this study regarding the centrality of the professor's mediating role.

One participant declared not having used the tool (N/A), which reduces the qualitative evidence base of the program, although it does not invalidate the richness of the available testimonies.

In sum, despite being the program with the fewest participants in the sample, Early Childhood Education contributed some of the deepest pedagogical reflections identified throughout this study. The convergence of a metacognitive understanding of feedback, an explicit

articulation between guiding questions and critical thinking, and a consistent emphasis on the professor's mediating role suggests that, at least among the faculty who engage with GenAI in this program, its pedagogical appropriation is grounded in a clear and theoretically informed understanding of how AI-supported feedback can contribute to higher-order learning.

Degree in Social Sciences

In the Social Sciences program, perceptions towards the use of GenAI are characterized by their diversity and, in some cases, by a critical reflective orientation consistent with the discipline's epistemology. One professor described the use of the tool in terms of analytical confrontation, positioning AI as an interlocutor rather than a corrector:

"Confrontar mi análisis con el análisis propuesto por la IA." (DCS#5)

This finding is arguably one of the most original qualitative contributions of the entire study, as it reveals a qualitatively different mode of interaction with GenAI than the one predominant in the other programs analyzed. Rather than using the tool to identify errors or validate a predefined answer, this professor deliberately generates an independent analysis and then contrasts it against the AI's output a practice that positions GenAI not as an authority that dispenses corrections, but as an intellectual interlocutor whose interpretation must itself be evaluated, questioned, and weighed against the professor's own judgment.

This mode of engagement resonates with the literature on reflective dialogue and metacognition, in which learning (or, in this case, professional reasoning) is deepened not through the passive reception of an external verdict, but through the process of externalizing one's own thinking, comparing it against an alternative perspective, and reconciling or defending the discrepancies that emerge.

Understood this way, the confrontational use of AI described here functions as a structured form of dialectical reasoning: the professor's analysis and the AI's analysis operate as two positions to be reconciled through critical scrutiny, rather than as a question with a single correct answer to be verified. This use is corroborated by another response from the same program, in which a professor describes using GenAI to review a research question and

objectives *"ante incoherencias metodológicas"* ["in light of methodological inconsistencies"], reflecting a similar pattern of using the tool to stress-test one's own reasoning rather than to simply accept its output.

Given its conceptual significance, this interlocutor-based mode of engagement is treated in this study as a cross-cutting emergent category distinct from the more instrumental or correction-oriented uses of GenAI identified in other programs and is revisited in the interpretive synthesis at the end of this chapter, where its implications for the broader understanding of teacher GenAI interaction are discussed further.

Another participant highlighted the tool's precision in understanding complex student productions, although without further depth on its articulation with critical thinking:

"La IA es muy precisa a la hora de comprender las percepciones de los estudiantes. Los estudiantes se mostraron receptivos a los conceptos presentados." (DCS#7)

One participant explicitly declared not having used the tool ('Not applicable'), which, added to the brief responses of other professors in the program, suggests that the appropriation of GenAI in Social Sciences is still incipient. This pattern may plausibly be related to the epistemological particularities of the discipline which tend to privilege interpretive and dialectical modes of reasoning less readily automated by AI tools and to the absence of specific institutional guidelines; however, since the available data do not provide direct evidence to support this explanation, it is offered here as a possible interpretation rather than as a conclusion derived from the responses themselves.

Relationships between perceptions, institutional conditions, and GenAI use in feedback

The second objective sought to examine the relationships between faculty perceptions, institutional conditions, and the use of GenAI in feedback processes oriented towards critical thinking, identifying possible differences by program and type of contractual engagement. Qualitative data allow for the enrichment of quantitative findings, revealing differentiated patterns of use, tensions between the formative potential of the tool and its practical limitations,

and the extent to which the disciplinary context appears to shape the way professors appropriate GenAI.

Product feedback versus cognitive process feedback

One of the most significant findings of the qualitative analysis and one of the original contributions of this study to research on AI-mediated formative feedback is the emergence of the distinction between product feedback and process feedback as a central analytical category, rather than a merely descriptive result. This distinction refers to the asymmetry between the use of GenAI to provide feedback on products (error correction, textual coherence, citation) and its use to provide feedback on cognitive processes (argumentation, reflection, critical thinking). The data indicate that the first type of use is widely predominant in all programs, while the second, although present, appears more sporadically and is generally associated with professors with greater pedagogical elaboration.

Process-oriented feedback constitutes the central analytical focus of this research, as it is precisely this modality rather than product-oriented correction that connects most directly with the development of critical and creative thinking. Within the formative feedback literature, feedback is understood to be most transformative for learning when it does not merely indicate what is correct or incorrect, but instead engages the learner in an active process of reflection, self-questioning, and reconstruction of their own reasoning (Hattie & Timperley, 2007; Nicol & Macfarlane-Dick, 2006). Process feedback, as documented across the programs analyzed here, aligns with this formative logic: rather than closing the learning episode with a corrective verdict, it opens a space in which students must reconsider their own arguments, justify their decisions, or reconcile discrepancies between their reasoning and external input conditions that are widely recognized as necessary, though not sufficient, for the development of critical thinking.

In Foreign Languages, product feedback focused mainly on grammatical, stylistic, and textual coherence correction:

"Señala errores de inglés puntuales, los resalta y brinda opciones para reescribir." (DLE#2)

However, experiences of process-oriented feedback also emerged, such as the use of questions generated by AI to lead students to reflect and question their actions:

"Diseñé un prompt que me permitió la revisión de un trabajo de manera óptima; esta revisión generó una serie de comentarios de retroalimentación que mediante preguntas llevó a los estudiantes a reflexionar y cuestionar su actuar, de esta manera pudieron mejorar sus respuestas y desempeños." (DLE#9)

This account constitutes one of the strongest pieces of empirical evidence gathered in this study, as it makes visible the specific mechanism through which feedback shifts from a corrective to a regulatory function. Rather than delivering direct answers or corrections, the professor deliberately designed the AI-generated feedback around questions, which require the student to actively process the feedback rather than passively receive it. This use of questioning transforms the feedback episode into an exercise of learning regulation: to answer the question, the student must first evaluate their own prior response, identify the reasoning gap the question points to, and reconstruct their argument accordingly. In this sense, the professor's design decision prioritizing questions over corrections operationalizes, in an AI-mediated context, the same self-regulatory mechanism identified earlier in the Early Childhood Education program, reinforcing this dynamic as a cross-cutting pattern rather than an isolated occurrence.

In Physical Education, process feedback emerged in accounts where AI supported the identification of inconsistencies between learning objectives and tasks, as documented earlier in Jfrios's account. Likewise, in the context of mathematical reasoning with foreign language elements, a professor described how the comparison between the algorithm proposed by AI and the elements worked on in class generated critical learning scenarios:

"Desde el escenario anterior se compara el algoritmo que sugiere la IA con los elementos dados en clase, ahí pueden surgir varios escenarios: uno de ellos que lo ofrecido por la IA no corresponda al problema, por tanto el estudiante se ve en la necesidad de abordar elementos conceptuales que permitan aclarar la respuesta." (DEF#16)

Beyond illustrating an instance of process-oriented feedback, this account is better interpreted through the lens of cognitive conflict: when the AI-generated algorithm does not match the elements developed in class, the student is confronted with two competing representations of the same problem, and this discrepancy rather than the AI's output in itself is what compels the student to revisit conceptual foundations in order to resolve the inconsistency.

This reading reframes GenAI's contribution not as the direct source of learning, but as a generator of productive discrepancies that the student must actively reconcile, a mechanism closely aligned with constructivist accounts of learning through the confrontation of ideas.

In Early Childhood Education, process feedback was the predominant modality in the documented accounts. One professor related how GenAI was used to generate questions that invited students to justify their pedagogical observations, strengthening the link between practical experience and theoretical categories. In Social Sciences, cognitive process feedback appeared mainly in relation to argumentation and the verification of information accuracy, an aspect especially relevant given the interpretive and critical nature of the discipline:

"Mostrar falta de veracidad." (DEI#11)

"Verificando % de uso de la IA, y explicando cómo pueden ampliar la consulta del tema y la argumentan en la construcción textual." (DEI#8)

The role of the professor as a critical mediator

A transversal pattern identified in the qualitative data from all four academic programs is the conceptualization of the professor as a critical mediator of the feedback generated by AI. Unlike the product–process distinction discussed above, which varies in expression across disciplinary contexts, this pattern emerges consistently and independently of program, discipline, or type of feedback produced, positioning it as a second integrative category of this study one that connects and, in a sense, underlies the findings reported across all previous sections of this chapter.

This pattern is especially relevant in relation to the second objective, as it suggests that the quality of GenAI use in feedback is determined not only by the tool itself, but by the pedagogical decisions of the professor who implements it. This statement represents one of the main theoretical contributions of this study, insofar as it displaces the analytical focus away from the technological capabilities of GenAI that is, away from what the tool can generate and places it instead on the pedagogical mediation exercised by the professor that is, on what is done with what the tool generates. In other words, the evidence gathered across programs suggests that it is

not GenAI itself that determines whether feedback contributes to critical thinking, but the pedagogical intentionality with which professors filter, contextualize, and complement its output.

In Early Childhood Education, this mediating role was expressed with greater conceptual clarity:

"Con ayuda de la IA analicé los escritos según la rúbrica y generé comentarios iniciales que luego revisé y ajusté antes de compartirlos. [...] Mantener el rol del docente como mediador crítico que revisa, contextualiza y complementa la retroalimentación generada por la IA." (DEI#2)

In Foreign Languages, several professors emphasized the need to critically review AI products before sharing them with students:

"Todo esto, con la responsabilidad de leer o revisar uno a uno los documentos para contrastar la opinión personal del docente con la revisión que hace la IA." (DLE#14)

In Social Sciences, a professor expressed the mediating logic in terms of complementarity, warning that AI should not substitute for one's own reasoning:

"Sugerí utilizar la IA como complemento. No para que haga el trabajo." (DCS#6)

These findings are consistent with the postulates of Boud and Molloy (2013) on feedback as a dialogic and emancipatory practice, in which the professor cannot completely delegate their guiding function to a technology, but must assume an active role in the contextualization and interpretation of the feedback generated. This principle can be considered a synthesis of the study's principal scientific contribution: rather than demonstrating that GenAI itself transforms feedback practices, the findings indicate that the real transformative factor remains the professor's pedagogical mediation, with GenAI operating only as a resource whose formative value is contingent on how it is critically appropriated. Given its explanatory reach across all four programs analyzed, this finding is revisited in the concluding chapter of this study as one of its original contributions to the understanding of AI-mediated formative feedback.

Adoption gap and conditions of use by program

Qualitative data confirm and nuance the adoption gap identified in the quantitative component. Of the total participants, 13 professors declared in P1 not having used GenAI for feedback, with a notable concentration in Foreign Languages (8 participants) and Physical Education (4 participants). This finding is significant given that Foreign Languages is the program with the largest number of professors in the Faculty, which amplifies the impact of the gap.

Some non-user participants did not express active rejection of the tool, but rather lack of knowledge or absence of training opportunities:

"No he utilizado pero este año quiero conocer mucho del tema." (DLE#4)
"No la he usado. Conocerla, primero que todo." (DEF#9)

These expressions of favorable but unacted-upon disposition connect with the facilitating conditions dimension of the UTAUT2 model, suggesting that the adoption gap does not respond solely to active resistance, but also to the absence of training infrastructure and institutional support, a finding that is deepened in the analysis of the third objective.

Specific Objective 3: Experiences, expectations, and barriers perceived in the use of GenAI for formative feedback

The third objective sought to interpret the experiences, expectations, and barriers expressed by professors in the open-ended questions, in order to understand the meanings, ethical tensions, and opportunities they attribute to the use of GenAI in formative feedback. The qualitative data from question P3 ('What conditions do you consider necessary at UCEVA?') constitute the primary source of this analysis, although patterns of meaning also emerged from the narratives of P1 and P2.

