Student feedback and teaching practices: analysis of pedagogical reflection in Mathematics

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Abstract: This article focuses on institutional evaluations conducted by students and their impact on teachers' reflections on Mathematics teaching practices. The study was based on the concepts of reflective teacher and reflective school, through which teaching practice is critically analyzed in the school context. Three Mathematics teachers from a public school in São Paulo (Brazil) participated in the study. Data were generated from student feedback, discussed in formative meetings with the teachers, and analyzed using Discursive Textual Analysis. The analysis was based on four categories. The results indicate that teachers, when reflecting on student feedback, activated processes of reflection on their classroom actions, rethinking strategies, recognizing weaknesses, and developing alternatives more suited to students' needs. Furthermore, the study presents student feedback as a resource for continuing in-service training, the effectiveness of which depends on institutional support and the appreciation of the school community.

Keywords: Mathematics Education. In-Service Education. Student Feedback.

Comentario estudiantil y prácticas docentes: análisis de la reflexión pedagógica en Matemáticas

Resumen: Este artículo se centra en las evaluaciones institucionales realizadas por estudiantes y su impacto en las reflexiones de los profesores sobre las prácticas de enseñanza de las Matemáticas. El estudio se basó en los conceptos de profesor reflexivo y escuela reflexiva, a través de los cuales la práctica docente se analiza críticamente en el contexto escolar. