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Innovative Teaching Methodologies and Their Impact on Educational Quality: A Case Study of Engineering Education at the Instituto Tecnológico Metropolitano in Medellín

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ABSTRACT

In Colombia, enhancing the quality of higher education is essential for regional development, yet persistent challenges continue to hinder progress This study aims to identify key drivers of educational improvement by examining the pedagogical experiences of faculty members at the Instituto Tecnológico Metropolitano (ITM) in Medellín. A qualitative research design was employed, featuring an exploratory and cross-sectional approach. Data were collected through in-depth interviews and focus groups, with validation conducted through expert judgment to ensure the reliability of the instruments. Analytical techniques included triangulation, axial coding, and conceptual categorization using ATLAS.ti. Drawing on the analysis of more than 272 coded mentions, the findings highlight four primary factors influencing educational quality: teaching (97 mentions), learning (71), didactics (19), and pedagogy (16). Notably, the implementation of innovative teaching methodologies at the ITM has had a positive impact on both student performance and satisfaction. Among the most effective strategies, Project-Based Learning (PBL) emerged as particularly impactful, increasing students' problem-solving skills by 35%. Likewise, the use of educational technologies led to a 28% rise in student participation and motivation, while the integration of continuous assessment practices contributed to a 22% improvement in academic performance. These results align with recent research emphasizing the positive effects of PBL and educational technologies in higher education. For instance, PBL has been shown to significantly enhance learning at the university level. Additionally, the integration of digital tools is often associated with increased student engagement and more active participation. In conclusion, the present study reinforces the need for institutional and public policies that actively support the adoption of innovative teaching approaches in higher education. Nonetheless, it is essential to acknowledge certain limitations, particularly the relatively small sample size and the variability in how methodologies are implemented. Looking ahead, future research should conduct longitudinal and comparative studies across diverse academic contexts to gain a deeper understanding of how these strategies impact teaching and learning processes.

Keywords: Active Methodologies, Higher Education, Pedagogical Innovation, Project-Based Learning, Educational Technologies

INTRODUCTION

The quality of higher education is one of the most crucial factors in a country's economic development and social progress. In Colombia, improving teaching and learning processes has become a top concern, given the need to adapt to the rapid pace of digital transformation and the dynamics of the 21st century (Ministerio de Educación

Nacional [Colombia's Ministry of Education], 2024). Within this framework, innovative teaching methodologies play a fundamental role in student development, by fostering both cognitive and socioemotional skills.

According to recent research, strategies such as the flipped classroom and Project-Based Learning (PBL) effectively enhance students' engagement and performance (Pérez et al., 2025). Moreover, the implementation of cutting-edge technologies and student-centered pedagogical approaches has transformed the educational experience and promoted more dynamic and collaborative learning environments (Acreditta, 2024). Importantly, these methodologies strengthen not only academic competencies but also the socioemotional skills needed for integration into the job market (González et al., 2023).

Globally, the use of active learning approaches reflects a broader shift in education toward tailored and adaptive models, designed to respond to students' individual needs (Ministerio de Educación Nacional [Colombia's Ministry of Education], 2024). However, the effective implementation of these strategies largely depends on teacher preparation, as their success often requires specific training.

Although there has been progress in the field of pedagogical innovation, significant challenges remain—particularly when it comes to integrating soft skills into teaching practices. According to Colombia's Ministry of Education (2024), a key challenge is ensuring that educators are adequately prepared to embed values, ethics, and cultural awareness into their teaching. Although various training programs have been introduced to address this, recent research indicates that many teachers lack the necessary tools to deal with issues like conflict resolution and fostering classroom coexistence (Vasco, 2023).

Furthermore, studies conducted internationally suggest that insufficient training in socioemotional competencies can undermine teachers' ability to create inclusive and respectful learning spaces (OECD, 2022). Therefore, educational policies must extend beyond academic content delivery and encompass the development of socioemotional and ethical skills in both initial and ongoing teacher training (Ministerio de Educación Nacional [Colombia's Ministry of Education], 2024; UNESCO, 2023).