Faculty training: the condition most mentioned in all programs

Faculty training (CI3) emerged as the most mentioned necessary condition in the four programs, with 24 fragments classified into this subcategory, making it the most robust qualitative finding of the study. It is important to clarify that this robustness should be understood

in methodological terms as thematic recurrence that is, the consistency with which this category emerged, independently and spontaneously, across all four programs analyzed rather than as a claim of statistical generalization, which falls outside the scope of a qualitative analysis of this kind. This transversal convergence suggests that professors, regardless of their program and level of tool use, identify training as the primary requirement for an effective pedagogical integration of GenAI. Given its consistency across the entire sample, this finding is revisited in the general conclusions of this study as one of its main practical contributions, since the evidence indicates that, from participants' own perspective, the effective integration of AI depends less on technological availability than on the development of pedagogical capacities for its critical and formative use.

In Physical Education, training demands tended to be expressed in a more direct and instrumental manner:

"Que los docentes tengan más capacitación para su uso." (DEF#12)

"Capacitación docente para obtener todo el provecho de la IA en el desarrollo del pensamiento crítico y creativo." (DEF#17)

This second fragment deserves particular attention, as it connects directly with the central purpose of this study: the participant does not request training in the use of GenAI as an end in itself, but explicitly frames it as a means to the development of critical and creative thinking. This association made spontaneously by the participant rather than prompted by the instrument suggests that, at least for some professors, faculty training is not perceived merely as a technical or operational need, but as a condition intrinsically linked to the pedagogical purpose that motivates this research.

In Foreign Languages, training demands incorporated more specific nuances, pointing to the need to go beyond generic training to aim towards concrete pedagogical competencies:

"Que se realicen cursos más prácticos y específicos, no solo teóricos y generales." (DLE#15)

"Los profesores deben estar capacitados para evaluar calidad y sesgos de retroalimentación generada por IA. Diseñar prompts estratégicos que promuevan reflexión, no corrección automática." (DLE#10)

This second testimony constitutes one of the strongest pieces of evidence in the entire study, as it reveals that the training being demanded is not merely technical or instrumental in nature. The participant explicitly identifies two distinct competencies: the capacity to critically evaluate the quality and biases of AI-generated feedback, and the capacity to design prompts strategically oriented towards reflection rather than automatic correction. Both competencies presuppose the exercise of pedagogical and ethical judgment the ability to assess whether AI output is trustworthy and formative, and the ability to intentionally design AI use so that it serves reflection rather than shortcuts. This reframes faculty training not as a matter of learning to operate a tool, but as the development of a form of professional judgment specific to AI-mediated pedagogical practice.

In Early Childhood Education, the demand for training was articulated with greater theoretical depth, linking faculty training with the development of metacognitive knowledge:

"La UCEVA debería promover espacios de formación docente que orienten el uso pedagógico de la IA más allá de la corrección, enfocándose en la formulación de preguntas que favorezcan la reflexión, la argumentación y la toma de decisiones conscientes sobre el propio aprendizaje." (DEI#3)

This quotation synthesizes one of the most original contributions of this study, as it integrates, within a single narrative, faculty training, metacognition, reflection, and critical thinking. The participant does not merely request more training, but specifies its pedagogical orientation: moving beyond corrective use towards the formulation of questions capable of fostering reflection, argumentation, and conscious decision-making about one's own learning. In doing so, this testimony effectively articulates the full conceptual chain underlying this research from institutional condition (training), through pedagogical mediation (question design), to the cognitive outcome pursued (critical and self-regulated thinking) and is therefore revisited in the discussion and conclusions chapters as a synthesis of the study's central theoretical contribution.

In Social Sciences, mentions of training were briefer but equally present, with expressions such as *"Formación," "Hacer talleres prácticos de capacitación,*" and "*Cualificación avanzada en IA*," which evidence a demand for professional updating on the subject.

Ethical conditions and academic integrity

Ethical conditions constituted the second most frequent thematic area, with 14 fragments classified across its two constituent subcategories: academic integrity (CI5), which groups concerns about plagiarism, authorship, and the preservation of students' intellectual autonomy; and responsible use of AI (CI6), which groups concerns about dependency, mechanical use, and the need for guidelines governing appropriate pedagogical implementation. Professors expressed concerns related to the responsible use of the tool, the prevention of technological dependency, and the preservation of student intellectual autonomy. These three concerns emerged recurrently across all four academic programs analyzed, reinforcing the cross-cutting nature of this category within the study.

In Foreign Languages, ethical concerns were articulated around the need for clear institutional guidelines:

"Deben establecerse unos lineamientos muy claros y éticos frente a la propuesta de uso y, dadas nuestras condiciones actuales, la adición de condiciones muy claras en el reglamento de la universidad." (DLE#3)

"Es necesario diseñar una guía institucional sobre el uso de la IA, que mencione aspectos éticos y legales y repercusión en el ámbito institucional." (DLE#4)

These testimonies deserve a broader interpretation than a simple call for oversight. Rather than requesting control or restrictive mechanisms, these participants are asking for institutional frameworks that actively guide the responsible pedagogical implementation of artificial intelligence, that is, structures that enable and orient a legitimate use of GenAI in feedback, rather than mechanisms whose primary function is to police or limit it. This distinction is relevant for the study, as it suggests that faculty perceive the absence of guidelines not as a gap to be filled defensively, but as an obstacle to the confident and pedagogically sound adoption of the tool.

In Early Childhood Education, ethical concern was oriented towards the prevention of dependency and intentional pedagogical design:

"Formación docente y estudiantil en el uso pedagógico y ético de la IA, para evitar un uso mecánico o dependiente. Diseñar actividades donde la IA no logré la entrega de las respuestas finales, sino que generé preguntas, sugerencias y orientaciones que inviten a analizar, argumentar y reflexionar." (DEI#2)

This is one of the most important quotations in this chapter, as it provides direct evidence that participants conceive of AI as a resource for promoting cognitive processes rather than as a mechanism for replacing students' reasoning. The professor explicitly opposes two models of AI use: one in which the tool delivers final answers, fostering mechanical dependency, and another in which it generates questions, suggestions, and guidance that invite analysis, argumentation, and reflection. This distinction closely mirrors the product–process framework developed earlier in this chapter, reinforcing the coherence between the ethical conditions discussed here and the pedagogical patterns identified throughout the qualitative analysis: for this participant, the ethical use of GenAI and its pedagogically productive use are, in effect, the same design decision.

In Social Sciences, ethics also emerged in relation to truthfulness and critical thinking:

"Que no sea una verdad absoluta, que siempre esté en un proceso de análisis y crítica donde los estudiantes también puedan pensar por sí mismos." (DCS#5)

These expressions are consistent with the warnings of Williamson and Kizilcec (2023) regarding the risks of algorithmic bias in educational contexts, and with the calls from UNESCO (2023) and the 4U Manifesto (2024) for an ethical, critical, and human-centric integration of artificial intelligence in higher education.

Institutional conditions: infrastructure, access, and guidelines

Institutional conditions constituted a further necessary condition identified by participants, encompassing two subcategories: access to tools (CI1), referring to the availability of licensed or specialized AI platforms, and technological infrastructure (CI2), referring to

connectivity, equipment, and the technical resources needed to support their use. Together, these two subcategories grouped 12 fragments, concentrated mainly in demands for technological infrastructure and access to specialized tools. In Foreign Languages and Physical Education, participants pointed out the need to improve connectivity and access to licenses for AI tools:

"Considero pertinente tener acceso a IA paga por la institución y que se enfoque en aspectos académicos y didácticos." (DLE#15)

"Mejor WiFi y equipos, mayor acceso." (DLE#7)

This first testimony represents an important practical contribution of the study, as it points to institutional access to AI tools as a potential mechanism for reducing the technological adoption gap identified earlier in relation to the second specific objective. Insofar as a considerable share of non-use was interpreted as evidence of that gap, this participant's request suggests that at least part of the gap may not stem from a lack of interest or willingness on the part of faculty, but from structural barriers cost, access, and infrastructure that fall outside individual professors' control. Read together, these two findings suggest that closing the adoption gap requires not only pedagogical training, but institutional investment in the material conditions that make sustained and equitable use of GenAI possible.

A prominent proposal emerged in Foreign Languages, where a professor raised the need for an AI developed from the Latin American context, pointing to the geopolitical biases of the available tools as an obstacle to critical thinking:

"Es necesaria una IA desarrollada desde nuestro contexto (Colombia, Latinoamérica), desafortunadamente las IA disponibles presentan sesgos notorios sobre todo en asuntos geopolíticos como el Zionismo, lo que conlleva a un enturbiamiento del pensamiento crítico." (DLE#12)

This fragment illustrates a sophisticated understanding of the limitations of GenAI that goes beyond technical infrastructure to enter into the political and epistemological implications of the available tools, an aspect that reinforces the relevance of incorporating critical perspectives into AI faculty training.

Taken together, the institutional conditions identified by participants extend beyond technological resources narrowly defined. Read alongside the findings on faculty training and ethical conditions discussed above, they point to the need for an institutional ecosystem one that integrates infrastructure and access, faculty training, ethical guidelines, and ongoing pedagogical support rather than a single isolated intervention. This integrated understanding reinforces the coherence among the qualitative categories examined in this chapter, suggesting that the conditions necessary for GenAI to meaningfully contribute to critical and creative thinking at UCEVA are interdependent rather than separable.

Institutional culture and educational innovation

The dimension of institutional culture (CI7 and CI8) grouped 12 fragments that reveal both individual attitudes of professors and expectations regarding UCEVA's role in the adoption of GenAI. In Physical Education, expressions of individual disposition towards the use of the tool predominated, alongside explicit demands for institutional policy:

"La UCEVA establezca lineamientos pedagógicos claros para docentes y estudiantes sobre el uso de la IA, asegurando que se utilice como una herramienta de apoyo y no como sustituto del pensamiento propio." (DEF#1)

"Lineamientos institucionales claros sobre el uso pedagógico de la IA." (DEF#8)

The first of these testimonies effectively summarizes participants' institutional concerns, but its scope extends beyond a request for formal guidelines in a narrow, regulatory sense. By explicitly linking such guidelines to the goal of ensuring that AI functions *"como una herramienta de apoyo y no como sustituto del pensamiento propio"* ["as a support tool and not as a substitute for one's own thinking"], the participant frames institutional policy as a means of embedding a particular pedagogical stance towards AI within the institution one that safeguards students' autonomous reasoning as a shared value. Read this way, the demand is not merely for the existence of written guidelines, but for the construction of an institutional culture that actively orients and sustains the pedagogical use of AI over time, beyond what any single regulatory document could achieve on its own.

These demands are consistent with the diagnosis presented in the problem statement, which documented the absence of formal guidelines on the pedagogical use of AI in the UCEVA Faculty of Education (Problem Statement, 2025), and with national findings indicating that only one in three Colombian universities has formalized the pedagogical use of AI (Díaz, 2024). The convergence between these institutional demands and the national panorama suggests that the absence of formal guidelines at UCEVA is not an isolated institutional shortcoming, but reflects a broader structural gap affecting Colombian higher education more generally. Situated within this national context, the present findings contribute contextualized evidence of how this gap is experienced and articulated by faculty on the ground, offering UCEVA both a diagnosis consistent with the national trend and a set of participant-derived insights that could inform the design of institution-specific guidelines, rather than a generic policy response.

Interpretive synthesis: transversal patterns and particularities by program

"La UCEVA debería promover espacios de formación docente que orienten el uso pedagógico de la IA más allá de la corrección, enfocándose en la formulación de preguntas que favorezcan la reflexión, la argumentación y la toma de decisiones conscientes sobre el propio aprendizaje." (DEI#3)

This quotation, presented earlier in this chapter in relation to faculty training, synthesizes one of the study's most original contributions, as it integrates within a single narrative faculty training, metacognition, reflection, and critical thinking. Given its integrative scope, it is revisited here as the opening reference for this synthesis and is further taken up in the discussion and conclusions chapters of this study.

The qualitative analysis of open-ended responses allows for the identification of four transversal patterns that articulate the research's three specific objectives and emerge with consistency in the four Faculty of Education programs. These four patterns were identified as the principal emergent findings of the analysis on the basis of three convergent criteria: their recurrence across all four academic programs rather than within a single disciplinary context, their direct correspondence with the study's specific objectives, and the analytical weight given to them throughout the preceding sections of this chapter, where each was documented, quoted, and interpreted in detail. It is this combination of cross-program recurrence, objective alignment, and

depth of prior interpretation rather than an a priori selection that supports their status as the study's principal findings.

