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The current landscape of formative assessment and feedback in graduate studies: a systematic literature review

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Formative assessment has evolved into a comprehensive approach for enhancing student learning across academic levels, yet gaps remain regarding its impact on graduate students with diverse needs. This study conducts a systematic literature review (SLR) of empirical research published between 2014 and 2024, analyzing 188 initial articles retrieved from Scopus and Web of Science, which were narrowed down to 19 eligible studies. The aim is to examine how formative feedback influences the learning and motivation of graduate students. The results indicate that: (a) immediate and specific feedback enhances academic performance and promotes self-regulation, empowering students to manage their learning processes more effectively; (b) technological tools facilitate personalized and accessible feedback, tailoring learning experiences to individual needs; and (c) the implementation of feedback strategies that consider individual differences contributes to greater equity and effectiveness in graduate education. This study not only addresses gaps in the literature by synthesizing evidence on formative assessment but also highlights the transformative role of technology and personalized strategies in promoting autonomous and meaningful learning in graduate programs.

KEYWORDS

formative assessment, immediate feedback, graduate education, self-regulation of learning, personalized learning, educational technologies

1 Introduction

In the field of education, and particularly in graduate programs, formative assessment has emerged as a key practice for fostering deep and meaningful learning. In this regard, Atwa et al. (2024) demonstrated that formative assessment, accompanied by timely and specific feedback, improves conceptual understanding, reduces anxiety, and enhances students' academic performance. Similarly, Merula and Thiery (2023) highlight the importance of continuous dialogue between teachers and students in this process, aiming to create a positive teaching and learning experience.

In the context of graduate studies, Cañadas (2023) points out that formative assessment goes beyond measuring knowledge; it contributes to the development of essential skills such as critical thinking, problem-solving, and teamwork. Yan et al. (2021) emphasize the importance of feedback aimed at developing competencies at this educational level. Moreover, Hattie and Timperley (2007) and Vaughan and Uribe (2024) agree that timely and specific feedback, along with a clear understanding of assessment criteria, is essential for students to regulate their own learning and prepare for the challenges of the professional world.

This shift toward a more learning-focused assessment is theoretically supported by constructivism and competency-based approaches. Piaget (1980) and Vygotsky (1978), whose theories have been fundamental to understanding the active role of students in constructing their knowledge, laid the foundation for this perspective. In particular, Vygotsky (1978) emphasized the role of the social environment and collaborative learning in cognitive development. Later researchers, such as Black and Wiliam (2010), Menéndez et al. (2019), and Anijovich and Cappelletti (2020), expanded on this view by highlighting the importance of formative assessment not only as a tool for monitoring academic progress but also as a means to promote deep learning and the development of key competencies. From a sociocultural approach, Shepard et al. (2018) offer a broader interpretation, explaining how motivational factors, such as self-regulation and self-efficacy, are intimately linked to cognitive development. This theoretical framework suggests that effective formative assessment should go beyond simply measuring knowledge, actively promoting the development of skills and competencies essential for the academic success of graduate students.

In the context of graduate programs, formative assessment takes on particular relevance due to the specific demands of this educational level, such as the promotion of autonomy and research capabilities. Juwah and Macfarlane (2004) pointed out that at the graduate level, formative assessment must be more flexible and personalized, responding to the individual needs of students. This approach is key to fostering the development of advanced competencies. Andriamiseza et al. (2023) reinforce this perspective by emphasizing the importance of specific feedback oriented toward competency development at this educational level. Similarly, Boud and Falchikov (2006) argue that formative assessment not only encourages reflective learning but also contributes significantly to students' professional development, preparing future researchers to face challenges in their respective disciplines. Furthermore, Leenknecht et al. (2021) demonstrated that formative assessment has a positive impact on motivation, retention, and the transfer of learning, which are essential factors for success in graduate programs.

Despite the growing relevance of formative assessment in graduate studies, its effective implementation presents significant challenges that have not yet been fully addressed in the literature. Although several studies have explored formative assessment in general educational contexts, a significant gap remains regarding the limited high-quality evidence base supporting efficient formative assessment practices in graduate programs. This lack of robust evidence hinders the adoption of evidence-based practices. Moreover, the outcomes of formative assessment depend on the level of implementation and the specific context in which it is applied, leading to variations in the strategies used and their results (Morris et al., 2021). Additionally, it is essential to consider the unique characteristics and academic needs of graduate students, which naturally differ significantly from those of other educational levels. Friedrich-Nel and Mac Kinnon (2015) pointed out that research on the impact of formative assessment on motivation, retention, and learning in graduate students remains limited and fragmented. Moreover, there is little clarity about which teaching practices are most effective for implementing formative feedback that influences autonomous learning and the acquisition of advanced competencies at this level.