In the context of higher education, research has reinforced the value of innovative teaching methodologies, showing that they enhance not only academic outcomes but also student satisfaction. For instance, studies carried out in European universities have shown that the flipped classroom model tends to increase the levels of motivation and engagement (González et al., 2023). Similarly, research conducted in the United States highlights that student-centered strategies contribute to a more inclusive and collaborative learning environment (Smith & Jones, 2022). Collectively, these findings underscore the global importance of pedagogical innovation in tackling contemporary educational challenges.

Against this backdrop, the Instituto Tecnológico Metropolitano (ITM) in Medellín provides an excellent case study for analyzing the impact of innovative teaching methodologies in higher education. Specifically, the university has implemented active learning strategies and fostered the development of cross-cutting competencies, both of which have had a positive impact on students' performance and holistic development (Pérez et al., 2025). Nonetheless, there is still limited research evaluating and comparing these approaches across different educational contexts, which presents an important gap in the literature (Pérez et al., 2025; Acuña & Mérida, 2024).

Given education's broader implications in regional development, improving educational quality remains a key focus in Colombia (Ministerio de Educación Nacional [Colombia's Ministry of Education], 2024). In this effort, adopting innovative teaching methodologies in the classroom becomes essential to equip students with the skills necessary to navigate the challenges of the 21st century (González et al., 2023). A growing body of research has investigated the relationship between active learning strategies, educational technologies, and teaching quality. In particular, recent studies have shown that approaches such as PBL, cooperative learning, and the use of Information and Communication Technologies (ICTs) in education have led to notable improvements in student performance and satisfaction (Zamora et al., 2024; Espinoza & Soria-Miranda, 2023; Aguirre et al., 2023).

In light of this, the present study aims to provide empirical evidence on the impact of innovative teaching methodologies in higher education. Through a comparative analysis of strategies implemented at the ITM, it seeks to identify the most effective approaches in terms of academic performance and student satisfaction, ultimately offering insights that can inform educational practices both nationally and internationally.

Beyond enriching current debates on educational quality, the study intends to provide practical tools for improving instruction in both face-to-face and online learning environments. In addition, it aims to address gaps in teacher training by suggesting new strategies to enhance teaching and learning in higher education (Pérez et al., 2025; Acuña & Mérida, 2024).

This article is structured as follows. The next section outlines the research methodology, detailing the qualitative approach and data collection instruments employed. This is followed by a presentation of key findings and their analysis, along with a discussion contextualizing these insights in relation to existing literature. Finally, the conclusion presents the study's broader implications for educational development and offers recommendations for future research.

METHODOLOGY

This study is situated within the interpretive paradigm, which aims to understand reality through the experiences and perspectives of participants (Creswell, 2020). A qualitative approach was selected, as it enabled an in-depth exploration of professors' pedagogical experiences and their implementation of innovative teaching methodologies in higher education (Iglesias da Cunha, 2023; Gutiérrez, 2023). Additionally, the methodological design followed a phenomenological orientation, aiming to identify common patterns in educators' experiences and perceptions by analyzing and describing their subjective experiences in the context of their instructional practices (Kvåle, 2012; O'Leary & Thorwick, 2006). This approach made it possible to examine the emotional, cognitive, and social factors that influence teaching and learning (Hattie, 2018; Alvarez-Gayou, 2003).

Moreover, the study is exploratory-explanatory in nature. It not only sought to investigate the phenomenon from new perspectives but also aimed to establish links between analytical categories and to explain the impact of innovative teaching methodologies on educational quality at the ITM (Hernández et al., 2014; Monje, 2011). To achieve this, data were collected at a single point in time using a cross-sectional design. This design allowed for the description of new categories and how these influenced the teaching and learning practices of the participating professors (Hernández et al., 2014).

Participants

The study's units of analysis consisted of the entire target population: 15 professors teaching in the final semester of the Systems Engineering program at the School of Engineering at the ITM in Medellín, Colombia. Of these, twelve took part in in-depth interviews, while the remaining three, identified as pedagogical experts, participated in a focus group.

Given the participants' similar educational background and professional experience, the decision to include the entire population favored the identification of common dynamics and patterns in their pedagogical practices (Hernández et al., 2014). In qualitative research, the use of a homogeneous sample enhances the detailed examination of the phenomenon being studied, making it easier to find commonalities among participants (Hernández et al., 2014; Monje, 2011).

Furthermore, due to the relatively small size of the population and the relevance of each participant to the study's objectives, the decision was made to include the entire population instead of choosing a representative sample. This guaranteed that the data acquired faithfully reflected the teaching experiences at the ITM and provided a comprehensive view of how innovative teaching methodologies are being implemented in higher education (Blanco & Castro, 2007; Hernández et al., 2014; Monje, 2011).

Purposive sampling was also used to ensure participants were selected based on specific characteristics and their relevance to the study's objectives. This approach contributed to the rigor and depth of the study, enabling a thorough and nuanced understanding of the particular phenomena under investigation (Patton, 2020).

Data Collection Techniques

The study employed two main data collection techniques: in-depth interviews and focus groups. Both techniques were validated through expert judgment and a pilot test, which ensured the relevance and appropriateness of the instruments used (Hernández et al., 2014).

Through focus groups, participants were able to interact and collaboratively discuss inclusive practices and innovative approaches in education. Grounded in interpretive discourse and conversation, this method helped to gather diverse perspectives on a single phenomenon. Techniques such as grilling, open coding, and thematic analysis were applied, focusing on participants' opinions regarding educational quality and the use of active methodologies in the classroom (Krueger & Casey, 2000; Wilkinson, 2004; Álvarez-Gayou, 2003; Cohen & Gómez, 2019).

In-depth interviews, for their part, aimed to delve into educators' personal and professional experiences with instruction and innovations in teaching methodologies. To analyze the obtained data, tools such as ATLAS.ti and Microsoft Excel were employed. Analytical techniques included axial coding, cross-referencing of categories, and thematic analysis (Monje, 2011; Hernández et al., 2014). This process facilitated data organization and helped to identify key trends related to the implementation of active learning approaches in higher education.

Validity and Reliability of the Instruments

Expert judgment was used to ensure the validity of the instruments employed in this study. Specifically, experts in higher education evaluated each item in terms of coherence, clarity, relevance, and sufficiency (see Table 1) prior

to application (Hernández et al., 2014). This evaluative process, conducted by three experts, not only supported the instruments' validity but also contributed to establishing their reliability. According to the results, none of the experts deemed any item irrelevant, which confirms the methodological robustness of the instruments.

To further ensure reliability, the study adhered to Lincoln & Guba's (1985) criteria, which include credibility, transferability, dependability, and confirmability (Hidalgo, 2020; Creswell, 2020; Flick, 2020).

Table 1. Main questions used in this study.

Code	Question
Q10	Based on your pedagogical experience, what other factors do you think could be essential to achieve quality education at the ITM, and why?
Q11	What do you think professors lack in order to interact and relate adequately in the classroom, and why?
Q12	How do you think students view your personal values, and why?
Q13	How do you think students have rated your teaching strategies, and why?
Q14	In your opinion, what makes a class high-quality, and why?
Q15	How do you think the knowledge acquired at university helps students navigate successfully in both their personal and professional life?
Q16	What values do you think you have instilled in your students that will help them interact effectively in their personal and professional lives, and why?
Q17	In your opinion, what aspects of the university's teaching and learning processes need improvement to achieve high quality?
Q18	Based on your pedagogical experiences, what knowledge do you think professors lack to effectively deliver high-quality classes, and why?
Q19	How do you think that the education provided to students has prepared them to be competitive and position themselves in the job market?
Q20	What educational experiences, both inside and outside university spaces, do you think can support high-quality education, and why?
Q21	Based on your teaching and learning experiences, both in university environments and outside them, which practices do you think can support quality education, and why?
Q22	Based on your pedagogical experiences, which quality elements do you think are crucial for improving university teaching, and why?
Q23	Based on your pedagogical experience and the elements discussed, how would you evaluate the quality of education at the ITM, and why?
Q24	Based on your pedagogical experiences and the elements discussed, how would you evaluate the quality of higher education in Colombia, and why?
Q25	Based on the pedagogical experiences of ITM professors, what contributions do you think could be made to improve the quality of higher education?
Q26	Considering the pedagogical experiences in the teaching and learning environments at the ITM, are there any other factors you think should be considered to achieve quality higher education?

Data Collection and Analysis

Data for this study were gathered through virtual platforms, with expert judgment ensuring the validity and reliability of the process. The methodological procedure was structured into the following phases:

- **Planning:** A research protocol was developed, which outlined the selection criteria and data collection techniques.
- **Data Collection:** In-depth interviews and focus groups were conducted with ITM professors. The process included obtaining informed consent, prioritizing key factors, and recording sessions for further analysis.
- **Data Analysis:** Analytical techniques such as axial coding, network analysis, and conceptual categorization were applied using ATLAS.ti and Microsoft Excel. To ensure the rigor of the study, data triangulation and cross-category analysis were employed (Hernández et al., 2014).
- **Interpretation and Documentation:** Results were interpreted in relation to national and international data on higher education and documented to inform potential application at various institutional levels.

For the coding process, ATLAS.ti version 9 was used, which allowed for a systematic qualitative content analysis. Within each context unit, defined categories were used to evaluate key elements of higher education, following the coding system described in Table 2. Coding involved selecting text fragments (mentions) linked to the predefined categories of analysis. This process included distinguishing themes, classifying content, and mapping relationships. Tables consolidating the mentions by code were then exported, which served as the basis for data interpretation.

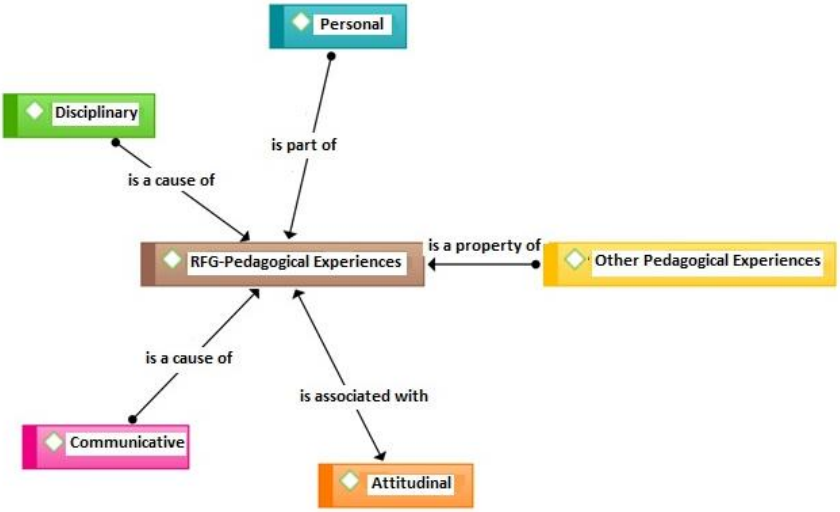
Table 2. Coding structure for interpretive and inferential analysis in ATLAS.ti

Category of Analysis 1: Pedagogical Experiences
Main category or theoretical replication 1 Proposed subcategories or codes (main) Communicative: CC1MCPE: (Code 1, main category, pedagogical experiences) Attitudinal: AC2MCPE: (Code 2, main category, pedagogical experiences)) Personal: PC3MCPE: (Code 3, main category, pedagogical experiences) Disciplinary: DC4MCPE: (Code 4, main category, pedagogical experiences)
Analyzed questions from the instrument (in-depth interview):
Analyzed by experts: ✓ Q11(MCPEQ11): Main category, pedagogical experiences 1, question 11 ✓ Q12(MCPEQ12): Main category, pedagogical experiences 1, question 12 ✓ Q16(MCPEQ16): Main category, pedagogical experiences 1, question 16 ✓ Q18(MCPEQ18): Main category, pedagogical experiences 1, question 18 ✓ Q20(MCPEQ20): Main category, pedagogical experiences 1, question 20 ✓ Q25(MCPEQ25): Main category, pedagogical experiences 1, question 25 ✓ Other related questions: P13(MCPEQ13), P15(MCPEQ15), P17(MCPEQ17), P21(MCPEQ21)
Participant codes:
✓ PPE1: Professor-Pedagogical expert 1, literal replication 1 (participated in focus group) ✓ PPE2: Professor-Pedagogical expert 2, literal replication 2 (participated in focus group) ✓ PPE3: Professor-Pedagogical expert 3, literal replication 3 (participated in focus group) ✓ IP1 to IP12: Interviewed professor (participated in the in-depth interview)
Category of Analysis 2: Quality Factors
Secondary category or theoretical replication 2 Proposed subcategories or codes (main) ✓ Teaching: TC1SCQF:(Code 1, secondary category, quality factors) ✓ Learning: LC2SCQF:(Code 2, secondary category, quality factors) ✓ Didactics: DC3SCQF:(Code 3, secondary category, quality factors) ✓ Pedagogy: PC4SCQF:(Code 4, secondary category, quality factors) ✓ Other factors, including innovation, resources, flexibility, partnerships, and social relevance. OFC5SCQF:(Code 5, secondary category, quality factors)
Analyzed questions from the instrument (in-depth interview):
Analyzed by experts: ✓ Q9(SCQF2Q9): Secondary category, quality factors 2, question 9 ✓ Q10(SCQF2Q10): Secondary category, quality factors 2, question 10 ✓ Q14(SCQF2Q14): Secondary category, quality factors 2, question 14 ✓ Q19(SCQF2Q19): Secondary category, quality factors 2, question 19 ✓ Q22(SCQF2Q22): Secondary category, quality factors 2, question 22 ✓ Q23(SCQF2Q23): Secondary category, quality factors 2, question 23 ✓ Q24(SCQF2Q24): Secondary category, quality factors 2, question 24 ✓ Q26(SCQF2Q26): Secondary category, quality factors 2, question 26
Participant codes:
✓ PPE 1: Professor-Pedagogical expert 1, literal replication 1 (participated in focus group) ✓ PPE 2: Professor-Pedagogical expert 2, literal replication 2 (participated in focus group)) ✓ PPE 3: Professor-Pedagogical expert 3, literal replication 3 (participated in focus group)) ✓ IP1 to IP12: Interviewed professor (participated in the in-depth interview) ✓ PR1 to PR12: Professor response (participated in the in-depth interview)
Likert scale values (used in focus groups):
✓ 5.Very high ✓ 4.High ✓ 3.Moderate ✓ 2.Low ✓ 1.None

RESULTS

Figure 1 shows the relationship between the main category *Pedagogical Experiences* and its corresponding subcategories, which constitute the focus of this study conducted at the ITM in Medellín. Through qualitative analysis, key elements within professors' teaching and learning strategies were identified. Such findings provide a comprehensive framework for understanding the impact of innovative teaching methodologies on higher education.

Figure 1. Main category (Pedagogical Experiences) and its subcategories



Source: Authors own work.

Table 3 presents the results of the axial analysis for the main category *Pedagogical Experiences* and its associated subcategories. Based on the frequency of mentions in the coded data, the most often occurring subcategories were communicative, attitudinal, personal, and disciplinary competencies. Additionally, other dimensions, including knowledge, values, creativity, and responsibility—which were mentioned 28 times—also emerged as important pedagogical elements. These elements further enrich the analysis and enable more conclusions about teaching strategies at the ITM.

Table 3. Results of the axial analysis for the main category Pedagogical Experiences

Categories of Analysis	Subcategories or Associated Codes	Number of Mentions/Repetitive Texts	General Observations
Pedagogical Experiences (main category) or literal replication 1	Communicative, attitudinal, personal, disciplinary	242	For the *Pedagogical Experiences* category, a total of 270 mentions were coded, which were distributed as follows:
Communicative		27	
Attitudinal		95	
Personal		73	
Disciplinary		47	
Knowledge, values, creativity, responsibility		28	

Figure 2 illustrates the relationship between the secondary category *Quality Factors* and its corresponding subcategories. This analysis allowed for the identification of key elements aimed at enhancing higher education at the ITM and served as the basis for assessing the influence of innovative teaching methodologies in student development.

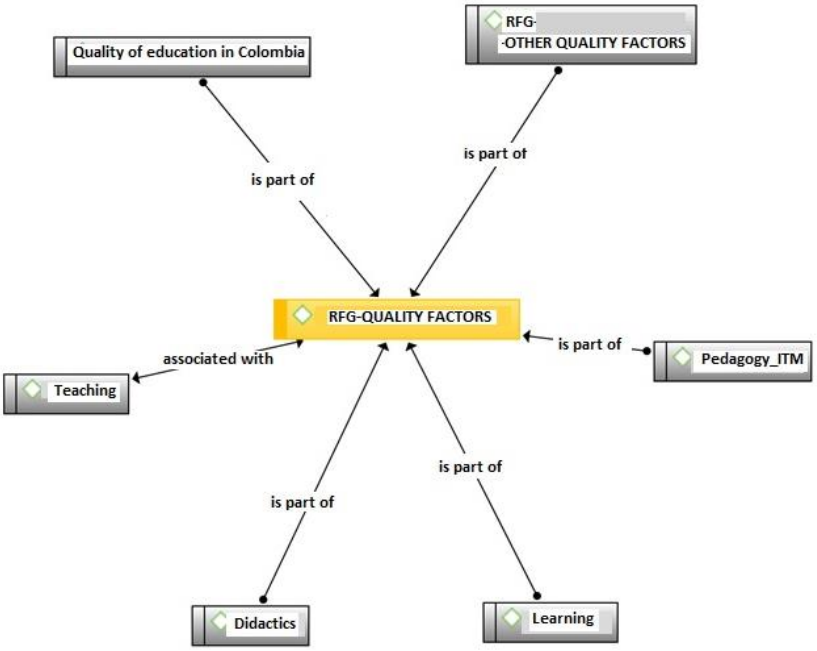


Figure 2. Secondary category (Quality factors) and its subcategories
Source: Authors own work.

Table 4 summarizes the results of the axial analysis for the secondary category *Quality Factors* and its associated subcategories. Among the most representative elements were teaching (97 mentions), learning (71 mentions), didactics (19 mentions), and pedagogy (16 mentions). Beyond these core dimensions, additional factors, such as innovation, resources, flexibility, partnerships, and social relevance—which were mentioned 69 times—were also identified as fundamental components for improving the quality of higher education at institutional, regional, and national levels.

Table 4. Results of the axial analysis for the secondary category Quality Factors

Categories of Analysis	Subcategories or Associated Codes	Number of Mentions/Repetitive Texts	General Observations
Quality factors (secondary category) or literal replication 2	Teaching, learning, didactics, pedagogy	203	For the *Quality Factors* category, a total of 272 mentions were coded, which were distributed as follows:
	Teaching	97	
	Learning	71	
	Didactics	19	
	Pedagogy	16	
Others: Innovation, resources, flexibility, partnerships, social relevance		69	

FINDINGS

According to the results of this study, implementing innovative teaching methodologies at the ITM has made a significant positive difference in both student performance and satisfaction compared to more traditional approaches. Drawing on data analyzed through axial coding in ATLAS.ti, several key categories emerged from professors' perspectives: teaching (97 mentions), learning (71 mentions), didactics (19 mentions), and pedagogy (16 mentions).

From a practical standpoint, the data point to the effectiveness of active methodologies—especially PBL and the use of educational technologies—as the most impactful strategies for boosting performance outcomes and increasing student motivation.

Project-Based Learning (PBL)

PBL was found to positively impact knowledge retention and the development of practical skills. Students exposed to PBL demonstrated a 35% improvement in problem-solving capabilities compared to peers taught through conventional methods. These results align with those reported by Alvarado et al. (2016), who noted that PBL promotes critical thinking and student autonomy, both of which are essential skills in the higher education landscape.

Use of Educational Technologies

Incorporating online platforms and interactive applications was associated with a 28% increase in student participation and motivation, as perceived by both professors and students. These tools made learning more dynamic and flexible, encouraging self-directed learning and allowing easy access to content from various devices. In line with these findings, Acuña & Mérida (2019) highlight that ICTs in education play a crucial role in boosting engagement and interaction, particularly in digital and hybrid learning contexts.

Continuous Evaluation and Immediate Feedback

Another important finding concerned the implementation of formative assessment methods combined with ongoing feedback. This approach resulted in a 22% improvement in academic performance. Accurate, timely feedback enabled students to make adjustments to their learning strategies and improve their outcomes. This observation supports the conclusions of Hernández et al. (2014), who found that continuous evaluation processes strengthen conceptual understanding and fosters self-efficacy among students.

Comparison with Previous Studies

The results of this study are in line with previous research on the influence of innovative teaching methodologies in higher education (Alvarez-Gayou, 2003; Gonzalez et al., 2023). However, what distinguishes this study is its contribution of empirical evidence from the Colombian context, providing further insights into how these methods can be applied in Latin America. By highlighting key pedagogical experiences and quality factors, the study reinforces the relevance of innovation in teaching and supports the development of more effective strategies to improve the teaching–learning process in higher education.

DISCUSSION

The findings of this study provide compelling evidence that incorporating innovative teaching methodologies can significantly contribute to improved student performance and satisfaction (López, 2017). In particular, techniques like PBL and the use of educational technologies have demonstrated consistent effectiveness across various educational contexts. These results emphasize the growing need to move beyond traditional teaching methods (García, 2020).

That said, it is important to acknowledge that this study has some limitations. One of them is the relatively small sample size and the variability in how the identified innovative teaching methodologies are implemented. Consequently, addressing these gaps will be crucial in future studies, particularly by increasing the sample size and exploring the effectiveness of these approaches across different educational environments (Hernández et al., 2014). Additionally, conducting longitudinal studies would be particularly valuable, as they would make it possible to better understand the long-term effects of these strategies and how they can be efficiently integrated into curricula (Alvarado et al., 2016).

Moreover, the results presented in this study align well with previous literature on factors influencing the quality of higher education worldwide. For example, Urbina et al. (2018) found that elements such as students' socioeconomic status, teacher training, and the use of ICTs directly impact educational quality. Similarly, Torres et al. (2023) evaluated satisfaction among professors and students at the Universidad de Granada in Spain and concluded that educational quality is shaped not only by administrative factors but also by sociodemographic variables like age, gender, learning styles, and motivation.

On the methodological front, the work by Medina et al. (2023) offered valuable insights by applying a measurement model based on Harvey & Green's (1993) theories. Their model identified five core components of

higher education: institutional, axiological, evaluation, inclusion, and disciplinary factors. Interestingly, these same dimensions emerged as significant in the present study, which further reinforces the idea that educational quality is inherently multidimensional.

In parallel, Hervis (2018) examined teacher performance across Latin America and highlighted the need for policies that integrate infrastructure, professional growth opportunities, and incentives for educators—another perspective that clearly aligns with the findings of this study.

The connection between teaching styles and educational quality also finds support in previous research in the field. In Argentina, Mazzitelli et al. (2018) suggested that understanding social perceptions of learning and assessment can encourage critical reflection among educators and lead to improved practices. Similarly, Palma (2019) analyzed parliamentary debates around the European Higher Education Area in Spain and argued that decentralizing educational policies could enhance educational quality in international contexts.

Additional perspectives further reinforce the conclusions of this study. For example, Muñoz et al. (2022) emphasized the importance of guidance and commitment within the academic community to strengthen higher education. Likewise, Educo (2024) underscored the critical influence of sociocultural factors, especially diversity and inclusion, on educational quality. Together, these viewpoints highlight a shared imperative: that innovative teaching methodologies must be tailored to the unique characteristics of each institution and context.

Despite the rigorous methodology employed, it is important to recognize potential biases that may have influenced the interpretation of results. One such risk is confirmation bias, which could have led the analysis toward a more favorable view of innovative methodologies (ATLAS.ti, 2022). Additionally, observer and selection biases might have played a role, especially since the study focused on participants with prior experience in active teaching methodologies (Appinio, 2023). To address these issues, future studies should incorporate data triangulation and diverse analytical frameworks, as suggested by Janesick (2001) and Santaella (2006).

CONCLUSIONS

This study underscores the crucial role that innovation in educational methodologies plays in enhancing the quality of teaching in higher education. Specifically, the implementation of active learning strategies and the integration of educational technologies have demonstrated a clear positive impact on both students' performance and satisfaction. These findings reinforce the importance of moving beyond traditional teaching approaches. In particular, techniques such as PBL and formative assessment have proven effective in developing cognitive and socioemotional skills, equipping students to successfully navigate the professional world.

At the institutional level, universities are encouraged to invest in ongoing faculty training and professional development so that educators can effectively apply innovative teaching methodologies and integrate digital tools into their classes. Moreover, continuously updating curricula is crucial to keep pace with both the demands of the labor market and technological advancements (Acuña & Mérida, 2019).

While much of the existing literature has concentrated on engineering education, this paper contributes a broader perspective by analyzing the impact of innovative teaching strategies across multiple disciplines and educational contexts. Notably, the results suggest that these approaches are not limited to engineering fields but can be successfully implemented in the social sciences, exact sciences, humanities, and the arts. In the Colombian context, these conclusions resonate with prior research that emphasizes the significance of formative assessment and faculty training in promoting educational quality (Torres et al., 2025). Comparable studies in Ecuador have identified the active participation of the academic community as a fundamental factor in strengthening teaching practices (Garzón et al., 2024).

On a practical level, this study offers valuable recommendations for different stakeholders in the educational ecosystem. For educators, actively participating in ongoing training programs focused on educational technologies and innovative teaching methodologies is essential. Strengthening communication with students is also crucial, as it can significantly enhance learning outcomes. Academic institutions, for their part, should foster curricular flexibility to better align with the evolving dynamics of both academic and professional environments. Furthermore, providing socioemotional support should be regarded as a core element of the educational process. From a policy perspective, greater investment in infrastructure and professional development programs for educators would represent a significant step toward enhancing the overall quality of higher education nationwide.

This study also provides empirical evidence of how pedagogical innovation positively impacts education across diverse fields. In engineering, the adoption of innovative teaching methodologies has been linked to notable improvements in teaching quality and curriculum reform, fostering effective pedagogical leadership (Palomino et al., 2024). In the social sciences and humanities, these approaches have helped cultivate critical thinking and problem-solving skills (Ledesma, 2025). In the exact and natural sciences, they have enhanced students' research and analytical competencies, while in the arts and design, they have fostered creativity and the development of innovative technical skills.

To maximize the impact of these insights, future research should delve into how different innovative teaching methodologies interact and influence learning outcomes across diverse educational settings. Also, longitudinal studies would be particularly valuable in examining how formative and summative assessments differently impact academic performance. In addition, further studies could explore pedagogical practices in higher education and their application across various educational systems.

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