Firstly, a predominance of instrumental use over reflective pedagogical use is observed, constituting an integrative category derived from the overall qualitative findings rather than a pattern specific to any single program. This pattern is directly continuous with the product–process distinction discussed earlier in this chapter: the predominance of instrumental use corresponds to the widespread presence of product-oriented feedback (error correction, textual coherence, plagiarism detection) across all programs, while the more selective reflective pedagogical use corresponds to the less frequent, but pedagogically richer, process-oriented feedback documented among professors with greater pedagogical elaboration.

The majority of professors who reported concrete experiences of use (P1 and P2) described applications oriented towards error correction, textual coherence review, and plagiarism detection, while use oriented towards fostering reflection, argumentation, and critical thinking appeared more selectively, associated with professors with greater pedagogical elaboration.

This asymmetry is consistent with the findings of Avalos Guijarro (2024), who reported a moderate impact of AI on academic performance ($d = 0.51$) versus a stronger impact on the development of critical thinking ($d = 0.68$), suggesting that the tool's most significant formative potential is not yet being fully exploited.

Secondly, the role of the professor as a necessary condition for GenAI to contribute to the development of critical thinking clearly emerges, constituting a second integrative category derived from the qualitative findings as a whole. The testimonies from all programs coincide that the tool must be mediated, reviewed, and contextualized by the professor, who maintains pedagogical responsibility for the feedback. This finding dialogues with Hattie and Timperley's (2007) conception of effective feedback, which requires not only clear and specific returns, but also a framework of understanding that allows the student to appropriate them to regulate their own learning.

Thirdly, faculty training is consolidated as the most urgent condition identified transversally by the four programs. This pattern is supported both by the frequency of coded excerpts with faculty training accounting for the largest number of fragments classified within the necessary-conditions dimension and by the convergence of narratives across the four programs, expressed both by active users and non-users of the tool. Taken together, this dual evidentiary basis indicates that the adoption gap at UCEVA does not respond primarily to active resistance, but to the absence of contextualized, practical, and pedagogically grounded training spaces. This finding reinforces the recommendations of the 4U Manifesto (2024) and Bedoya Villa et al. (2024) regarding the urgency of training strategies that accompany the integration of AI in Colombian higher education.

Fourthly, the absence of clear institutional guidelines emerged as a structural obstacle pointed out with insistence in all programs, especially in Foreign Languages and Physical Education. The demand for institutional policies that regulate the pedagogical and ethical use of GenAI reflects faculty awareness regarding the risks of disorderly integration and constitutes an opportunity for UCEVA, through its Faculty Training School, to build an institutional framework consistent with the PEI's formative principles (UCEVA, 2020). Taken together, these four transversal patterns converge on a single integrative idea: despite the disciplinary differences documented across programs, artificial intelligence acquires genuine educational value only when it is pedagogically mediated by professors and sustained by appropriate institutional conditions training, ethical guidelines, and infrastructure rather than by the technical capabilities of the tool alone.

Finally, the disciplinary particularities of each program were clearly expressed in the qualitative data. Early Childhood Education showed the greatest theoretical elaboration regarding the metacognitive use of GenAI; Foreign Languages evidenced the greatest diversity of uses and the greatest polarization between active adoption and non-use; Physical Education exhibited the highest volume of documented concrete experiences but with less systematic pedagogical reflection; and Social Sciences showed a critical orientation towards the tool consistent with the discipline's epistemology, although with less available qualitative evidence base. These differences reinforce the relevance of designing GenAI integration strategies that recognize and

respond to the pedagogical and epistemological specificities of each degree, just as Delgado de Frutos et al. (2024) point out in their comparative analysis by educational level.

Note on unclassifiable responses

A total of 30 responses were classified as 'Unclassified' in the analysis matrix, corresponding to participants who explicitly declared not having used GenAI in their feedback practices. These responses are not interpreted as empty data, but as direct evidence of the adoption gap documented in the quantitative component. The distribution of these responses by program (Foreign Languages: 8; Physical Education: 4; Social Sciences: 1; Early Childhood Education: 1, plus the 'Not applicable' responses in P3) allows for territorializing the gap and orienting institutional interventions towards the contexts where adoption is most limited. Methodologically, the inclusion of these testimonies in the analysis guarantees the study's credibility and dependability, insofar as it reflects the complete reality of the observed phenomenon (Lincoln & Guba, 1985).

Integration of Quantitative and Qualitative Findings: Joint Displays, Meta-Inferences, and Dialogue with Prior Research

Consistent with the convergent mixed-methods design adopted in this study, this final section integrates the quantitative results presented across the eight UTAUT2 dimensions with the qualitative findings derived from the categorization matrix, through the development of joint displays (Fetters, Curry, & Creswell, 2013). Beyond triangulating quantitative and qualitative evidence internally, this integration is further enriched through a dialogue with the international, national, and local studies reviewed in Chapter II, allowing the findings of this research to be situated within the broader landscape of empirical evidence on generative AI in education.

Table 1 presents the distribution of the 66 participating professors by program. Of these, 52 belong to a single program: Foreign Languages (n = 26) and Physical Education (n = 19) account for most of that group, whereas Social Sciences (n = 5) and Early Childhood Education (n = 2) are very small groups. The remaining 14 professors teach across several programs and are excluded from program-level comparisons. In addition, 50 participants reported current or past use of GenAI (users) and 16 had never used it (non-users). Given the exploratory-descriptive

scope of the study and the small size of some subgroups, the comparisons that follow are presented as descriptive tendencies rather than statistically validated differences..

Limitations of the Study

Several limitations should be considered when interpreting the findings of this study, particularly those concerning sample size and the composition of the participating groups.

First, participation was uneven across programs. Of the 66 participating professors, 52 belong to a single program, distributed as follows: Foreign Languages (n = 26), Physical Education (n = 19), Social Sciences (n = 5), and Early Childhood Education (n = 2). The remaining 14 professors teach across several programs and could not be assigned to a single disciplinary group. Owing to the low participation in Social Sciences and, especially, Early Childhood Education, the descriptive statistics reported for these programs reflect the responses of very few individuals. With only two participants, the means for Early Childhood Education (for example, the highest Facilitating Conditions and the lowest Social Influence) are highly sensitive to individual responses and cannot be interpreted as characteristic of the program as a whole. Similarly, the qualitative voices attributed to each program, such as those coded as DEI or DCS, should be understood as individual accounts rather than as representative positions of their programs.

Second, the comparison between users (n = 50) and non-users (n = 16) also rests on a modest and unbalanced sample. Differences between these groups, such as those observed in institutional compatibility (FC3) and confidence in detecting AI-generated bias (ECP1), are reported as descriptive tendencies, since the small size of the non-user group limits the stability of the percentages.

Third, consistent with the exploratory-descriptive scope of the study, the analyses do not include inferential tests of differences between programs or between user groups. The differences reported here should therefore be read as observed tendencies and not as statistically validated effects, and they should not be generalized beyond the participating professors.

Fourth, the study was conducted within a single Faculty of Education at one institution (UCEVA), and the data rely on professors' self-reported perceptions and accounts of their own practice. These findings are therefore situated in this specific institutional context, and their transferability to other faculties, institutions, or regions should be examined with caution.

Despite these limitations, the convergent design allows the quantitative and qualitative evidence to be read together, which strengthens the interpretive value of the patterns identified, particularly those that recur across the larger groups (Foreign Languages and Physical Education) and across the qualitative accounts. Future research could address these limitations by increasing participation in the smaller programs, incorporating inferential analyses once the group sizes allow it, and extending the study to other institutions in order to contrast the tendencies documented here.

Discussion

Instrumental use overshadows reflective pedagogical use

Our findings show a predominance of instrumental engagement with GenAI: between 78% and 86% of users (n = 50) agreed that the tool improves efficiency and personalization (PE1–PE3), whereas only 30% considered that it supports deeper cognitive processes (PE4). This gap between efficiency and depth appears to be more than a statistical pattern; it resonates with the tension voiced by DCS#7, who described AI as *"muy precisa a la hora de comprender las percepciones de los estudiantes,"* a comment centered on precision rather than pedagogical depth, in contrast with DEI#1's account of feedback built around "*comentarios y preguntas orientadoras que invitaban a los estudiantes a cuestionarse."* Although these two accounts are illustrative rather than representative, one possible interpretation is that GenAI's most valuable formative function, prompting reflection rather than simply correcting, is present but still limited, and appears more clearly in the accounts of professors who describe stronger pedagogical elaboration. In this reading, the professor acts as a critical mediator who may determine whether the tool remains a corrective device or becomes a prompt for reflection. This interpretation is consistent with Avalos Guijarro (2024), whose systematic review reported a moderate effect of AI on academic performance (d = 0.51) and a stronger effect on critical thinking (d = 0.68); read

alongside our qualitative evidence, it suggests that the formative potential documented internationally may, at UCEVA, depend to a considerable extent on how professors choose to use the tool, rather than on the tool alone.

Ease of use does not guarantee pedagogical integration

Participants reported GenAI as easy to learn (68%) and to understand (82%), yet only half considered it easy to integrate into their teaching workflow (EE2: 50%). This difference of 18 to 32 percentage points can be read as a quantitative expression of a distinction that recurs in the qualitative data: knowing how to use a tool is not the same as knowing how to teach with it. DLE#4 described GenAI as a *"copiloto pedagógico"* whose purpose was *"escalar la calidad del feedback sin sacrificar tiempo ni personalización,"* a formulation that treats ease of use as a means to a pedagogical end rather than an end in itself. This pattern is in line with Nirchi et al. (2024), who reported that novice teachers in Italy valued AI mainly for personalizing and innovating instruction, whereas more experienced tutors used it mostly as administrative support; a similar divide may be operating at UCEVA, although our data do not allow us to test it. Taken together, these results suggest that the critical step lies less in technical access than in the professor's capacity to turn an easily learned tool into deliberate pedagogical design, which is precisely where mediation becomes decisive.

Institutional support has not kept pace with individual adoption

A marked gap separates users from non-users regarding institutional compatibility (FC3: 72% of 50 users vs. 18.75%, that is, 3 of 16 non-users), and just over half of users (58%) found GenAI compatible with existing institutional platforms (FC2). Because the non-user group is small, the percentage reported for non-users should be read with caution. These figures are consistent with what participants repeatedly described as an *"ausencia de directrices institucionales claras,"* and with the still incipient, unguided appropriation documented particularly in Social Sciences and Foreign Languages (with the caveat that Social Sciences comprises only five professors). One possible reading is that individual professors are adapting to GenAI faster than the institution is building structures to support them, a mismatch that echoes Bedoya Villa et al. (2024) and Díaz Ramírez and Díaz Ramírez (2024), both of whom identified the absence of institutional policy as a central barrier in Colombian higher education. From this

perspective, the lack of clear guidelines matters not only administratively but pedagogically: without shared institutional criteria, each professor must exercise critical mediation in isolation. These findings place UCEVA's Faculty of Education as broadly consistent with a national pattern, although they do not allow us to claim that it is representative of it.

The professor as an indispensable mediator

In the accounts from all four programs, a recurring condition emerged for GenAI to contribute to critical thinking: it must be reviewed, contextualized, and mediated by the professor, who retains pedagogical responsibility for the feedback. In our data this does not appear as a peripheral safeguard but as what separates the productive use described by DEF#9, who used AI "*como apoyo para identificar inconsistencias entre los objetivos de aprendizaje y las tareas propuestas,"* from the cautionary case reported by DEF#1, in which students' arguments *"no fueron argumentados... de la mejor manera pues se guiaron solo por la IA y no dieron sus conceptos personales."* These two accounts are illustrative, and we do not claim they are representative of each program. Still, the contrast is consistent with Hattie and Timperley's (2007) argument that effective feedback requires not only accurate information but a framework of understanding that allows the learner to appropriate it, a framework that, in the accounts we analyzed, appears to be supplied mainly through the professor's mediation. The finding is also consistent with Giraldo and Delgado (2025), conducted at UCEVA itself, who identified pedagogical mediation as a key enabler of formative feedback, and with Nirchi et al.'s (2024) warning about the risks of technological dependency in the absence of deliberate pedagogical design. Read together, these elements suggest that the professor's role as critical mediator is what can turn AI-generated output into an occasion for students to build their own reasoning rather than merely reproduce it.