This research gap is particularly relevant in the context of the growing cultural diversity of graduate programs and the complexity of their curricula. Therefore, the objective of this study is to conduct a systematic literature review (SLR) of the past 10 years, focusing on empirical research on formative assessment. The aim is to analyze, process, and synthesize the characteristics, perceptions, impact, influence, and innovations of formative assessment on the learning outcomes of graduate students. By fulfilling this objective, it is expected to contribute to the enrichment of the academic debate on best practices in formative assessment in graduate programs. This research is justified by the need to synthesize recent empirical studies that explore formative assessment in the graduate context. Although research on formative assessment has grown in recent decades, significant gaps persist regarding its application at this educational level.

2 Background

2.1 Formative assessment in graduate studies

The purpose of formative assessment is to foster conscious and responsible learning in students through a systematic evaluation structure and a continuous support process provided by teachers. Beyond simply measuring academic progress, formative assessment offers students the opportunity to visualize their progress, identify areas for improvement, and strengthen their autonomous learning, which is especially relevant in the context of graduate studies (Cruzado Saldaña, 2022). The main objective is not only to assess performance but also to analyze the strategies and actions necessary to redirect and optimize the learning process. In this sense, evidence of achievement is used by both teachers and students to understand the learning processes and outline the path to better results (Mandinach and Schildkamp, 2021). The adoption of autonomy and self-regulation becomes a priority, and formative assessment serves as a key tool to improve continuous performance in an educational environment that demands high levels of specialization and critical reflection (Anijovich, 2017). Thus, in graduate studies, formative assessment not only supports academic progress but also guides continuous improvement and the adaptation of teaching strategies to maximize learning.

In graduate programs, formative assessment becomes essential due to the need to foster critical and reflective autonomy in students. Asiú et al. (2020) note that, at this educational level, the roles of teachers and students are complementary, as continuous feedback allows the learning process to be adjusted

and personalized. From a process-centered perspective, formative assessment provides relevant information about the construction of learning and allows for adjustments in pedagogical strategies to improve achievement levels (Fernández Leandro et al., 2022). In this context, assessment is not only used to verify competencies but also as a tool to redirect the teaching-learning process and promote self-regulation and self-management of knowledge. This approach offers students a continuous opportunity for improvement, as formative assessment, being a cyclical process of feedback and adjustment, becomes a means to drive new ways of learning, supported by effective teacher guidance (Cabrales, 2010; Fernández Leandro et al., 2022).

2.2 Feedback as the main benefit of formative assessment

When discussing teaching and learning processes, it is essential to frame the evaluation process as a mechanism that provides meaningful feedback and ensures the achievement of learning objectives (Louhab et al., 2018). Formative assessment stands out for its primary benefit of offering feedback and support to both students and teachers, with the aim of optimizing performance levels, achieving objectives, and informing decisions related to learning (Muñoz Velasco and Gonzáles Serrano, 2024). Feedback is a key component of formative assessment, allowing students to adjust their learning processes based on information provided by their teachers. This enables them to reflect on their performance and make informed decisions to improve future tasks (Fiskerstrand and Gamlem, 2024). It engages students and prepares them to enhance their learning (Guevara Fernández et al., 2024).

This process extends beyond simply correcting errors; it fosters ongoing dialogue between students and teachers, promoting a more active, in-depth, and meaningful learning process (Vattøy et al., 2022). The goal is to improve the achievement of learning objectives. By integrating feedback into the assessment process, an environment is created where students not only receive comments on their performance but also develop critical skills such as self-regulation and critical thinking (León-Wharton, 2021).

Formative feedback not only informs but also encourages critical analysis and continuous improvement, establishing itself as an essential pillar for maintaining a high level of academic engagement. Quality feedback strengthens this engagement when it helps students envision future learning and involves emotional resonance (Dávila Ramírez and Huertas Martínez, 2024).

Formative feedback has become a cornerstone in the educational process, significantly contributing to students' academic engagement (Sánchez Valdez and Carrión-Barco, 2021). Similarly, Dorencelle and Mollo (2022) emphasize that "an integrated formative feedback model fosters constant dialogue between teachers and students." Furthermore, feedback should not only be informative but also reflective, promoting critical analysis and continuous improvement in professional development (Saiz-Linares and Susinos-Rada, 2018).

At the postgraduate level, there are results about the effect of formative assessment on students, Borter (2024) analyzed exhaustively the effects that can be observed, he considered additional formative evaluations apart from the scheduled ones, so, his findings suggest improvement and positive impact on learning for postgraduate psychology students who received this additional contribution from the formative assessment; nevertheless, this also reveals variations in the self-regulated learning behavior and the level of time and effort invested in activities by the students. Statistically, the improvements in the final test results were significant for the ones who participated in additional formative assessments and dedicated more time and effort, they reached a measurement of $d = 0.33$ (measured with Cohen's d), while the ones who did not invest many resources obtained lacking or low significance improvements.

