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The Use of Formative Assessment and Feedback as Teaching and Learning Tools in Medical Education

ARTICLE

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Abstract
Current medical education uses essential tools to continuously improve student learning. This study identified how formative assessment and feedback contribute to teaching and learning in the medical context. An integrative review was conducted in September 2024 via the CAPES Journals Portal, in databases such as BVS, PubMed, SciELO, and Scopus. The inclusion criteria were: articles published between 2014 and 2024 in English and Portuguese, in peer-reviewed journals; and the exclusion criteria were: book chapters, pre-prints, letters, editorials, and course completion papers. The study identified four themes: the impact of formative assessment on student performance and engagement; the role and effectiveness of formative feedback; methodologies and approaches for technology-driven formative assessment; and challenges and recommendations for effective implementation. Ultimately, formative assessment and feedback are crucial in medical education, driving engagement and continuous improvement; their successful implementation requires teacher training, trust, and the strategic use of technology.
Keywords: Education. Feedback. Learning. Assessment.

Utilização da avaliação formativa e do feedback como instrumentos de ensino e aprendizagem na educação médica

Resumo
A educação médica atual utiliza ferramentas essenciais para aprimorar continuamente o aprendizado dos estudantes. Este estudo identificou como a avaliação formativa e o feedback contribuem para o ensino e a aprendizagem no contexto médico. Realizou-se uma revisão integrativa em setembro de 2024 via o Portal de Periódicos da CAPES, nas bases BVS, PubMed, SciELO e Scopus. Os critérios de inclusão foram: artigos publicados entre 2014 e 2024 em inglês e português, em periódicos revisados por pares e, exclusão: capítulo de livro, pré-print, carta, editorial e trabalhos de conclusão de curso. No estudo, foram identificados quatro temas: impacto da avaliação formativa no desempenho e

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engajamento dos alunos; o papel e a efetividade do feedback formativo; metodologias e abordagens para avaliação formativa impulsionadas pela tecnologia; e desafios e recomendações para a implementação efetiva. Por fim, a avaliação formativa e o feedback são cruciais na educação médica, impulsionando o engajamento e a melhoria contínua; sua implementação bem-sucedida exige capacitação de professores, confiança e uso estratégico de tecnologias.
Palavras-chave: Educação. Feedback. Aprendizagem. Avaliação.

1 Introduction

Medical education has been undergoing a significant transformation, progressively moving away from traditional teaching methods and, in particular, from summative assessment as the predominant tool. Since the 1970s, the educational landscape has witnessed the emergence of discussions that led to the introduction of active methodologies. These approaches, unlike previous ones, place the student at the center of the learning process, prioritizing the practical application of knowledge in real-world settings and fostering autonomy in the pursuit of learning (Miranda *et al.*, 2020; Costa, Oliveira & Dantas, 2020).

In this context of paradigm shift, active learning transcends mere passive listening or the observation of exercise resolution. It encompasses a complex set of activities that demand from students a high level of cognitive engagement, such as analysis, synthesis, and evaluation (Oliveira, 2009; Bonwell & Eison, 1991). Consequently, the focus of teaching shifts from the simple transmission of information to the development of essential competencies in future health professionals.

Educational assessment, in particular, has adapted to these new demands and to the constant sociopolitical, economic, and health transformations, exemplified by the impact of the Covid-19 pandemic on teaching models (Oliveira, 2009). Although some Latin American countries still maintain traditional approaches, many institutions, including those in the health field, have embraced active methodologies such as Problem-Based Learning (PBL) and Team-Based Learning (TBL), which require new assessment strategies (Gomes *et al.*, 2021).

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Within medical education, the importance of formative assessment and, specifically, formative feedback has been widely recognized. Feedback is not merely a support tool for achieving meaningful learning and developing critical thinking as opposed to rote memorization (Mackintosh-Franklin, 2021), but also a dynamic process in which teachers and students transform one another, creating an environment conducive to the exchange of ideas and the development of competencies (Borges *et al.*, 2014). For formative assessment to fulfill its main goal of enhancing student learning, it is crucial to train faculty members in effective assessment methods and to encourage the provision of timely feedback (Arja *et al.*, 2018).