An adoption gap that is still unfolding, not yet closed

Nearly a quarter of respondents (24%, n = 16 of 66) reported never having used GenAI, and a further 12% (n = 8) had used it previously but no longer did; together, they place over a third of the faculty (24 of 66) outside current use (Figure 4). The 30 open-ended responses classified as "Unclassified" can be read not as missing data but as testimony of this gap: DLE#7's statement that *"no he utilizado Gen IA para retroalimentar, solo para búsqueda de información"*

describes a real relationship with the tool, not an absence of one. This pattern echoes Roe et al. (2024), who documented low familiarity and general skepticism toward GenAI among academic staff internationally, and Delgado de Frutos et al. (2024), who found that higher education teachers tend to weigh ethical and safety concerns more heavily than adoption enthusiasm. In contrast with Khlaif et al. (2024), whose Middle Eastern sample of early adopters displayed relatively consolidated adoption patterns, the inclusion of both users and non-users in our sample offers a view of a faculty that seems to be in a transitional stage. We consider this one of the study's specific contributions, since much of the literature reviewed in Chapter II focuses on already-adopting populations rather than institutions still in the process of adopting. This also carries a pedagogical implication: professors who have not yet experimented with the tool are, for now, less positioned to exercise informed critical mediation over its use.

Ethical uncertainty runs deeper than technical distrust

Participants expressed persistent uncertainty about institutional ethical orientations, and users reported greater confidence than non-users in detecting AI-generated bias (ECP1: 62% of 50 users vs. 25%, that is, 4 of 16 non-users). Because the non-user group is small, this difference is reported as a descriptive tendency. One possible reading is that it reflects differences in exposure and not in technical skill alone: professors who have used the tool may have had more opportunity to develop a critical eye toward its outputs, as DLE#10 illustrated in describing responses that were *"en su mayoría información pertinente y acertada"* despite occasional errors, a calibrated, experience-based trust rather than blind acceptance. This is consistent with Cervantes de la Cruz et al. (2024) and Avalos Guijarro (2024), both of whom identified data privacy and ethical uncertainty as persistent concerns even among participants who recognized AI's benefits, and it suggests that ethical literacy and hands-on experience may need to develop together, rather than ethical guidance simply preceding use. In this sense, critical mediation also has an ethical dimension: professors need to be able to question what the tool produces before they can guide students in doing the same.

Disciplinary context shapes but does not determine the same underlying tensions

Program-level comparisons must be read in light of the very unequal group sizes shown in Table 1: Foreign Languages (n = 26) and Physical Education (n = 19) account for most of the 52

professors who belong to a single program, whereas Social Sciences (n = 5) and Early Childhood Education (n = 2) are very small groups. The comparisons that follow are therefore strictly descriptive and should not be generalized.

Foreign Languages and Physical Education showed the most favorable overall UTAUT2 profiles (M = 3.53–3.97), while Social Sciences showed the lowest descriptive scores; consistent with the study's exploratory-descriptive scope, this is reported as an observed tendency rather than a statistically validated difference, and the Social Sciences values in particular reflect the responses of only five professors. Early Childhood Education recorded the highest Facilitating Conditions (M = 4.25) and the lowest Social Influence (M = 2.89), but with only two professors these means cannot be interpreted as a program-level pattern; they are reported for completeness and as a reminder of the limits of program-level inference in this study.

Qualitatively, this diversity took shape in distinct disciplinary voices: DEI#1's call for implementation *"alineada con un enfoque metacognitivo del aprendizaje"* [aligned with a metacognitive approach to learning] versus DCS#5's more adversarial stance *of "confrontar mi análisis con el análisis propuesto por la IA"* [confront my analysis with the analysis proposed by AI] illustrate two different pedagogical philosophies toward the same tool, understood as individual voices within their programs rather than as positions representative of them. This is in line with Delgado de Frutos et al. (2024), who found that teachers' perceptions of AI differ significantly by educational level and disciplinary context; our data are compatible with this claim and add a nuance specific to formative feedback that is largely absent from the international literature reviewed in Chapter II.

Both voices, though different, place the professor as the one who decides how the tool enters the pedagogical relationship, which suggests that mediation may be exercised in discipline-specific ways rather than through a single model, a conjecture that larger samples per program would be needed to examine.

Situating this study relative to its closest local antecedent

While Giraldo and Delgado's (2025) local antecedent and our own findings converge on the centrality of pedagogical mediation, the two studies reach this conclusion through distinct

empirical routes that we consider complementary rather than redundant. Giraldo and Delgado (2025) built a theoretical account of the conditions of possibility for formative feedback by triangulating the perspectives of twelve high-impact international researchers with documentary analysis of their published work, an expert-informed, largely conceptual approach. The present study, by contrast, examines that account from the perspective of UCEVA's own teaching staff: it directly surveys professors across the faculty's four undergraduate programs, uses a validated technology-acceptance framework (UTAUT2) alongside qualitative accounts of classroom practice, and includes both current users and non-users of GenAI. In this sense, the study offers a program-differentiated, GenAI-specific, practitioner-level contrast with the conditions identified by international experts, an initial step from theoretical diagnosis toward institutional evidence that constitutes the specific contribution of this research relative to its closest local antecedent, within the limits of its exploratory scope.

Synthesis

Taken together, these threads point to an interpretive claim that we consider the central contribution of this study: the educational value of GenAI in formative feedback does not appear to be a property of the technology itself, but an outcome of pedagogical mediation sustained by adequate institutional conditions. Where the literature reviewed in Chapter II has tended to examine technology acceptance (UTAUT2-based studies such as Nirchi et al., 2024) and pedagogical impact (effect-size studies such as Avalos Guijarro, 2024) as largely separate lines of inquiry, our convergent design allows us to explore how these two dimensions interact: professors who are technologically confident but institutionally unsupported, or pedagogically willing but insufficiently trained, appear to converge on the same result, an underexploited formative potential.

In every case, the professor emerges as the critical mediator who converts access into meaningful learning, provided that the institution offers the guidance, training, and criteria that mediation requires. Given the exploratory scope and the small size of some subgroups, this is offered as a well-grounded interpretation for this context and not as a generalizable finding; it is, in our view, the most direct response this study offers to its central research problem.

Table 4

Joint Display: Integration of Quantitative and Qualitative Findings, in Dialogue with Prior Research

Analytical Theme	Quantitative Finding	Qualitative Finding	Convergence / Divergence (Cuanti-Cuali)	Dialogue with Prior Research
Instrumental vs. reflective use of GenAI	Performance Expectancy: 78-86% agreement on efficiency/personalization (RE1-RE3); only 30% agreed GenAI supports deeper cognitive processes (RE4)	Predominance of instrumental use, e.g.: *"La IA es muy precisa a la hora de comprender las percepciones de los estudiantes."* (DCS#7); contrasted with more reflective uses such as: *"Las devoluciones se centraron en comentarios y preguntas orientadoras que invitaban a los estudiantes a cuestionarse..."* (DEI#1)	Convergence	Consistent with Avalos Guijarro (2024), whose systematic review found a moderate effect on academic performance (d=0.51) but a stronger effect on critical thinking (d=0.68) suggesting that AI's most significant formative potential remains underexploited relative to its instrumental use.

Ease of use vs. depth of pedagogical integration	Effort Expectancy: high agreement on ease of learning (68%) and comprehension (82%), but only 50% on effortless integration into workflows (EE2)	Faculty training identified as the most urgent condition; e.g.: *"Implementé GenAI como copiloto pedagógico para retroalimentar producciones escritas. El objetivo era escalar la calidad del feedback sin sacrificar tiempo ni personalización."* (DLE#4)	Convergence	Aligns with Nirchi et al. (2024, Italy), who found that novice teachers valued AI's ease of personalizing and innovating teaching, while tutors experienced it mainly as administrative support.
Institutional support and training gaps	Facilitating Conditions: marked knowledge gap between users and non-users (CF3: 72% vs. 18.75%); only 58% found GenAI compatible with institutional platforms (CF2)	"Ausencia de directrices institucionales claras" as a structural obstacle; reflected in program-level accounts of incipient, unguided appropriation, particularly in Social Sciences and Foreign Languages	Convergence	Directly consistent with Bedoya Villa et al. (2024) and Díaz Ramírez & Díaz Ramírez (2024), both identifying the absence of institutional policies as a central barrier in Colombian higher education.

The teacher as mediator of AI-generated feedback	Tension between efficiency (Performance Expectancy) and concerns about weakened reflective capacity (RE4); 80% of users verified AI-generated content accuracy (DER3)	*"La IA generativa se utilizó como apoyo para identificar inconsistencias entre los objetivos de aprendizaje y las tareas propuestas..."* (DEF#9); contrasted with a case of AI used without mediation: *"...no fueron argumentados por los estudiantes de la mejor manera pues se guiaron solo por la IA y no dieron sus conceptos personales..."* (DEF#1)	Convergence	Strongly consistent with Giraldo and Delgado (2025) conducted at UCEVA itself who identified pedagogical mediation strategies as key enablers of formative feedback, and with Nirchi et al.'s (2024) warning about dependency without pedagogical design.
Adoption gap across the faculty	24% never used GenAI, 12% used it previously but no longer do (36% outside current use, Figure 4)	30 open-ended responses classified as "Unclassified"; e.g.: *"No he utilizado Gen IA para retroalimentar. Solo para búsqueda de información."* (DLE#7)	Convergence	Echoes Roe et al. (2024), who found low familiarity with GenAI and general skepticism among academic staff internationally, and Delgado de Frutos et al. (2024), who reported that higher education teachers emphasized ethical/safety concerns over adoption enthusiasm.

Ethical uncertainty and institutional ambiguity	Uncertainty regarding institutional ethical orientations (Social Influence); users more confident detecting bias than non-users (DER1: 62% vs. 25%)	Recurring reservations linked to reliability of AI-generated content; e.g.: *"Para retroalimentar escritos de mis estudiantes, generó algunas respuestas erróneas, pero en su mayoría información pertinente y acertada."* (DLE#10)	Convergence	Consistent with Cervantes de la Cruz et al. (2024) and Avalos Guijarro (2024), both identifying data privacy and ethical challenges as persistent concerns even where AI's benefits were acknowledged.
Disciplinary and program-level particularities	Foreign Languages and Physical Education show the most favorable UTAUT2 profiles (M=3.53–3.97); Social Sciences shows the lowest scores; Early Childhood Education combines high Facilitating Conditions (M=4.25) with the lowest Social Influence (M=2.89)	Early Childhood Education's most elaborate account: *"...es necesario que su implementación esté alineada con un enfoque metacognitivo del aprendizaje."* (DEI#1); Social Sciences' more critical-analytical stance: *"Confrontar mi análisis con el análisis propuesto por la IA."* (DCS#5)	Convergence, with qualitative nuance	Resonates with Delgado de Frutos et al. (2024), who found that teachers' perceptions of AI differ significantly by educational level and disciplinary context.

Note. Quantitative percentages correspond to the AI-using group (n=50) unless otherwise noted. Participant codes indicate academic programs (DLE = Foreign Languages; DEF = Physical Education; DEI = Early Childhood Education; DCS = Social Sciences). Qualitative excerpts appear in their original Spanish. Own elaboration, based on data collected for this study.

Taken together, these joint displays support four overarching meta-inferences for this study, each situated in dialogue with prior research. First, teachers across the Faculty of

Education at UCEVA hold a predominantly favorable disposition toward generative AI, consistent with the optimism reported internationally by Alwaqdani (2024) and nationally by Cervantes de la Cruz et al. (2024) yet, as in those studies, this disposition coexists with a well-documented institutional gap in training, infrastructure, and ethical guidance.

Second, the pedagogical value of AI-supported feedback is not automatic: both strands of evidence in this study, together with the local antecedent of Giraldo and Delgado (2025), converge on the finding that meaningful integration depends on the teacher's critical mediation of AI-generated content, directly addressing this study's third specific objective.

Third, disciplinary context matters, echoing Delgado de Frutos et al.'s (2024) finding that AI perceptions vary meaningfully by educational level and field suggesting that institutional strategies for AI adoption should be differentiated rather than uniform.

Finally, unlike Khlaif et al. (2024), whose Middle Eastern sample of early adopters showed relatively consolidated adoption patterns, the present study's inclusion of both users and non-users reveals a faculty still navigating a transitional stage of adoption a distinctive contribution of this research, since fewer studies specifically examine generative AI within formative feedback practices oriented toward critical thinking in teacher education programs.

Conclusions

The present study contributes to the understanding of how professors in the Faculty of Education at UCEVA perceive and use Generative Artificial Intelligence (GenAI) in formative feedback practices aimed at fostering critical thinking. Beyond describing faculty perceptions and current uses of GenAI, the central contribution of this research is to show that the educational value of GenAI does not reside in the tool itself, but depends on the pedagogical mediation exercised by professors and on the institutional conditions that make such mediation possible. The findings provide evidence of both the opportunities and challenges associated with the integration of AI into higher education, highlighting the importance of pedagogical, ethical, and institutional factors in shaping its educational value.

First, the findings indicate that professors generally hold favorable perceptions toward the use of GenAI in formative feedback processes, particularly regarding Performance Expectancy: 86% of current users recognized its potential to reduce time spent on repetitive assessment tasks (item RE1), and approximately 80% agreed that it contributes to clearer, more useful feedback. Effort Expectancy showed a more uneven pattern: while 68% of participants considered GenAI accessible and easy to learn, only 50% agreed that integrating it into their pedagogical workflow was equally straightforward (item EE2), suggesting that perceived ease of use does not automatically translate into ease of pedagogical integration.

Second, the study reveals that the pedagogical use of GenAI remains predominantly focused on instrumental functions such as error correction, content revision, and product improvement. This pattern is directly consistent with the product–process distinction developed in the qualitative findings: the use of GenAI concentrated overwhelmingly on product-oriented feedback, while its use for process-oriented feedback supporting argumentation, reflection, and critical thinking although present remained comparatively limited and confined mainly to professors with greater pedagogical elaboration. Consequently, the transformative potential of GenAI for fostering higher-order cognitive processes has not yet been fully developed within the Faculty of Education.

Third, and probably the most important conclusion of this study, is that the effectiveness of AI-supported feedback depends fundamentally on the professor's role as a critical mediator. This finding constitutes the central contribution of the research, as it synthesizes the most original result of the qualitative analysis: rather than confirming that GenAI itself transforms feedback practices, the evidence gathered across all four programs indicates that the real transformative factor is the pedagogical mediation exercised by the professor. Faculty members consistently emphasized that AI should function as a pedagogical support tool rather than as a substitute for professional judgment. Therefore, meaningful feedback continues to require teacher interpretation, contextualization, and pedagogical decision-making, with GenAI operating only as a resource whose formative value is contingent on how critically and intentionally it is appropriated.

Fourth, the findings indicated that the principal barriers to GenAI integration are not primarily technological but pedagogical and institutional. This is illustrated by the marked gap in perceived facilitating conditions between current users and non-users (item CF3: 72% vs. 18.75%), together with the prominence of faculty training, ethical concerns, and demands for clear institutional guidelines, indicating that successful implementation requires a comprehensive framework that combines professional development, ethical regulation, technological infrastructure, and pedagogical support.

Taken together, these four findings converge on a single integrative conclusion: the predominance of instrumental over reflective use, the necessity of the professor's critical mediation, faculty training as a priority condition, and clear institutional policies are not isolated results, but interdependent dimensions of the same underlying phenomenon. The extent to which GenAI contributes to the development of critical thinking at UCEVA depends jointly on all four; a well-trained professor exercising critical mediation without adequate institutional support is as limited in impact as clear institutional guidelines without professors prepared to enact them pedagogically.

Finally, considering that most professors already report favorable perceptions of GenAI while only a minority currently extend its use toward process-oriented, reflective feedback, the study concludes that Generative Artificial Intelligence can become a valuable ally in

strengthening formative assessment and promoting critical thinking in higher education. However, this potential does not depend on the technical capabilities of the tool itself, but on the establishment of pedagogically mediated, ethically oriented, and institutionally supported practices that prioritize student autonomy, reflective learning, and the development of critical judgment rather than the simple automation of academic tasks.

Recommendations

Based on the findings obtained through the integration of both the quantitative and qualitative components of this study, several recommendations are proposed to support the responsible and meaningful integration of Generative Artificial Intelligence (GenAI) into formative feedback practices within the Faculty of Education at UCEVA.

As the primary institutional recommendation of this study, it is recommended that the Faculty of Education strengthen professional development opportunities focused on the pedagogical integration of GenAI. This recommendation is prioritized above the others because faculty training emerged as the most recurrent category across the qualitative analysis, consistently identified as the most urgent condition by teachers across all four academic programs. Training initiatives should not be limited to the technical use of AI tools but should also address pedagogical strategies, ethical considerations, and specifically the design of feedback oriented toward cognitive processes rather than product correction alone, given that this distinction between product-oriented and process-oriented feedback emerged as one of this study's principal findings (Types of Feedback dimension). Such training would enable teachers to employ AI in ways that foster critical thinking, reflection, and student autonomy.

A second recommendation concerns the development of institutional regulation at three distinct levels, which should be understood as complementary rather than interchangeable. Institutional guidelines would establish general institutional positioning and expectations regarding the pedagogical use of GenAI within the Faculty of Education.

Ethical frameworks would address the principled dimension of this use — academic integrity, data privacy, transparency, and responsible authorship — providing the normative foundation for decision-making in ambiguous situations. Usage protocols, in turn, would translate these guidelines and ethical principles into concrete, operational procedures for specific academic tasks (e.g., how GenAI-assisted feedback should be documented, disclosed to students, or verified for accuracy).

The concerns expressed by participants regarding academic integrity, reliability of AI-generated content, and responsible use highlight the need for this three-tiered structure, which

would provide faculty members with a coherent framework for decision-making at each level and contribute to the establishment of consistent and ethically grounded educational practices.

Likewise, and representing one of this study's most original contributions, professors should be encouraged to explore pedagogical uses of GenAI that extend beyond instrumental functions such as error correction, content revision, or product improvement. While product-oriented applications may contribute to efficiency, the findings of this study suggest that deliberately shifting practice toward process-oriented feedback feedback that uses AI as a tool for questioning, argumentation, reflection, and problem-solving represents the most direct pathway through which AI-supported feedback can genuinely strengthen students' critical thinking.

Furthermore, the Faculty of Education should promote collaborative spaces where professors can exchange experiences, challenges, and successful practices related to the use of GenAI in educational contexts. Given the disciplinary particularities identified across the four academic programs including the more critical-analytical orientation observed in Social Sciences, the pragmatic and product-focused approach in Physical Education, and the more theoretically elaborated, metacognitive engagement in Early Childhood Education it is recommended that these collaborative spaces be structured as interdisciplinary communities of practice, explicitly bringing together faculty from different programs.

Finally, future research should continue exploring the relationship between GenAI, formative feedback, and critical thinking from multiple perspectives, building specifically on the gaps identified in this study. Future studies could examine: (1) the role of the teacher as a critical mediator of AI-generated feedback; (2) the design and evaluation of feedback practices explicitly oriented toward cognitive processes, moving beyond the product-oriented uses that currently predominate; and (3) the evaluation of faculty development programs focused on AI-supported feedback, to determine whether targeted training measurably shifts practice from instrumental to reflective uses of GenAI.

Taken together, these recommendations point to a single coordinated agenda for the Faculty of Education: prioritizing faculty training, articulating institutional and ethical guidelines, promoting reflective and interdisciplinary practice, and pursuing further research, so that the

pedagogical integration of generative AI moves deliberately from its current, largely instrumental use toward practices that genuinely support critical and creative thinking at UCEVA.

References

Al-Zahrani, A. M., & Alasmari, T. M. (2024). Exploring the impact of artificial intelligence on higher education: The dynamics of ethical, social, and educational implications. *Palgrave Communications, 11*(1), 1–13. https://www.nature.com/articles/s41599-024-03432-4

Alianza 4U. (2024). *Manifiesto sobre la adopción de la inteligencia artificial en la educación superior*. Universidad EAFIT. https://www.eafit.edu.co/exa/Documents/VERSION_FINAL_REVISADA_MANIFIESTO_IA.pdf

Andino Jaramillo, R. A. (2022). *Formación pedagógica en educación inclusiva para docentes de bachillerato*. ResearchGate.

Andrade, H. L. (2010). Summing up and moving forward: Key challenges and future directions for research and development in formative assessment. In *Handbook of formative assessment* (pp. 344–351). Routledge.

Bender, E. M., Gebru, T., McMillan-Major, A., & Shmitchell, S. (2021). On the dangers of stochastic parrots: Can language models be too big? *Proceedings of the 2021 ACM Conference on Fairness, Accountability, and Transparency (FAccT '21)*, 610–623. https://doi.org/10.1145/3442188.3445922

Bennett, R. E. (2011). Formative assessment: A critical review. *Assessment in Education: Principles, Policy & Practice, 18*(1), 5–25. https://doi.org/10.1080/0969594X.2010.513339

Black, P., & Wiliam, D. (1998a). Assessment and classroom learning. *Assessment in Education: Principles, Policy & Practice, 5*(1), 7–74. https://doi.org/10.1080/0969595980050102

Black, P., & Wiliam, D. (1998b). Inside the black box: Raising standards through classroom assessment. *Phi Delta Kappan, 80*(2), 139–148. https://doi.org/10.1177/003172171009200119

Borja, J., Ramírez, L., & Vélez, C. (2025). *Inteligencia artificial en la docencia universitaria: Retos éticos y pedagógicos*. Editorial Académica Colombiana.

Boud, D., & Molloy, E. (2013). Rethinking models of feedback for learning: The challenge of design. *Assessment & Evaluation in Higher Education, 38*(6), 698–712. https://doi.org/10.1080/02602938.2012.691462

Carless, D., & Boud, D. (2018). The development of student feedback literacy: Enabling uptake of feedback. *Assessment & Evaluation in Higher Education, 43*(8), 1315–1325. https://doi.org/10.1080/02602938.2018.1463354

Cervantes, J., Moreno, D., & Ríos, F. (2024). *Educación crítica en la era digital: Inteligencia artificial y pensamiento superior*. Fondo Editorial Universitario.

Chatterjee, S., & Bhattacharjee, K. K. (2020). Adoption of artificial intelligence in higher education: A quantitative analysis using structural equation modeling. *Education and Information Technologies, 25*(4), 3443–3463. https://doi.org/10.1007/s10639-020-10152-1

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319–340. https://doi.org/10.2307/249008

Descartes, R. (2006). *Discourse on the method*. Penguin Classics. (Original work published 1637)

Díaz, S. D. (2025, abril 3). *Inteligencia artificial en Colombia: Innovación y casos de éxito recientes*. Impacto TIC. https://impactotic.co/inteligencia-artificial/ia-en-colombia-innovacion-y-casos-de-exito-reciente/

Díaz Barriga, F., & Hernández, G. (2010). *Estrategias docentes para un aprendizaje significativo: Una interpretación constructivista* (3.ª ed.). McGraw-Hill Interamericana.

Díaz Ramírez, M. A., & Díaz Ramírez, J. P. (2024). La organización de experiencias en la incorporación de la inteligencia artificial en entornos virtuales de aprendizaje. *Revista CIEG, 6*(86), 100–115. https://revista.grupocieg.org/wp-content/uploads/2024/01/Ed.6586-100-Diaz-y-Diaz.pdf

El Nuevo Siglo. (2024). *Nueve de cada diez estudiantes colombianos usan la IA generativa*. https://www.elnuevosiglo.com.co/cultura-y-sociedad/nueve-de-cada-diez-estudiantes-colombianos-usa-la-ia-generativa

Ertmer, P. A. (1999). Addressing first- and second-order barriers to change: Strategies for technology integration. *Educational Technology Research and Development, 47*(4), 47–61. https://doi.org/10.1007/BF02299597

Ertmer, P. A. (2005). Teacher pedagogical beliefs: The final frontier in our quest for technology integration? *Educational Technology Research and Development, 53*(4), 25–39. https://doi.org/10.1007/BF02504683

Floridi, L., & Chiriatti, M. (2020). GPT-3: Its nature, scope, limits, and consequences. *Minds and Machines, 30*(4), 681–694. https://doi.org/10.1007/s11023-020-09548-1

Foucault, M. (1975). *Vigilar y castigar: Nacimiento de la prisión*. Siglo XXI Editores.