Following this, Sabale et al. (2022) highlights the formative assessment relevance in the postgraduate student's comprehensive development. By providing opportune and personalized feedback, this not only enhances the academic performance but also fosters skills such as self-regulation, problem-solving, and critical thinking. By adapting the assessment strategies to each student needs, institutions can ensure a meaningful and lasting learning.

2.3 Impact of formative feedback on academic engagement

Dorencelle and Mollo (2022) highlight that an integrated formative feedback model can transform the educational experience, increasing students' academic engagement and enabling them to take an active role in their learning. This approach prioritizes not only correction but also the development of autonomous learning and critical reflection, essential elements in graduate education. Sorkar Gómez (2021) points out that formative assessment, when focused on the learning process rather than the final product, improves the quality of learning and promotes active participation in planning and evaluating one's progress. The constant interaction between teachers and students, through detailed and growth-oriented feedback, fosters sustained motivation and deep academic engagement (Sánchez Valdez and Carrión-Barco, 2021). This type of feedback not only enhances academic performance but also supports the development of critical competencies that students will need throughout their professional careers.

2.4 Innovations in formative assessment

In recent years, formative assessment has gained particular relevance due to innovations that have enabled its adaptation and personalization through the use of digital technologies. The integration of technological tools has transformed teaching-learning processes, facilitating interaction, and continuous monitoring of students' progress (Katuk, 2019; Varlakova et al., 2022). These innovations have not only expanded the possibilities of formative assessment but have also created more collaborative and motivating learning environments, improving students' active participation (Webb et al., 2018). Furthermore, adaptive approaches, such as lesson study and personalized methodologies, have allowed students to advance at their own pace, increasing the quality of learning and self-determination (Fiskerstrand, 2021;

Thinwiangthong et al., 2020). In this context, formative assessment continues to evolve as a key tool for maximizing learning in the graduate setting, providing a more flexible approach tailored to students' needs.

2.5 Influence of formative assessment on learning achievement and competencies

There is extensive documentation on the influence of formative assessment on learning achievement and competency development. One of the essential components of this process is feedback, in which students' active participation plays a crucial role, as it directly impacts learning achievement (Van der Kleij et al., 2019). Additionally, immediate and effective feedback is key to enabling students to recognize their shortcomings and identify opportunities for improvement (Hattie and Timperley, 2007). Formative assessment fosters students' active participation in their learning process, promoting the acquisition of self-regulation skills that positively influence long-term learning, as it allows students to plan, monitor, and evaluate their own progress in a sequential manner (Panadero, 2017).

One of the main benefits of formative assessment is that it allows for personalized learning, providing teachers with detailed information about students' progress. This facilitates the adaptation of individual methodologies, which in turn contributes to more effective learning (Black and Wiliam, 2018). Additionally, by involving students in self-assessment and peer assessment processes, motivation and engagement increase, as they take greater responsibility for their own learning (Nicol and Macfarlane-Dick, 2006), thus promoting deeper learning.

Currently, formative assessment also contributes to the development of essential competencies in the technological field, which are critical in a constantly changing world. Feedback in simulated learning environments, facilitated by the use of information technologies, allows students to refine technical and professional skills, preparing them for entry into the labor market (Boud and Molloy, 2013). Additionally, the use of these technologies enhances students' digital competencies, fostering more effective interaction among them (Ghomi and Redecker, 2019).

Finally, it is worth noting that formative assessment not only focuses on the knowledge to be acquired but also facilitates the development of cognitive competencies such as critical thinking and conflict resolution (Sadler, 1989), socio-emotional competencies such as empathy and resilience (Durlak et al., 2011), and collaborative competencies such as teamwork skills. Peer assessment activities, in particular, promote more effective communication among students, fostering collaboration and teamwork (Johnson and Johnson, 2009).

3 Methods

To conduct this research, a systematic literature review (SLR) was chosen as it represents a rigorous methodology. The process is carried out in a precise, transparent, and comprehensive manner, making it replicable—in other words, other researchers can repeat the procedure to obtain similar results. The goal of an SLR is to minimize research bias and maximize the transparency and reproducibility of findings (Azarian et al., 2023; Rogge et al., 2024). The foundation of an SLR lies in clearly, specifically, and systematically defining the rules and procedures for conducting the research, including the search, selection, and evaluation of studies, thereby ensuring the thoroughness and objectivity of the review (Elsman et al., 2024).