In light of this pedagogical evolution and the growing relevance of formative assessment, this study aims to identify and describe how formative assessment and feedback contribute as teaching and learning tools in the context of medical education.

2 Methodology

This study is an integrative literature review (Grant & Booth, 2009). This methodology allows for the systematic synthesis and analysis of content, contributing to the updating and refinement of the proposed topic (Sousa & Santos, 2016).

To conduct the research, the phases proposed by Souza, Silva, and Carvalho (2010) were followed: 1) development of the guiding question; 2) search or sampling in the literature; 3) data collection; 4) critical analysis of the studies included; 5) discussion of the results and presentation of the integrative review.

The search was conducted primarily on the Portal de Periódicos of the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) in September 2024. This portal offers high-quality scientific content and encompasses databases such as the Biblioteca Virtual em Saúde (BVS), PubMed, Scientific Electronic Library Online (SciELO), and Scopus.

As a search strategy, the following combination key was used: “formative assessment” AND “medical education” AND “feedback”. Next, for filtering and analysis of

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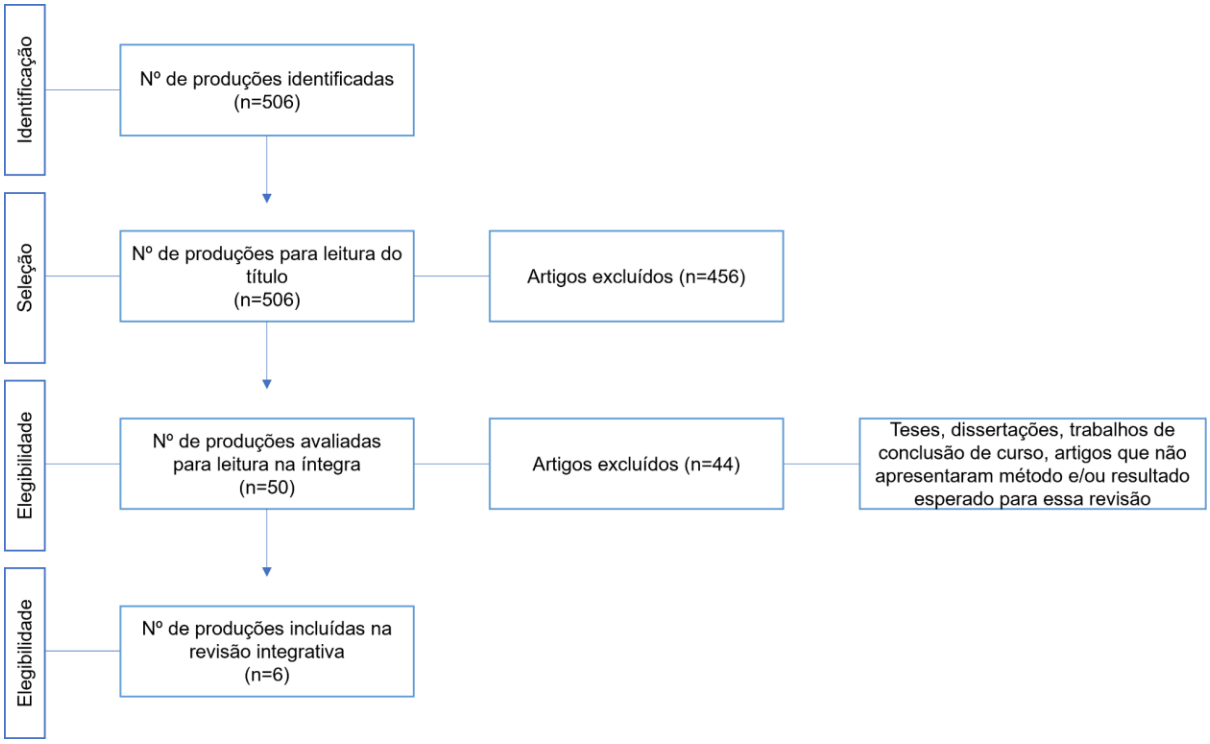
the studies found, the inclusion criteria were defined as articles published between 2014 and 2024, in English and Portuguese, in peer-reviewed journals. The exclusion criteria were book chapters, preprints, letters, editorials, and undergraduate theses.