Foucault, M. (1982). The subject and power. *Critical Inquiry, 8*(4), 777–795. https://doi.org/10.1086/448181

Ferrer Franco, M. A. (2025). *Formación de docentes UCEVA en el campo de herramientas tecnológicas e inteligencia artificial* [Informe interno]. Escuela de Formación Docente, Unidad Central del Valle del Cauca.

GAD3. (2024). *Inteligencia artificial y la empleabilidad del futuro para estudiantes de educación superior*. Planeta Formación y Universidades.

Gómez, L. F., & Morales, S. (2024). La evaluación, la inteligencia artificial y otras tecnologías de vanguardia en la educación. *Prometeo, 1*(3), 85–88. https://prometeojournal.com.ar/index.php/prometeo/article/view/85

Goodfellow, I. J., Pouget-Abadie, J., Mirza, M., Xu, B., Warde-Farley, D., Ozair, S., Courville, A., & Bengio, Y. (2014). Generative adversarial networks. *arXiv*. http://arxiv.org/abs/1406.2661

Greene, J. C., Caracelli, V. J., & Graham, W. F. (1989). Toward a conceptual framework for mixed-method evaluation designs. *Educational Evaluation and Policy Analysis, 11*(3), 255–274. https://doi.org/10.3102/01623737011003255

Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of Educational Research, 77*(1), 81–112. https://doi.org/10.3102/003465430298487

Heritage, M. (2010). *Formative assessment: Making it happen in the classroom*. Corwin Press.

Hernández, R., Fernández, C., & Baptista, P. (2014). *Metodología de la investigación* (6a ed.). McGraw-Hill.

Holmes, W., Bialik, M., & Fadel, C. (2019). *Artificial intelligence in education: Promises and implications for teaching and learning*. Center for Curriculum Redesign.

Jardón, M., Allas, W., Zamora, D., & Cedeño, N. (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://www.reincisol.com/ojs/index.php/reincisol/article/view/537

Johnson, R. B., & Onwuegbuzie, A. J. (2004). Mixed methods research: A research paradigm whose time has come. *Educational Researcher, 33*(7), 14–26. https://doi.org/10.3102/0013189X033007014

Kaplan, A., & Haenlein, M. (2019). Siri, Siri, in my hand: Who's the fairest in the land? On the interpretations, illustrations, and implications of artificial intelligence. *Business Horizons, 62*(1), 15–25. https://doi.org/10.1016/j.bushor.2018.08.004

Kerlinger, F. N., & Lee, H. B. (2002). *Foundations of behavioral research* (4th ed.). Wadsworth.

LeCun, Y., Bengio, Y., & Hinton, G. (2015). Deep learning. *Nature, 521*(7553), 436–444. https://doi.org/10.1038/nature14539

Lipman, M. (2003). *Thinking in education* (2nd ed.). Cambridge University Press. https://doi.org/10.1017/CBO9780511840272

Lipton, Z. C. (2018). The mythos of model interpretability. *Communications of the ACM, 61*(10), 36–43. https://doi.org/10.1145/3233231

Luckin, R. (2018). *Machine learning and human intelligence: The future of education for the 21st century*. UCL Institute of Education Press.

McCarthy, J., Minsky, M. L., Rochester, N., & Shannon, C. E. (2006). A proposal for the Dartmouth Summer Research Project on Artificial Intelligence, August 31, 1955. *AI Magazine, 27*(4), 12. https://doi.org/10.1609/aimag.v27i4.1904

Ministerio de Educación Nacional [MEN]. (2024). *Educación superior inicia el camino para integrar la inteligencia artificial en el país*. https://www.mineducacion.gov.co/portal/salaprensa/Comunicados/423752:Educacion-superior-inicia-el-camino-para-integrar-la-inteligencia-artificial-en-el-pais

Ministerio de Educación Nacional de Colombia. (2008). *Usar la evaluación en el aula para mejorar*. MEN. https://www.mineducacion.gov.co/1621/article-162385.html

Ministerio de Educación Nacional de Colombia. (s.f.). *Evaluación para los aprendizajes*. https://www.mineducacion.gov.co/1621/article-162342.html

Montes Miranda, A. J., Alarcón Lora, A. A., & Romero González, Z. (2019). La evaluación sumativa: El enfoque de la medición. *Revista ESPACIOS, 40*(9), 3. https://www.revistaespacios.com/a19v40n09/19400903.html

Newell, A., & Simon, H. (1956). The logic theory machine—A complex information processing system. *IEEE Transactions on Information Theory, 2*(3), 61–79. https://doi.org/10.1109/tit.1956.1056797

Nicol, D., & Macfarlane-Dick, D. (2006). Formative assessment and self-regulated learning: A model and seven principles of good feedback practice. *Studies in Higher Education, 31*(2), 199–218. https://doi.org/10.1080/03075070600572090

Nilsson, N. J. (2009). *The quest for artificial intelligence*. Cambridge University Press.

Novakovich, J. (2016). Fostering critical thinking and reflection through blog-mediated peer feedback. *Journal of Computer Assisted Learning, 32*(1), 16–30. https://doi.org/10.1111/jcal.12123

OpenAI. (n.d.). *Openai.com*. Retrieved October 6, 2025, from https://openai.com/es-ES/

Organisation for Economic Co-operation and Development [OECD]. (2021). *OECD principles on artificial intelligence*. OECD Publishing. https://doi.org/10.1787/ai-2021-en

Orozco Silva, L. E. (2019). Trabajo docente y políticas de evaluación externa en Colombia y Brasil. *Revista Colombiana de Educación, 77*, 109–129. https://doi.org/10.17227/rce.num77-6497

Pajares, M. F. (1992). Teachers' beliefs and educational research: Cleaning up a messy construct. *Review of Educational Research, 62*(3), 307–332. https://doi.org/10.3102/00346543062003307

Paris, B. M. (2022). Instructors' perspectives of challenges and barriers to providing effective feedback. *Teaching & Learning Inquiry, 10*(3). https://doi.org/10.20343/teachlearninqu.10.3

Pedrosa-de-Jesus, H., Guerra, C., & Watts, M. (2019). Active co-constructive written feedback: Promoting students' critical thinking in a higher education context. In *Proceedings of the 7th International Conference on Technological Ecosystems for Enhancing Multiculturality (TEEM'19)* (pp. 129–136). ACM. https://doi.org/10.1145/3362789.3362923

Piaget, J. (1972). Intellectual evolution from adolescence to adulthood. *Human Development, 15*(1), 1–12. https://doi.org/10.1159/000271225

Piaget, J., & Cook, M. (1952). *The origins of intelligence in children*. International Universities Press.

Poole, D. L., & Mackworth, A. K. (2017). *Artificial intelligence: Foundations of computational agents* (2nd ed.). Cambridge University Press. https://doi.org/10.1017/9781108164085

Popham, W. J. (2008). *Transformative assessment*. ASCD.

Rumelhart, D. E., Hinton, G. E., & Williams, R. J. (1986). Learning representations by back-propagating errors. *Nature, 323*(6088), 533–536. https://doi.org/10.1038/323533a0

Sadler, D. R. (1989). Formative assessment and the design of instructional systems. *Instructional Science, 18*(2), 119–144. https://doi.org/10.1007/BF00117714

Scriven, M. (1967). The methodology of evaluation. In R. W. Tyler, R. M. Gagné, & M. Scriven (Eds.), *Perspectives of curriculum evaluation* (pp. 39–83). Rand McNally.

Shute, V. J. (2008). Focus on formative feedback. *Review of Educational Research, 78*(1), 153–189. https://doi.org/10.3102/0034654307313795

Strauss, A., & Corbin, J. (1998). *Basics of qualitative research: Techniques and procedures for developing grounded theory* (2nd ed.). Sage Publications.

Stufflebeam, D. L., & Shinkfield, A. J. (2007). *Evaluation theory, models, and applications*. Jossey-Bass.

Supelano Londoño, L. (2024). *Transformación digital y nuevas pedagogías en la educación superior*. Ediciones Universidad Pedagógica Nacional.

Thorn, P. D. (2015). Nick Bostrom: Superintelligence: Paths, dangers, strategies. *Minds and Machines, 25*, 285–289.

Turing, A. (1950). Computing machinery and intelligence. *Mind, 59*(236), 433–460. https://doi.org/10.1093/mind/LIX.236.433

Tyler, R. W. (Ed.). (1969). *Educational evaluation: New roles, new means* (Vol. 68, Pt. 2). NSSE.

United Nations Educational, Scientific and Cultural Organization [UNESCO]. (2023). *Guidance for generative AI in education and research*. UNESCO Publishing. https://unesdoc.unesco.org/ark:/48223/pf0000386085

Vaswani, A., Shazeer, N., Parmar, N., Uszkoreit, J., Jones, L., Gomez, A. N., Kaiser, L., & Polosukhin, I. (2017). Attention is all you need. *arXiv*. http://arxiv.org/abs/1706.03762

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly, 27*(3), 425–478. https://doi.org/10.2307/30036540

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

Vygotsky, L. S. (1978). *Mind in society: Development of higher psychological processes* (M. Cole, V. John-Steiner, S. Scribner, & E. Souberman, Eds.). Harvard University Press.

Wiliam, D. (2018). Feedback: At the heart of—but definitely not all of—formative assessment. In A. A. Lipnevich & J. K. Smith (Eds.), *The Cambridge handbook of instructional feedback* (pp. 3–28). Cambridge University Press. https://doi.org/10.1017/9781316832134.003

Williamson, B., & Kizilcec, R. F. (2023). Algorithmic bias and educational fairness: Rethinking data, models, and responsibility in AI-enabled learning environments. *British Journal of Educational Technology, 54*(4), 1238–1253. https://doi.org/10.1111/bjet.13345

Winstone, N. E., Nash, R. A., Parker, M., & Rowntree, J. (2017). Supporting learners' agentic engagement with feedback: A systematic review and a taxonomy of recipience processes. *Educational Psychologist, 52*(1), 17–37. https://doi.org/10.1080/00461520.2016.1207538

Yin, R. K. (2018). *Case study research and applications: Design and methods* (6th ed.). SAGE.

Yudkowsky, E. (2008). Artificial intelligence as a positive and negative factor in global risk. In N. Bostrom & M. M. Ćirković (Eds.), *Global catastrophic risks* (pp. 308–345). Oxford Academic. https://doi.org/10.1093/oso/9780198570509.003.0021

Zou, D., Xie, H., & Wang, F. (2023). Effects of technology enhanced peer, teacher and self-feedback on students' collaborative writing, critical thinking tendency and engagement in learning. *Journal of Computing in Higher Education, 35*, 166–185. https://doi.org/10.1007/s12528-022-09328-0

Appendices

Appendix 1

Percepciones docentes sobre el uso de Inteligencia Artificial generativa en la retroalimentación académica para el desarrollo del pensamiento crítico.

Los estudiantes Daniel Andrés Peñaranda Aguelo y Gustavo Adolfo Almanza Lance, estudiantes de la Licenciatura en Lenguas Extranjeras con énfasis en inglés de la Unidad Central del Valle del Cauca (UCEVA), se encuentran desarrollando una investigación en el marco de su proceso formativo. Dicha investigación tiene como propósito conocer las perspectivas y expectativas de los docentes respecto al uso de la inteligencia artificial generativa (GenAI) en los procesos de retroalimentación formativa, particularmente aquellos orientados al desarrollo del pensamiento crítico de los estudiantes.

El estudio se llevará a cabo con la participación de docentes de los **programas de pregrado de la Facultad de Ciencias de la Educación de la UCEVA**, en el año 2025.

El cuestionario constituye una **adaptación contextualizada** del instrumento desarrollado por **Khlaif et al. (2024)** en su estudio *University Teachers' Views on the Adoption and Integration of Generative AI Tools for Student Assessment in Higher Education*, basado en el modelo **UTAUT2**.

El formulario está organizado en ítems de 10 bloques, los bloques exploran variables como: **rendimiento esperado, esfuerzo esperado, influencia social, condiciones facilitadoras, motivación hedónica, valor–precio, hábito, intención y comportamiento de uso, innovatividad personal en TI y consideraciones éticas y de riesgo**. Cada dimensión se mide a través de afirmaciones valoradas en una **escala tipo Likert de 1 a 5** (1 = *Totalmente en desacuerdo*, 5 = *Totalmente de acuerdo*), con la opción adicional de *"No aplica"* para quienes aún no usan IA.

Además, el cuestionario incluye **ítems de selección múltiple**, preguntas sobre **frecuencia de uso** de la IA en retroalimentación y **preguntas abiertas** que permiten profundizar en experiencias, casos de uso, barreras y oportunidades percibidas por los docentes.

* Indica que la pregunta es obligatoria

Glosario

En la presente investigación se abordarán diversos términos clave, los cuales se comprenderán desde un enfoque conceptual y contextual que permita una mejor interpretación de los fenómenos analizados. A continuación, se definen los conceptos fundamentales:

GenIA (Inteligencia Artificial Generativa): En el contexto de esta investigación, la IA generativa se entiende como una rama de la inteligencia artificial enfocada en la creación de contenido original —como textos, imágenes, música o simulaciones a partir de patrones aprendidos en grandes bases de datos. Según Goodfellow et al. (2014) y Floridi & Chiriatti (2020), este tipo de IA no solo reproduce información existente, sino que genera nuevos productos con características similares a las producciones humanas.
Su funcionamiento se basa principalmente en la arquitectura Transformer (Google, 2017), un modelo de red neuronal que utiliza mecanismos de codificación posicional y autoatención, permitiendo que los sistemas identifiquen y prioricen las partes más relevantes de la información. Esta estructura ha posibilitado el desarrollo de modelos de lenguaje capaces de producir contenido coherente y contextualizado, lo cual fundamenta su uso en la presente investigación para explorar su potencial en los procesos de retroalimentación académica orientada al fomento del pensamiento crítico.

Retroalimentación orientada al fomento del pensamiento crítico: se concibe como un proceso pedagógico continuo que promueve la reflexión, la autorregulación y el juicio autónomo del estudiante. Siguiendo a Vygotsky (1978) y Piaget (1972), se entiende que el pensamiento crítico se desarrolla mediante la interacción y el conflicto cognitivo que impulsan la reconstrucción del conocimiento, mientras que Foucault (1982) aporta una dimensión ética y reflexiva frente al saber. En este marco, el feedback formativo descrito por Hattie y Timperley (2007), y complementado por Nicol y Macfarlane-Dick (2006) y Boud y Molloy (2013), se asume como un diálogo constante orientado a mejorar el aprendizaje y fomentar la autonomía. Así, la inteligencia artificial generativa se incorpora como un recurso complementario que apoya este proceso, sin reemplazar la mediación pedagógica del docente.

Instrucciones

1. Inicio del cuestionario: Primero encontrará algunas preguntas generales relacionadas con su contexto sociodemográfico. Estas son importantes para caracterizar la muestra de participantes.

2. Preguntas principales: Luego se presentarán afirmaciones agrupadas por variables. Se le solicita indicar **en qué medida está de acuerdo o en desacuerdo** con cada una, utilizando la siguiente escala:

1 = *Totalmente en desacuerdo*
2 = *En desacuerdo*
3 = *Ni de acuerdo ni en desacuerdo*
4 = *De acuerdo*
5 = *Totalmente de acuerdo*

En caso de que no use herramientas de IA y el enunciado no sea aplicable a una expectativa sobre su uso, seleccione la opción **"No aplica"**.

3. Frecuencia de uso: Algunas preguntas requieren que señale **con qué frecuencia** utiliza la IA en procesos de retroalimentación, seleccionando entre opciones que van desde *"Nunca"* hasta *"Varias veces al día"*.

4. Preguntas abiertas: Al final encontrará preguntas abiertas en las que podrá describir sus experiencias, ventajas, desafíos o expectativas relacionadas con el uso de la GenIA en retroalimentación académica. Le invitamos a responder con la mayor claridad posible, ya que sus aportes cualitativos son fundamentales para la investigación.

5. Confidencialidad: Todas sus respuestas se utilizarán únicamente con fines académicos e investigativos.
Estimado/a docente:

Este cuestionario hace parte de una investigación de la Facultad de Ciencias de la Educación de la UCEVA. Su participación es voluntaria y anónima.

No hay respuestas correctas o incorrectas; lo importante es conocer opinión y con esta entender su uso y percepciones relacionados a todo lo mencionado anteriormente.
Al continuar, usted manifiesta su consentimiento informado.
Por favor, lea cuidadosamente cada enunciado y seleccione la opción que mejor refleje su **opinión, práctica o expectativa**.

1. **Correo electrónico** *

2. **¿Cuál es tu identidad de género?** *

Marca solo un óvalo.

- ◯ Mujer
- ◯ Hombre
- ◯ Persona no binaria
- ◯ Género fluido
- ◯ Prefiero no responder
- ◯ Otro: ___

3. **Edad** *

Marca solo un óvalo.

- ◯ 20 - 30 años
- ◯ 31 - 40 años
- ◯ 41 - 50 años
- ◯ 51 o más años

4. **Programa Académico**
(En caso de trabajar en más de uno, seleccionar cuáles) *

Selecciona todos los que correspondan.

- ☐ Licenciatura en Educación Física, Recreación y Deporte.
- ☐ Licenciatura en Ciencias Sociales.
- ☐ Licenciatura en Lenguas Extranjeras con Énfasis en inglés.
- ☐ Licenciatura en Educación Infantil.

5. **Indique su tipo de vinculación con la UCEVA** *

Marca solo un óvalo.

- Hora cátedra (HC)
- Tiempo completo (TC)
- Tiempo completo ocasional (TCO)

6. **¿Cuántos años lleva ejerciendo la docencia?** *

Marca solo un óvalo.

- 0 – 3 años
- 4 – 7 años
- 8 – 15 años
- 16 – 23 años
- 24 – 30 años
- 31 o más años

7. **¿Ha utilizado alguna vez Inteligencia Artificial Generativa (GenAI) para apoyar procesos de retroalimentación enfocada al desarrollo del pensamiento crítico en su docencia universitaria?** *

Marca solo un óvalo.

- Sí, la uso actualmente. *Salta a la pregunta 8*
- Sí, la he usado en algún momento, pero ya no. *Salta a la pregunta 8*
- No, nunca la he usado. *Salta a la pregunta 21*

Percepciones sobre la incorporación de la inteligencia artificial en la retroalimentación orientada al desarrollo del pensamiento crítico

8. **Rendimiento esperado (RE)** *

Marca solo un óvalo por fila.

	Totalmente en desacuerdo	En desacuerdo	Ni de acuerdo ni en desacuerdo	De acuerdo	Totalmente de acuerdo	No apli
RE1. La GenAI me permite redactar comentarios claros y útiles sobre el trabajo del estudiante.	◯	◯	◯	◯	◯	◯
RE2. Usar GenAI facilita mis prácticas de retroalimentación para fomentar el pensamiento crítico.	◯	◯	◯	◯	◯	◯
RE3. La GenAI me ayuda a generar retroalimentación que estimula procesos de análisis, evaluación o creación en los estudiantes.	◯	◯	◯	◯	◯	◯
RE4. La GenAI Solo me permite señalar errores o aciertos sin profundizar en procesos cognitivos del estudiante.	◯	◯	◯	◯	◯	◯

9. **Esfuerzo esperado (EE)** *

Marca solo un óvalo por fila.

	Totalmente en desacuerdo	En desacuerdo	Ni de acuerdo ni en desacuerdo	De acuerdo	Totalmente de acuerdo
EE1. Aprender a usar GenAI para retroalimentación orientada al pensamiento crítico me resulta sencillo.	◯	◯	◯	◯	◯
EE2. Integrar GenAI en mi flujo de retroalimentación para el pensamiento crítico no es demandante.	◯	◯	◯	◯	◯
EE3. Comprendo con facilidad las respuestas/sugerencias que produce la GenAI.	◯	◯	◯	◯	◯
EE4. La GenAI complica innecesariamente mi proceso de retroalimentación enfocada al desarrollo del pensamiento crítico.	◯	◯	◯	◯	◯

10. **Influencia social (IS)** *

Marca solo un óvalo por fila.

	Totalmente en desacuerdo	En desacuerdo	Ni de acuerdo ni en desacuerdo	De acuerdo	Totalmente de acuerdo	N ap
IS1 Personas importantes para mí piensan que debo usar GenAI en mis prácticas de retroalimentación enfocadas al desarrollo del pensamiento crítico.						
IS2. Mis líderes académicos promueven el uso pedagógico de GenAI en la retroalimentación enfocada al desarrollo del pensamiento crítico.						
IS3. El ambiente de mi programa favorece la experimentación con herramientas de GenAI para ofrecer retroalimentación orientada al fomento del desarrollo del pensamiento crítico.						

11. **Condiciones facilitadoras (CF)** *

Marca solo un óvalo por fila.

	Totalmente en desacuerdo	En desacuerdo	Ni de acuerdo ni en desacuerdo	De acuerdo	Totalmente de acuerdo	N ap
CF1 Cuento con los recursos necesarios para usar GenAI en la retroalimentación que busca fomentar el desarrollo del pensamiento crítico.						
CF2. La GenAI es compatible con las plataformas institucionales que uso para retroalimentar.						
CF3. Poseo los conocimientos necesarios para usar GenAI en la retroalimentación enfocada al desarrollo del pensamiento crítico.						
CF4. Conozco y sigo los lineamientos institucionales para un uso ético y responsable de GenAI.						

12. **Motivación hedónica (MH)** *

Marca solo un óvalo por fila.

	Totalmente en desacuerdo	En desacuerdo	Ni de acuerdo ni en desacuerdo	De acuerdo	Totalmente de acuerdo	N ap
MH1. Usar GenAI en la retroalimentación que busque estimular el desarrollo de pensamiento critico me resulta agradable.	◯	◯	◯	◯	◯	◯
MH2. Me siento incómodo/a cuando uso GenAI en la retroalimentación enfocada al desarrollo del pensamiento critico.	◯	◯	◯	◯	◯	◯

13. **Valor-precio (VP)** *

Marca solo un óvalo por fila.

	Totalmente en desacuerdo	En desacuerdo	Ni de acuerdo ni en desacuerdo	De acuerdo	Totalmente de acuerdo	No aplic
VP1. El costo (dinero/tiempo) de usar GenAI es razonable frente a los beneficios.	◯	◯	◯	◯	◯	◯
VP2. El valor pedagógico que obtengo con GenAI justifica el esfuerzo invertido.	◯	◯	◯	◯	◯	◯

14. **Hábito (H)** *

Marca solo un óvalo por fila.

	Totalmente en desacuerdo	En desacuerdo	Ni de acuerdo ni en desacuerdo	De acuerdo	Totalmente de acuerdo	ap
H1. Usar GenAI en retroalimentación enfocada al desarrollo del pensamiento crítico ya es parte de mi rutina docente.	◯	◯	◯	◯	◯	(
H2. No me veo usando GenAI en mi retroalimentación.	◯	◯	◯	◯	◯	(
H3. Planeo seguir usando GenAI en los procesos de retroalimentación que busquen promover el desarrollo del pensamiento critico de los estudiantes.	◯	◯	◯	◯	◯	(

15. **¿Con qué propósito ha usado GenAI para retroalimentar? En caso de ser otro (especifique)** *

Selecciona todos los que correspondan.

- [ ] Señalar errores o aciertos puntuales.
- [ ] Corregir el producto final de los estudiantes.
- [ ] Explicar conceptos o dar ejemplos adicionales.
- [ ] Detectar errores particulares de los estudiantes.
- [ ] Adaptar la retroalimentación al nivel cognitivo del estudiante.
- [ ] Otro: _____

16. **Frecuencia de uso de GenAI para retroalimentar buscando promover el pensamiento crítico:** *

Marca solo un óvalo.

- ◯ Nunca.
- ◯ Rara vez.
- ◯ Algunas veces.
- ◯ Frecuentemente.
- ◯ Siempre.

17. **Dimensión ética y de riesgos (DER)** *

Marca solo un óvalo por fila.

	Totalmente en desacuerdo	En desacuerdo	Ni de acuerdo ni en desacuerdo	De acuerdo	Totalmente de acuerdo
DER1. Tengo competencias para detectar sesgos de la GenAI.	◯	◯	◯	◯	◯
DER2. Me preocupo por la privacidad de la información al usar GenAI.	◯	◯	◯	◯	◯
DER3. Verifico la exactitud y las fuentes de lo que produce GenAI antes de incorporarlo en mi retroalimentación enfocada al pensamiento critico	◯	◯	◯	◯	◯

18. **Describa una experiencia concreta en la que haya utilizado GenAI para retroalimentar: ¿qué devoluciones generó y cómo reaccionaron sus estudiantes?** *

19. **Describa un ejemplo en el que la IA generativa haya retroalimentado un producto puntual (ej. señalar error) y un ejemplo en el que haya retroalimentado un proceso cognitivo (ej. ayudar a argumentar o reflexionar)** *

20. **¿Qué condiciones considera necesarias en la UCEVA para que el uso de GenAI en la retroalimentación contribuya al desarrollo del pensamiento crítico y creativo?** *

Percepciones sobre la incorporación de la inteligencia artificial en la retroalimentación orientada al desarrollo del pensamiento crítico

21. **Influencia social (IS)** *

Marca solo un óvalo por fila.

	Totalmente en desacuerdo	En desacuerdo	Ni de acuerdo ni en desacuerdo	De acuerdo	Totalmente de acuerdo	N ap
IS1 Personas importantes para mí piensan que debo usar GenAI en mis prácticas de retroalimentación enfocadas al desarrollo del pensamiento crítico.	◯	◯	◯	◯	◯	◯
IS2. Mis líderes académicos promueven el uso pedagógico de GenAI en la retroalimentación enfocada al desarrollo del pensamiento crítico.	◯	◯	◯	◯	◯	◯
IS3. El ambiente de mi programa favorece la experimentación con herramientas de GenAI para ofrecer retroalimentación orientada al fomento del desarrollo del pensamiento crítico.	◯	◯	◯	◯	◯	◯

22. **Condiciones facilitadoras (CF)** *

Marca solo un óvalo por fila.

	Totalmente en desacuerdo	En desacuerdo	Ni de acuerdo ni en desacuerdo	De acuerdo	Totalmente de acuerdo	N ap
CF1 Cuento con los recursos necesarios para usar GenAI en la retroalimentación que busca fomentar el desarrollo del pensamiento crítico.						
CF2. La GenAI es compatible con las plataformas institucionales que uso para retroalimentar.						
CF3. Poseo los conocimientos necesarios para usar GenAI en la retroalimentación enfocada al desarrollo del pensamiento crítico.						
CF4. Conozco y sigo los lineamientos institucionales para un uso ético y responsable de GenAI.						

23. **Motivación hedónica (MH)** *

Marca solo un óvalo por fila.

	Totalmente en desacuerdo	En desacuerdo	Ni de acuerdo ni en desacuerdo	De acuerdo	Totalmente de acuerdo	N ap
MH1. Usar GenAI en la retroalimentación que busque estimular el desarrollo de pensamiento critico me resulta agradable.						
MH2. Me siento incómodo/a cuando uso GenAI en la retroalimentación enfocada al desarrollo del pensamiento critico.						

24. **Valor-precio (VP)** *

Marca solo un óvalo por fila.

	Totalmente en desacuerdo	En desacuerdo	Ni de acuerdo ni en desacuerdo	De acuerdo	Totalmente de acuerdo	No aplic
VP1. El costo (dinero/tiempo) de usar GenAI es razonable frente a los beneficios.	○	○	○	○	○	○
VP2. El valor pedagógico que obtengo con GenAI justifica el esfuerzo invertido.	○	○	○	○	○	○

25. **Hábito (H)** *

Marca solo un óvalo por fila.

	Totalmente en desacuerdo	En desacuerdo	Ni de acuerdo ni en desacuerdo	De acuerdo	Totalmente de acuerdo	ap
H1. Usar GenAI en retroalimentación enfocada al desarrollo del pensamiento crítico ya es parte de mi rutina docente.	◯	◯	◯	◯	◯	(
H2. No me veo usando GenAI en mi retroalimentación.	◯	◯	◯	◯	◯	(
H3. Planeo seguir usando GenAI en los procesos de retroalimentación que busquen promover el desarrollo del pensamiento critico de los estudiantes.	◯	◯	◯	◯	◯	(

26. **¿Con qué propósito ha usado GenAI para retroalimentar? En caso de ser otro (especifique)** *

Selecciona todos los que correspondan.

- [ ] Señalar errores o aciertos puntuales.
- [ ] Corregir el producto final de los estudiantes.
- [ ] Explicar conceptos o dar ejemplos adicionales.
- [ ] Detectar errores particulares de los estudiantes.
- [ ] Adaptar la retroalimentación al nivel cognitivo del estudiante.
- [ ] Otro: _____

27. **Frecuencia de uso de GenAI para retroalimentar buscando promover el pensamiento crítico:** *

Marca solo un óvalo.

- ◯ Nunca.
- ◯ Rara vez.
- ◯ Algunas veces.
- ◯ Frecuentemente.
- ◯ Siempre.

28. **Dimensión ética y de riesgos (DER)** *

Marca solo un óvalo por fila.

	Totalmente en desacuerdo	En desacuerdo	Ni de acuerdo ni en desacuerdo	De acuerdo	Totalmente de acuerdo
DER1. Tengo competencias para detectar sesgos de la GenAI.	◯	◯	◯	◯	◯
DER2. Me preocupo por la privacidad de la información al usar GenAI.	◯	◯	◯	◯	◯
DER3. Verifico la exactitud y las fuentes de lo que produce GenAI antes de incorporarlo en mi retroalimentación enfocada al pensamiento critico	◯	◯	◯	◯	◯

29. **Describa una experiencia concreta en la que haya utilizado GenAI para retroalimentar: ¿qué devoluciones generó y cómo reaccionaron sus estudiantes?** *

30. **Describa un ejemplo en el que la IA generativa haya retroalimentado un producto puntual (ej. señalar error) y un ejemplo en el que haya retroalimentado un proceso cognitivo (ej. ayudar a argumentar o reflexionar)** *

31. **¿Qué condiciones considera necesarias en la UCEVA para que el uso de GenAI en la retroalimentación contribuya al desarrollo del pensamiento crítico y creativo?** *

Este contenido no ha sido creado ni aprobado por Google.

Google Formularios

Appendix 2.

Tuluá Valle, 5 de noviembre de 2025

Señores
Comité de Trabajo de Grado
Licenciatura en Lenguas Extranjeras con Énfasis en inglés
UCEVA

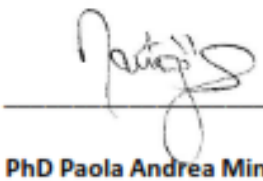
Asunto: *Validación del instrumento*

Cordial saludo.

Luego de revisar detenidamente las características del instrumento para ser usado en la investigación titulada: ***Understanding and Use of Artificial Intelligence in Academic Feedback by Professors in the Undergraduate Programs of the Faculty of Education at UCEVA: Its Contribution to the Development of Critical Thinking***, desarrollada por los estudiantes Gustavo Adolfo Almanza Lance y Daniel Andrés Peñaranda Agudelo, cuyo instrumento se denomina: ***Percepciones docentes sobre el uso de Inteligencia Artificial generativa en la retroalimentación académica para el desarrollo del pensamiento crítico***, el cual **corresponde a una adaptación del modelo** "University Teachers' Views on the Adoption and Integration of AI-Powered Tools" .

Se ha evidenciado que el instrumento **cumple con las características y funciones para las cuales fue adaptado**. El instrumento será aplicado por los estudiantes del programa de Licenciatura en Lenguas Extranjeras con Énfasis en Inglés de la Unidad Central del Valle del Cauca.

Atentamente,



PhD Paola Andrea Mina Gómez
Docente e Investigadora
C.C. 34.604.602

Tuluá Valle, 21 abril de 2026

Señores

Comité de Trabajo de Grado

Licenciatura en Lenguas Extranjeras con Énfasis en Inglés UCEVA

Asunto: Validación del instrumento cualitativo (matriz de categorización)

Cordial saludo,

Luego de revisar detenidamente las características del instrumento propuesto para la investigación titulada "Understanding and Use of Artificial Intelligence in Academic Feedback by Professors in the Undergraduate Programs of the Faculty of Education at UCEVA: Its Contribution to the Development of Critical Thinking", desarrollada por los estudiantes Gustavo Adolfo Almanza Lance y Daniel Andrés Peñaranda Agudelo, me permito emitir el concepto de validación correspondiente al instrumento cualitativo denominado matriz de categorización de respuestas abiertas.

Se evidencia que dicho instrumento constituye una construcción analítica coherente con los objetivos del estudio y con el enfoque metodológico mixto adoptado. La matriz permite organizar, codificar e interpretar la información derivada de las preguntas abiertas del cuestionario, facilitando la identificación de patrones, categorías y relaciones de significado en el discurso de los docentes.

Asimismo, el instrumento se fundamenta en principios del análisis cualitativo, particularmente en el enfoque de análisis temático (Braun & Clarke, 2006, 2021) y en estrategias de codificación sistemática (Miles, Huberman & Saldaña, 2014), lo que garantiza rigor en el tratamiento de los datos. De igual manera, presenta correspondencia entre las preguntas de investigación, los objetivos planteados y las categorías de análisis, cumpliendo con criterios de validez de contenido (Hernández-Sampieri et al., 2014).

La matriz contempla categorías, subcategorías y códigos claramente definidos, así como elementos de trazabilidad como fragmento textual e interpretación, lo cual fortalece la transparencia, consistencia y credibilidad del proceso analítico (Lincoln & Guba, 1985).

En este sentido, se considera que el instrumento cumple con los criterios de pertinencia, claridad, coherencia y suficiencia para el análisis de los datos cualitativos, por lo cual se avala su utilización en el desarrollo de la investigación mencionada.

Atentamente,

Nombre: Chrystian Mauricio Pérez Serna

Cargo: Docente Hora Catedra

C.C.: 1.116.264.986

Tuluá Valle, 5 de noviembre de 2025

Señores
Comité de Trabajo de Grado
Licenciatura en Lenguas Extranjeras con Énfasis en Inglés
UCEVA

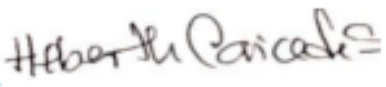
Asunto: *Validación del instrumento*

Cordial saludo.

Luego de revisar detenidamente las características del instrumento para ser usado en la investigación titulada: ***Understanding and Use of Artificial Intelligence in Academic Feedback by Professors in the Undergraduate Programs of the Faculty of Education at UCEVA: Its Contribution to the Development of Critical Thinking***, desarrollada por los estudiantes Gustavo Adolfo Almanza Lance y Daniel Andrés Peñaranda Agudelo, cuyo instrumento se denomina: ***Percepciones docentes sobre el uso de Inteligencia Artificial generativa en la retroalimentación académica para el desarrollo del pensamiento crítico***, el cual corresponde a una adaptación del modelo "University Teachers' Views on the Adoption and Integration of AI-Powered Tools" de Khalif.

Se ha evidenciado que el instrumento cumple con las características y funciones para las cuales fue adaptado. El instrumento será aplicado por los estudiantes del programa de Licenciatura en Lenguas Extranjeras con Énfasis en Inglés de la Unidad Central del Valle del Cauca.

Atentamente,



Docente UCEVA

94.366.696 de Tuluá

Tuluá Valle, 5 de noviembre de 2025

Señores
Comité de Trabajo de Grado
Licenciatura en Lenguas Extranjeras con Énfasis en Inglés
UCEVA

Asunto: *Validación de instrumentos*

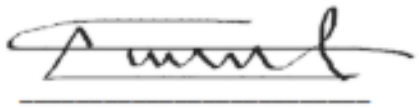
Cordial saludo.

Luego de revisar detenidamente las características del instrumento aplicado por los estudiantes Gustavo Adolfo Almanza Lance y Daniel Andres Peñaranda: **Percepciones docentes sobre el uso de Inteligencia Artificial generativa en la retroalimentación académica para el desarrollo del pensamiento crítico.**

Pertenecientes al trabajo de grado titulado: **Understanding and Use of Artificial Intelligence in Academic Feedback by Professors in the Undergraduate Programs of the Faculty of Education at UCEVA: Its Contribution to the Development of Critical Thinking.**

Se ha evidenciado que el instrumento cumple con las características y funciones para las cuales fue diseñado. Los instrumentos serán aplicados por la(s) estudiante(s) del programa de Licenciatura en Lenguas Extranjeras con Énfasis en Inglés de la Unidad Central del Valle del Cauca.

Atentamente,



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