The SLR underscores its importance through its inherent ability to provide a comprehensive and updated overview of a specific field of study. It is particularly valuable for identifying thematic gaps in the literature, supporting evidence-based decision-making, and contributing information for future research (Salih, 2024). The associated benefits are diverse: it enables the identification and synthesis of available evidence, thereby reducing selection bias (Mishra and Mishra, 2023); it enhances transparency and reproducibility in research through clear procedural definitions and thorough documentation (Rogge et al., 2024); and it fosters the generation of relevant research questions by identifying gaps in the literature (Salih, 2024). The selected databases for this search were Scopus and Web of Science, both recognized for their high reputation and academic rigor (Pranckute, 2021; Vera-Baceta et al., 2019).

To ensure an efficient and accurate search of the literature, boolean operators were employed in the database queries. These operators, such as AND, OR, and NOT, allowed for the logical combination of search terms, which facilitated the refinement of the obtained results. By using specific combinations of keywords, it was possible to cover a broader spectrum of relevant publications while excluding those that did not directly address the research objectives.

The selection and filtering process of the identified studies followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) diagram (Figure 1). This structured approach ensures transparency and reproducibility in the analysis, providing a framework to document each stage, from identifying studies to their final inclusion in the analysis. The following figure shows the different phases of the process, including the number of studies identified, filtered, and excluded at each stage (Moher et al., 2010).

To define the corpus of reviewed studies, inclusion and exclusion criteria were established. The selected articles had to be published in indexed journals, include empirical analyses on the topic of interest, and be written in English or Spanish. Editorial studies, reviews lacking a robust methodological framework, and publications prior to 2014 were excluded. Initially, the search results yielded a total of 188 articles, of which 33 were removed due to duplicates generated by searches in the Scopus and Web of Science databases. Subsequently, 58 articles were excluded for lacking a strong connection to the analysis of formative assessment. Of the remaining 97 articles, 31 were discarded as they could not be retrieved from the source. Finally, of the 66 articles selected for eligibility, 30 were excluded for not focusing on graduate students, and 17 for concentrating on specialization studies in the medical field. The final result was 19 eligible articles to conduct the systematic literature review. These criteria ensured that only the most recent and relevant studies were considered to address the research questions (Moher et al., 2010).

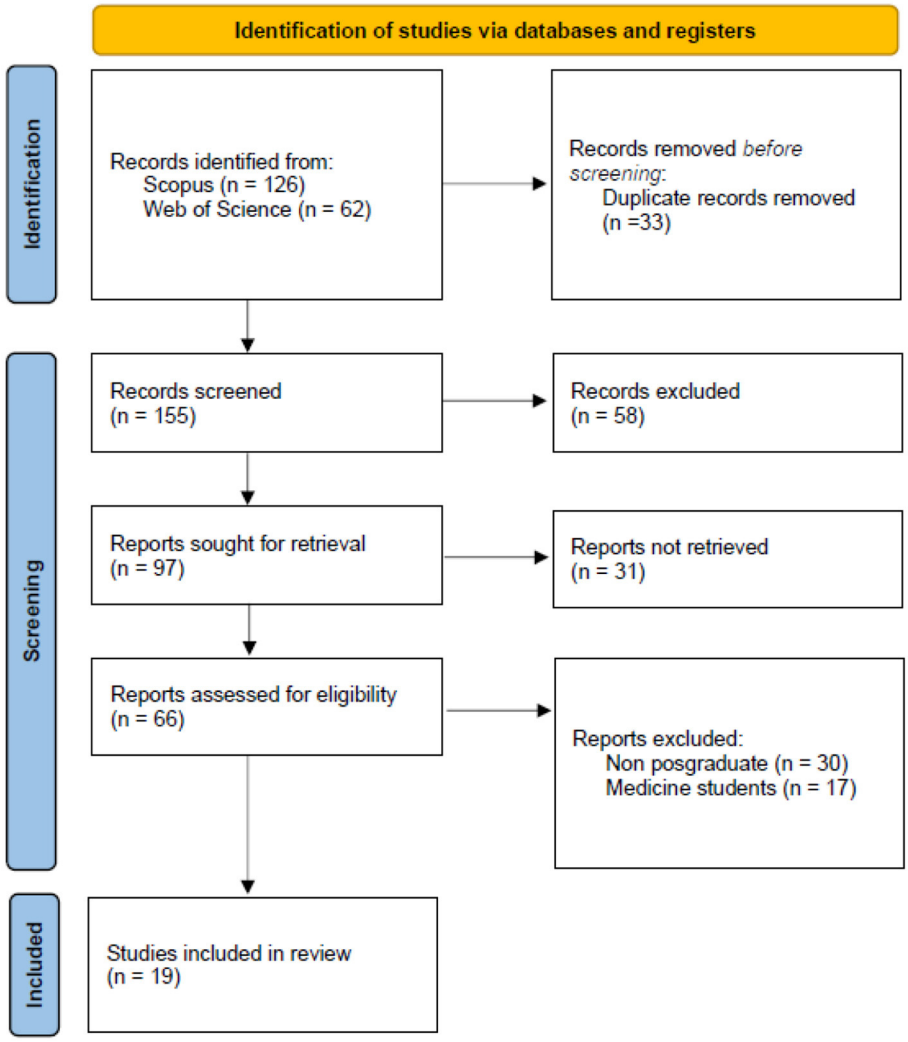

FIGURE 1
PRISMA diagram.