For data collection, the articles were screened by title and abstract, resulting in the selection of six articles, which were read in full.

3 Results and Discussion

After the search conducted in the CAPES Journal Portal, 506 articles were identified. In the first selection stage, in which only the titles were read, 456 articles were excluded, leaving 50. In the second stage, the abstracts were read and, in the end, 6 articles were selected for the integrative review.

Figure 1 – Flowchart of study selection for inclusion in the review



Source: The authors (2024).

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Table 1 presents the main data from the analyzed articles, namely author, year of publication, title, and objective. Table 2 presents the main findings of the included articles.

Table 1 – Characterization of the selected articles

N	Author/Year	Title	Objective
1	Mackintosh-Franklin (2021).	An evaluation of formative feedback and its impact on undergraduate student nurse academic achievement.	To evaluate the impact of formative feedback on the final academic performance of Nursing students in a module of an undergraduate course.
2	Ilangakoon; Ajjawi; Endacott; Rees (2022).	The relationship between feedback and evaluative judgement in undergraduate nursing and midwifery education: An integrative review.	To explore the relationship between feedback and evaluative judgment in undergraduate Nursing and Midwifery education.
3	Malau-Aduli; Preston; Adu; Alele; Gratani; Drovandi; Heslop (2019).	'Pharmacy students' perceptions of assessment and its impact on learning.	To investigate the perceptions of Pharmacy students from an Australian university regarding their assessment experiences and the impact of these assessments on their learning.
4	Arja; Acharya; Alezaireg; Ilavarasan; Ala; Arja (2018).	Implementation of formative assessment and its effectiveness in undergraduate medical education: an experience at a Caribbean medical school.	To compare student performance in summative assessments and semester grade averages with formative assessments and with the previous semester, in which no formal formative assessments were conducted.
5	Schlegel; Selfridge (2014).	Fun, collaboration and formative assessment: Skinquizition, a class-wide gaming competition in a medical school with a large class.	To describe an innovative approach and guiding principles for the formative assessment of a dermatology curricular module (*Integument II – Dermatology*) for a large cohort of Medical students at Ross University School of Medicine.
6	Young; Sugarman; Schwartz; O'Sullivan (2020).	Overcoming the challenges of direct observation and feedback programs: A qualitative exploration of resident and faculty experiences.	To investigate how participating faculty members and residents perceived their experience with a direct observation and feedback program that incorporated recommended elements to enhance this

			type of assessment in the context of competency-based medical education.

Source: The authors (2024).

Table 2 – Main findings of the studies

N	Author/Year	Main findings
1	Mackintosh-Franklin (2021).	Students who submitted formative assignments were significantly more likely to earn an “A” grade and less likely to fail the course compared to those who did not submit them. Moreover, the quantity or quality of the feedback provided by instructors did not have a significant impact on final grades. In other words, the mere act of submitting formative work appeared to make a difference, regardless of the feedback received. These results raise questions about the actual value of formative feedback, suggesting that its influence on academic performance may be limited. The study proposes that students’ motivation to learn and their willingness to submit formative work may be more critical factors for academic success than feedback itself.
2	Ilangakoon; Ajjawi; Endacott; Rees (2022).	It was identified that the concept of evaluative judgment, although not explicitly mentioned in the Nursing and Midwifery literature, is present and essential for student development. It was concluded that for feedback to effectively contribute to the development of evaluative judgment, students must be active participants in the process, engaging in dialogue about feedback, reflection, self-assessment, and comparison with others. Educators were the most valued sources of feedback, especially when there was a good relationship between the parties. Peer and patient feedback was also considered useful. Not all students were able to relate the feedback received to their own learning, highlighting the need for more specific and personalized responses.

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3	Malau-Aduli; Preston; Adu; Alele; Gratani; Drovandi; Heslop (2019).	Short-answer questions (SAQs) were the most well-received, as they allowed students to demonstrate partial knowledge and receive proportional scores. Over the past ten years, there have been significant changes in teaching, learning, and assessment methods driven by information technology tools. These technologies have supported the transition from passive learning to active engagement through multisensory experiential methodologies. Instructional games supported by technology allow dynamic interaction in competitive activities involving large groups. In addition to making learning more engaging, these games serve as effective instruments for formative assessment, providing teachers with opportunities to offer valuable observations and feedback.
4	Arja; Acharya; Alezaireg; Ilavarasan; Ala; Arja (2018).	After the introduction of formative assessments, a significant improvement in students' academic performance was observed, evidenced by the increase in the average GPA from 2.29 (without formative assessment) to 2.83 (with formative assessment). Most participants acknowledged the relevance of these assessments, with 83% stating that they contributed to achieving learning objectives and 81% reporting strengthened knowledge and understanding. Additionally, 62.7% expressed satisfaction with the feedback received, emphasizing the importance of specific and timely responses. However, challenges were noted in contexts with limited resources (time and faculty availability), which may affect assessment effectiveness. Continuous faculty development was identified as crucial for the successful implementation of formative assessments, ensuring that feedback is delivered effectively and at the appropriate time.
5	Schlegel; Selfridge (2014).	Both residents and faculty agreed that the main purpose of the Direct Observation and Structured Feedback Program (DOSFP) was to promote residents' growth and ensure the quality of patient care rather than simply evaluate competence. Initially, residents reported discomfort being observed during patient interviews, but this discomfort decreased over time. With continued practice, interactions became more authentic and less performance-driven. The ongoing relationship between supervisors and residents was crucial for building a strong educational alliance based on trust and safety. This allowed feedback to be more credible and specific, given the supervisor's deeper knowledge of the resident. The structured instruments used in the program helped improve the quality of feedback, making it more systematic, specific, and actionable. Residents particularly valued immediate verbal feedback that identified gaps. Even within trusting relationships, residents tended to dismiss feedback they disagreed with, suggesting a need for additional strategies to help them reconcile external feedback with self-assessment. The program helped foster a learning culture focused on growth rather than performance, facilitated by repeated direct observation and feedback within longitudinal relationships.

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6	Young; Sugarman; Schwartz; O'Sullivan (2020).	"Skinquizition" is a fast-paced, interactive quiz using audience response technology that engages the entire class in team-based competition. The game is conducted at the end of the dermatology module to prepare students for high-stakes final exams while promoting collaborative skills. The main objective of the game is to enhance student engagement and improve academic performance. Each team answers complex dermatology-related questions using images and other visual resources. Students receive immediate feedback on their responses, helping them identify knowledge gaps before final exams. Results showed increased engagement and satisfaction, as well as improved average scores in related subjects such as Microbiology, Pharmacology, Pathology, and Clinical Medicine after the game's introduction. The "Skinquizition" game proved to be an effective formative assessment tool for large groups, fostering collaborative learning, enhancing student motivation, and improving academic performance. Additionally, it provides feedback for both students and instructors, enriching the teaching and learning processes.

Source: The authors (2024).

Based on the results presented, the findings can be categorized into four main areas: 1. The impact of formative assessment on student performance and engagement; 2. The role and effectiveness of formative feedback; 3. Methodologies and approaches to formative assessment driven by technology; and 4. Challenges and recommendations for effective implementation.

The category *Impact of formative assessment on student performance and engagement* deepens the understanding of how formative assessment—conducted throughout the teaching-learning process with the goal of monitoring students' progress and providing feedback for improvement—directly influences academic success (as reflected in grades and course completion) and students' level of engagement. In essence, it examines what happens when students participate in assessments that do not count toward their final grades but are designed to help them learn. The studies reviewed show that the effect is highly positive, though sometimes in unexpected ways (Young *et al.*, 2020; Arja *et al.*, 2018).

An important finding in the studies, as reported by Mackintosh-Franklin (2021), is that the simple act of submitting formative assignments seems to be a decisive factor for success. Students who did so were significantly more likely to earn an "A" grade and less likely to fail. What is surprising is that the study by Mackintosh-Franklin (2021) suggests

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that the quantity or quality of the feedback provided by instructors did not have a noticeable effect on final grades.

This raises an important question: could the real value lie more in the student's intrinsic motivation to learn and their willingness to engage actively with the learning task (by submitting formative work) than in the details of the feedback received? This point invites reflection on what truly drives learning and how educators can nurture that motivation.

Although feedback may not be the only driver, the overall evidence points to a clear positive impact of formative assessment on performance. Arja *et al.* (2018) observed a considerable improvement in students' GPA after the implementation of formative assessments (rising from 2.29 to 2.83). Furthermore, most students themselves recognized the relevance of these assessments: 83% stated that they contributed to achieving learning objectives, and 81% reported strengthened knowledge and understanding. This shows that, from a broader perspective, students both perceive and benefit from formative assessment practices.

The way formative assessment is applied also makes a significant difference in student engagement and satisfaction. Malau-Aduli *et al.* (2019) highlighted that short-answer questions (SAQs) were very well received. Why? Because they allow students to demonstrate partial knowledge without being entirely penalized, while still earning proportional marks. This type of assessment, along with advances in IT tools, has transformed education from a passive model to one of active engagement. Instructional games supported by technology have emerged as methods that not only promote dynamic interaction between teachers and students but also serve as effective tools for formative assessment.

Supporting this idea, Young *et al.* (2020) introduced *Skinquizition*, an interactive quiz that not only increased student engagement and satisfaction but also helped learners identify their own knowledge gaps before major exams. Concrete results were seen in improved average scores in related subjects, reinforcing that gamified and interactive tools

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can be highly effective in promoting both collaborative learning and academic performance on a large scale.

In summary, this category demonstrates that formative assessment is a powerful tool for student success and engagement. However, its true impact may lie not only in detailed feedback but also in students' willingness to participate actively and in the use of methods and technologies that make the process engaging and relevant to their learning.

The category that addresses the *role and effectiveness of formative feedback* delves into the complexity of formative feedback—that is, the information students receive about their performance to guide their learning process. It explores not only what makes feedback valuable but also who should provide it, under what conditions it is most effective, and what the common challenges are in practical application.

It is important to highlight that Ilangakoon *et al.* (2022) found that educators are the most valued source of feedback for students. This is especially true when there is a strong teacher-student relationship. Such a connection suggests that trust and mutual respect create an environment in which feedback is more readily received and considered. The study also notes that peer and patient feedback (in contexts such as nursing and midwifery) is useful, particularly for developing evaluative judgment—the ability to critically assess one's own work and that of others.

Schlegel and Selfridge (2014) reinforce this idea, emphasizing the importance of the ongoing relationship between supervisors and residents in a Direct Observation and Structured Feedback Program (DOSFP). This strong educational alliance, based on trust and psychological safety, was crucial for making feedback more credible and specific. When residents trust their supervisors and feel safe, they are more open to accepting and acting upon feedback. Furthermore, immediate verbal feedback was considered especially impactful, likely because it is delivered at the moment of action, making it easier to connect behavior with observation.

Feedback is not a one-way process; its effectiveness depends heavily on student participation and the quality of delivery. Ilangakoon *et al.* (2022) emphasize that student engagement is essential and argue that, for feedback to be truly effective in developing

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evaluative judgment, learners must take an active role. This means participating in dialogue about feedback, reflecting on it, practicing self-assessment, and comparing their performance with that of others. Simply receiving feedback is not enough—the student must process it and interact with it actively.

Both studies by Ilangakoon *et al.* (2022) and Arja *et al.* (2018) emphasize the need for more specific and personalized feedback. Ilangakoon *et al.* (2022) note that not all students are able to relate generic feedback to their own learning. Similarly, Arja *et al.* (2018) indicate that students' satisfaction with instructors' feedback rests on the importance of targeted, specific input for the success of formative assessments. Feedback that pinpoints exactly what needs improvement and how to achieve it is far more useful than a vague comment. Schlegel and Selfridge (2014) also observed that the use of structured instruments in programs such as the DOSFP helped improve feedback quality, making it more systematic, specific, and actionable. This standardization can ensure that critical points are consistently addressed, which facilitates students' understanding and application of feedback.

Despite its benefits, the studies in this review point out that effective implementation of formative feedback faces challenges. One of the most provocative points comes from Mackintosh-Franklin (2021), who raises questions about the "real value" of formative feedback. The study suggests that in some cases the quantity or quality of feedback did not have a significant impact on final grades, since the mere act of submitting the formative assignment already seemed to make a difference. This does not mean that feedback is useless, but rather that its effect may be more complex and contextual than imagined, and that other factors, such as student motivation, may carry greater weight.

Schlegel and Selfridge (2014) identified an important limitation, since even within trusting relationships residents tended to dismiss feedback with which they did not agree. This points to the need for strategies that help learners reconcile external feedback with their own self-assessment.

Finally, Arja *et al.* (2018) highlight that settings with limited resources, especially time and faculty numbers, can drastically affect the effectiveness of formative assessment

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and feedback. An overburdened system may be unable to provide the specific, personalized, and timely input that students value and that is necessary for effective learning.

In summary, the category “The role and effectiveness of formative feedback” reveals that feedback is a multifaceted tool. Its effectiveness depends on the quality of the relationship between the giver and the receiver, on the specificity and direction of the information, on student activation in the process, and on the capacity to overcome challenges such as resource constraints or resistance to disagreement.

With respect to category 3, “Methodologies and approaches to formative assessment driven by technology,” there is a closer look at the ways in which formative assessment is applied, with particular attention to the transformative influence of technology. This category explores innovative strategies and tools that enable educators to monitor learning, provide feedback, and at the same time make the process more dynamic and engaging. Essentially, it examines the “how” of formative assessments, especially when technology enters the picture (Malau-Aduli *et al.*, 2019; Young *et al.*, 2020; Schlegel and Selfridge, 2014).

Technological advancement has revolutionized how students interact with content and how they are assessed. Malau-Aduli *et al.* (2019) highlight that progress in Information Technology tools has been a driving force for educational change. Previously, teaching tended to be passive, with students merely receiving information. With new technologies, learning has become active engagement, often through multisensory experiential methodologies. The use of virtual simulators, augmented reality, and interactive platforms activates different senses and learning styles. It is not merely about using a computer, it is about employing technology to create experiences that require students to do, explore, and discover.

A prominent example of this transition is instructional games. Malau-Aduli *et al.* (2019) explain that these games, supported by technology, allow dynamic interaction between teachers and students, often in a competitive and enjoyable environment. More than making learning appealing, the games function as effective instruments for formative

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assessment, offering instructors the opportunity to provide valuable observations and feedback in an immediate and engaging way. Young *et al.* (2020) illustrate this with *Skinquizition*, an interactive quiz that uses audience response technology to engage an entire class in team-based competition. This approach not only stimulates collaborative skills, it also provides immediate feedback on answers, helping students quickly identify their knowledge gaps. The success of *Skinquizition* in improving performance and satisfaction demonstrates the potential of interactive technologies to transform formative assessment into a powerful tool for learning and feedback in large groups.

Although not directly “technological” in the digital sense, direct observation represents a structured formative assessment methodology centered on continuous development. Schlegel and Selfridge (2014) detail the Direct Observation and Structured Feedback Program, the primary objective of which is not only to evaluate residents’ competence but also to promote their ongoing growth and ensure the quality of patient care. This reflects a formative assessment philosophy that goes beyond checking knowledge and aims at developing skills and behaviors. Repeated direct observation and consistent feedback within longitudinal relationships, that is, over time with the same supervisors, were fundamental for creating a learning culture focused on growth rather than performance. This continuous environment of observation and feedback fosters trust, enhances skills, and encourages self-reflection, helping residents develop professionally in a robust way. It is an example of how a well-structured methodology, even without heavy reliance on software, can be highly formative.

Ultimately, the category “Methodologies and approaches to formative assessment driven by technology” shows that innovation is not merely using new tools, it is rethinking how assessment can be integrated into the learning process to make it more active, engaging, and effective. Whether through interactive games that turn assessment into a learning experience or through structured observation programs that focus on continuous professional growth, the goal is always to use feedback to drive student development.

The fourth category, related to the challenges and recommendations for the effective implementation of formative assessment, delves into the practical obstacles that

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arise when applying this approach and into the solutions proposed by the studies to overcome them. It is not enough to know that formative assessment is beneficial, it is necessary to understand what can go wrong in its implementation and how to make it actually work (Arja *et al.*, 2018; Schlegel and Selfridge, 2014).

One of the pillars for the success of formative assessment lies in instructors' competence in applying it correctly. Arja *et al.* (2018) identified ongoing faculty development as a crucial factor for successful implementation. An instructor may master the theory, but if they do not know how to provide specific, actionable, and timely feedback the effectiveness of assessment drops dramatically.

Continuous professional development ensures that instructors are up to date with best practices, know how to use available tools, including technological ones, and above all can adapt their strategies to students' needs. Without such preparation, the potential of formative assessment may not be fully realized. In addition, the act of being assessed, even formatively, can generate discomfort. Addressing this and building a climate of trust is essential. Schlegel and Selfridge (2014), in detailing the DOSFP, noted that at first residents felt uncomfortable being observed during their interactions with patients, which is natural since close observation can create anxiety and the feeling of being judged.

However, the study showed that this discomfort decreased significantly with time and continued practice. Interactions became more authentic and less focused on performance for the sake of observation, and more on genuine learning. This finding reinforces the importance of a climate of trust and psychological safety. When learners, or residents in this case, perceive that observation and feedback are intended for their growth and not for punitive evaluation, resistance diminishes and they become more receptive. Repeated observation and consistent feedback within a trusting relationship transform what could be a stressful situation into a valuable learning opportunity (Schlegel and Selfridge, 2014; Arja *et al.*, 2018).

Thus, this category reminds us that the success of formative assessment depends on continued investment in those who apply it, namely instructors, to ensure the skills required to provide high-quality feedback. It also requires the creation of a psychologically

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safe and trusting environment in which students feel comfortable being observed and receiving constructive criticism, fully aware that the ultimate goal is their development.

4 Final considerations

Based on the studies included in this integrative review, it can be concluded that feedback is a central pillar of formative assessment, essential for driving students' self-assessment and active engagement while enriching the entire learning process.

However, the effective implementation of formative assessment and the provision of appropriate feedback face considerable challenges, especially in resource-limited settings where faculty shortages and time constraints pose significant obstacles.

To mitigate these challenges, it is crucial to invest in faculty development initiatives. Such programs are fundamental to equipping educators with the skills needed to deliver high-quality feedback effectively and in a timely manner. In addition, it is imperative to encourage instructors to design activities that promote students' active and reflective participation in the feedback process, fostering constructive dialogue and self-assessment in order to enhance their evaluative capacity in practice.

With regard to direct observation with feedback, challenges can be overcome through strategies such as targeted training for faculty and residents, the promotion of resident autonomy, and the establishment of ongoing supervisory relationships. These approaches aim to build a climate of trust, transforming feedback into an assessment tool with demonstrated validity and feasibility.

In sum, the introduction of formative assessments has led to a marked improvement in students' academic performance, strengthening learning and encouraging study habits. It is therefore essential that these assessments be fully integrated into traditional systems to achieve superior and enduring educational outcomes.

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