The research questions played a crucial role in guiding the systematic review process. These questions were designed to clearly and precisely address the central aspects of the investigated topic, serving as a guide for identifying and selecting the most relevant studies. The research questions were formulated based on the authors' criteria, taking into account the relevance of each topic addressed in the study. They were structured to facilitate an in-depth analysis of the existing literature, enabling the identification of patterns, knowledge gaps, and potential areas for future research. The following research questions guided this study: (1) What topics have been addressed in the reviewed articles over the past 10 years?; (2) What are graduate students' perceptions of feedback?; (3) What is the impact on academic engagement?; (4) What teaching practices influence the perception of feedback?; (5) What innovations have been seen in formative assessment among students?; (6) What is the influence of FA on students' learning achievements or competencies?

The result of the SLR process can be found at the following link: https://doi.org/10.5281/zenodo.13918325.

4 Results

4.1 How have the topics been addressed in the articles over the past 10 years?

Figure 2 was processed and analyzed using VOSviewer version 1.6.20, a software tool designed to visualize and process large volumes of information for bibliometric analysis (Bich et al., 2024). The figure represents a network of term co-occurrences, highlighting "feedback" as a central concept connected to various aspects of the teaching and learning process. The first cluster, in red, can be interpreted as "Feedback and Learning Processes" since it connects feedback with tasks, groups, performance, and learning processes, suggesting its importance in academic progress. The second cluster, in green, "Use of Feedback in University Contexts," emphasizes how feedback is implemented in university settings with a praxeological approach. The third cluster, in blue, "Performance and Task Evaluation," focuses on the relationship between student performance and assigned tasks. Finally, the fourth cluster, in yellow, "Evidence-Based Teaching and Learning,"

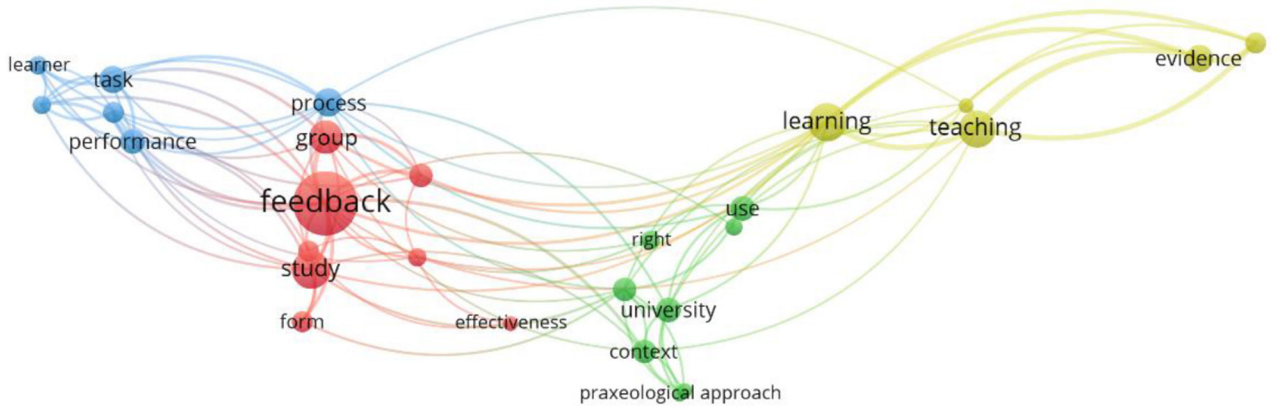

FIGURE 2
Bibliometric network.

reflects how teaching and learning are grounded in empirical evidence. Together, the figure shows how feedback is key to learning, impacting both individual performance and evidence-based pedagogical practices.

4.2 What are the perceptions of graduate students toward feedback in formative assessment?

Regarding graduate students' perceptions of feedback in formal education, there is general consensus about its crucial importance for students' academic development and continuous improvement. Talib et al. (2015) highlight that meaningful and specific feedback is one of the most valued aspects, as it allows students to restructure their knowledge and meet the expected standards in higher education. This focus on specificity is fundamental, as clear and targeted feedback fosters not only understanding but also the student's ability to apply concrete improvements. This idea is complemented by the findings of Dickson et al. (2019), who point out that students participating in peer feedback exercises, where continuous and detailed feedback was received, significantly improved their academic performance. They emphasize that feedback not only facilitates knowledge acquisition but also boosts confidence in future evaluations.

Moreover, the format of the feedback also plays a key role in students' perception. According to Talib et al. (2015), most students prefer to receive a combination of verbal and written feedback, as they consider that both modalities offer a more comprehensive view of their areas for improvement. This finding aligns with the observations of Coll et al. (2014), who remark that feedback provided by teachers should address both content aspects and academic and social participation, as these dimensions are deeply interrelated in online collaborative learning environments. This type of feedback, which goes beyond content, is perceived as more enriching by students, as it allows them to understand not only what they need to improve but also how they should actively engage in the learning process.

Another crucial aspect is timeliness, that is, the promptness with which feedback is provided. Both Talib et al. and Lee et al. emphasize that students value receiving timely feedback, which allows them to make adjustments before it is too late in the course. In fact, in situations where students received late feedback, they expressed frustration over not being able to implement the suggestions in future assignments (Lee et al., 2022; Talib et al., 2015). This perception that time is a crucial factor in feedback resonates with the research by Zheng et al. (2024), who identify that automated feedback through AI-assisted platforms can complement human feedback by providing immediate feedback, although it cannot yet fully replace the social interaction that students find valuable in peer feedback.

In general, students see feedback as an essential part of their learning process, particularly when it is timely, specific, and presented in multiple formats. This feedback not only improves their academic performance but also increases their confidence and reduces anxiety about future assessments, as demonstrated by Dickson et al. (2019) and Talib et al. (2015), who agree that continuous and well-structured feedback fosters a more inclusive and effective learning environment. This body of studies reinforces the idea that the quality of feedback directly impacts students' perception of their academic progress, making feedback an indispensable tool in graduate education.

4.3 What is the impact of feedback on academic engagement?

The impact of feedback on the academic engagement of graduate students has been explored from various perspectives, showing how the quality and nature of feedback directly influence the level of student engagement in their own learning process. A study by Zheng et al. (2024) indicates that automated and peer feedback increases engagement, as students not only receive information about their performance but are also motivated to improve continuously through a cycle of evaluation and self-assessment. This approach enables students to stay more connected

with their learning, contributing to greater engagement as they see their efforts translate into tangible improvements.

On the other hand, Coll et al. (2014)'s study on feedback in collaborative learning environments shows that students' engagement increases when feedback also covers aspects of social and academic participation. By receiving feedback on their participation in group activities, students feel more motivated to actively engage in discussions and projects, enhancing their sense of shared responsibility and belonging to the group. This is particularly relevant in online learning contexts, where social interaction can be challenging, but when integrated with appropriate feedback, students show a higher level of engagement.

Similarly, studies such as Dickson et al. (2019) highlight that formative feedback, whether from peers or teachers, has a direct effect on students' confidence, which in turn reinforces their academic engagement. Students who receive consistent and constructive feedback not only improve their performance but also develop a sense of self-efficacy that drives them to engage more deeply in academic tasks. This finding is supported by Raković et al. (2023), who in their research on the use of data and linguistic analysis to predict student performance, argue that feedback should focus not only on the final product but also on the cognitive and metacognitive processes students use during task development. By receiving feedback on these processes, students not only feel more engaged with the current task but also develop transferable skills for future academic projects.

Finally, Mohammed (2021) point out that the use of self-assessment and peer assessment can also positively impact academic engagement, especially in environments where students are responsible for their own progress. This type of assessment fosters a sense of autonomy, which increases intrinsic motivation and, consequently, overall engagement with the learning process. In this sense, feedback is not just a corrective tool but a mechanism that drives continuous engagement by involving students in an active cycle of self-assessment and constant improvement.

Together, these studies demonstrate that feedback has a substantial impact on academic engagement, as it not only improves students' direct performance but also strengthens their motivation, self-efficacy, and sense of belonging within the academic environment. When feedback is timely, specific, and multifaceted, students feel more engaged in their own learning, leading to greater academic commitment.

4.4 What teaching practices influence the perception of feedback in formative assessment?

The teaching practices that influence the perception of feedback in formal education are varied, and their effectiveness largely depends on how feedback processes are managed. Feller and Berendonk (2020) highlight that a key practice is the combination of formative and summative feedback, where teachers not only correct students' work but also provide comments that help students improve in future tasks. This perspective aligns with the findings of Dickson et al. (2019), who emphasize that formative feedback, when given in a timely manner, not only improves performance but also reinforces the positive perception of feedback as a tool for continuous learning.

Henderson and Phillips (2015) underscore the importance of clarity and specificity in feedback. This finding is supported by Talib et al. (2015), who point out that students value feedback that is clear, specific, and directly applicable to their academic work. When comments are vague or general, students tend to perceive feedback as less useful, which affects their engagement in the improvement process. In this sense, both clarity and specificity in teachers' comments are key factors influencing how students receive and apply feedback.

The use of educational technology has also been identified as a teaching practice that improves the perception of feedback. Jadon et al. (2022) found that digital platforms allowing students to review their comments at any time encourage deeper reflection and promote more effective use of feedback. This finding is consistent with what Coll et al. (2014) reported, who argue that the use of technological tools facilitates constant interaction between students and teachers, improving the perception that feedback is accessible and useful. Additionally, Raković et al. (2023) highlight that digital tools allow teachers to provide feedback not only on the final product but also on the cognitive processes involved, offering students a more holistic understanding of their learning.

Collaborative feedback is another teaching practice that positively influences the perception of feedback. According to Kalaitzopoulou et al. (2023), when teachers promote peer evaluation in a collaborative environment, students tend to value feedback more, as they are actively involved in creating evaluation criteria and in the learning process of their peers. This approach is supported by studies by Jiménez et al., who found that students participating in such activities have a greater understanding of feedback, improving their perception of its usefulness (Jiménez Moreno et al., 2022; Kalaitzopoulou et al., 2023). Well-managed collaborative feedback allows students not only to receive but also to generate valuable comments, increasing their engagement and satisfaction with the process.

Finally, Woods et al. (2023) suggest that practical and contextual feedback is key for students in applied learning environments, such as in the teaching of clinical skills. When students can see how feedback directly translates into practical and applicable improvements, they perceive it as more valuable and relevant. This finding aligns with what Feller and Berendonk (2020) and Mohammed (2021) noted, who conclude that students receiving feedback directly related to the practical application of their skills tend to value it more, as they consider it essential for their professional development.

4.5 What innovations have been seen in formative assessment among students?

In recent years, several innovations in formal education have transformed the way students interact with learning and feedback. One of the most notable innovations is the use of AI-assisted automated assessment platforms, as described by Zheng et al. (2024) these platforms offer immediate and detailed feedback on specific skills, such as language and writing

proficiency, allowing students to improve autonomously without waiting for teacher intervention. This type of automated feedback complements traditional assessment, providing more continuous and personalized support, resulting in greater student engagement. Henderson and Phillips (2015) also support this approach, noting that automation in feedback facilitates self-assessment, a skill increasingly necessary in autonomous learning environments.

Another important innovation is the integration of collaborative technologies that promote peer learning, as observed in the study by Kalaitzopoulou et al. (2023). These tools allow students to receive feedback not only from their teachers but also from their peers, enhancing collective learning. The use of platforms like online forums and co-editing tools has increased student interaction, improving the quality of feedback and fostering an environment where learning is a shared experience. Jadon et al. (2022) reinforce this idea, pointing out that collaborative platforms not only help improve the perception of feedback but also allow students to develop critical evaluation and reflection skills, strengthening their capacity for self-regulation in learning.

Finally, personalized learning through data analysis has been a key innovation in formal education. According to Raković et al. (2023), the use of data analysis and behavior tracking allows teachers to adapt feedback to the individual needs of students, significantly improving academic performance. This approach enables students to receive feedback on their cognitive and metacognitive processes, which not only improves their immediate performance but also provides them with strategies for future learning. As Feller and Berendonk (2020) also emphasize, this use of data has allowed students to develop a greater understanding of their progress, facilitating more adaptive and efficient learning.

4.6 What is the influence of formative assessment on students' learning achievements or competencies?

Formative assessment has a crucial impact on the development of students' learning and competencies, mainly due to the continuous and specific feedback it provides. Raković et al. (2023) emphasize that formative assessment based on the analysis of cognitive and metacognitive processes allows students to adjust their learning strategies more effectively, resulting in a significant improvement in their academic competencies. This approach, which focuses on both the process and the product, coincides with what Jadon et al. (2022) mention about the importance of constant feedback for developing greater self-regulation in students. By combining feedback with self-assessment and critical reflection strategies, students achieve more sustainable improvements in their academic performance.

Moreover, Feller et al. and Kalaitzopoulou et al. (2023) agree that formative assessment not only reinforces academic learning but also fosters interpersonal and collaborative competencies, such as teamwork and effective communication. In environments where students receive feedback from peers and teachers, greater critical reflection and a deeper understanding of concepts are promoted. This collaborative approach aligns with what Jiménez Moreno et al. (2022) identified about the relevance of peer feedback, which enhances skills such as the ability to objectively evaluate the work of others, in turn reinforcing the acquisition of cognitive and social competencies.

Finally, Woods et al. (2023) and Henderson and Phillips (2015) highlight how formative assessment also influences the development of practical and transferable competencies, such as problem-solving and decision-making. Feedback focused on the practical application of knowledge, as in the case of the clinical skills studied by Woods et al. (2023), allows students to transfer their learning to real-world contexts more effectively. This approach is complemented by Henderson and Phillips (2015), who argue that formative assessment encourages students to apply feedback not only in the academic realm but also in workplace or professional situations, ensuring the comprehensive development of their competencies.

5 Discussion

Feedback is a key driver of academic self-regulation in graduate students, enhancing their ability to manage their own learning. This study confirms that students who receive continuous feedback demonstrate significant improvements in planning, monitoring, and evaluating their progress, aligning with the self-regulated learning theory (Lee et al., 2022; Panadero, 2017). These findings suggest that specific and timely feedback acts as a catalyst for developing metacognitive skills, enabling students to approach their learning with greater autonomy. However, variability in how feedback is delivered across different programs and disciplines highlights the need for more standardized practices that ensure consistent effectiveness across contexts.

Immediate feedback has a direct and transformative impact on increasing motivation and academic engagement among graduate students. The analyzed studies consistently associate timely and specific feedback with higher levels of student participation and active involvement in academic tasks. Research by Hattie and Timperley (2007) and Feller and Berendonk (2020) supports the notion that immediate feedback fosters intrinsic motivation and a stronger sense of responsibility in learning. Additionally, the integration of immediate feedback into collaborative environments, as demonstrated in online and hybrid settings, enhances not only individual engagement but also collective accountability among peers. Nonetheless, challenges persist in maintaining the balance between immediacy and depth of feedback, particularly in large-scale graduate programs where resource limitations can hinder personalized interactions.

Personalized feedback is essential to maximizing learning in graduate settings. Various studies agree that personalized feedback significantly improves students' academic performance by adapting to their individual needs and learning styles. This assertion is supported by the theory of differentiated learning, which posits that tailoring feedback to student characteristics fosters more effective and autonomous progress (Henderson and Phillips, 2015; Zheng et al., 2024). Personalized feedback not only optimizes learning but also promotes greater equity by addressing individual differences among students.

Technology has transformed the way feedback is implemented in the educational sphere, providing more efficient and accessible tools. The use of digital platforms and automated tools has facilitated the delivery of immediate feedback, improving the

interaction between students and teachers and speeding up the process by which students receive comments on their performance. This approach is supported by the theory of technology-mediated learning, which suggests that digital tools not only accelerate processes but also allow for greater personalization and monitoring (Andriamiseza et al., 2023; Varlakova et al., 2022). Therefore, the integration of technology in feedback fosters more dynamic, accessible, and tailored learning to meet the individual needs of students.

Finally, although formative evaluation can present notable benefits, it is relevant to consider each student characteristics, especially when additional formative assessments are required to implement to foster the effects, because for student who have a high self-regulation capacity the incremental contribution of the formative assessment will provide the opportunity for a much deeper input in learning due to feedback and positive reinforcement. Nevertheless, for students who do not invest time and effort, the lack of a positive impact may be related to a low motivation or a perception of difficulty in assigned tasks (Borter, 2024).

On the other side, by adapting the formative assessment strategies according to each student needs can ensure a deeper and more meaningful learning. In this regard, this type of assessment is fundamental to develop high-order cognitive skills such as self-regulation and critical thinking in postgraduate students (Sabale et al., 2022).

6 Conclusion

In summary, this systematic review has demonstrated that formative feedback plays a crucial role in graduate education, enhancing both students' learning and academic engagement. (a) The results indicate that immediate and personalized feedback is essential for promoting student self-regulation, enabling more autonomous and sustained learning. (b) Additionally, the use of technology has optimized the way feedback is provided, increasing its effectiveness and accessibility. (c) Finally, the implementation of feedback strategies that consider the individual needs of students contributes to equity in the educational process, ensuring that all students have opportunities to improve their academic performance.

Although exhaustive in its analysis, this study presents some important limitations. First, the review was based exclusively on studies published in academic databases, which may have excluded relevant research that is not indexed or published in other formats. Additionally, the heterogeneity of the reviewed studies in terms of methodologies and educational contexts made it difficult to directly compare results, limiting the ability to generalize the conclusions to all graduate programs. Lastly, many studies did not provide detailed data on the long-term impact of formative feedback, leaving a gap in understanding its lasting effects on student learning.

Future research should address several areas that were not sufficiently explored in this review. First, longitudinal studies are needed to examine the long-term effects of formative feedback on motivation and academic performance. Additionally, it is recommended to explore the impact of personalized feedback in multicultural and diverse contexts to identify which strategies work best in different environments. Finally, further research should investigate the role of emerging technologies, such as artificial intelligence, in formative feedback to evaluate their potential in personalizing and automating learning.

Author contributions

BP: Conceptualization, Investigation, Project administration, Writing – original draft. DV-C: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. CG: Data curation, Investigation, Writing – original draft. EC: Data curation, Writing – original draft. MG: Data curation, Writing – original draft.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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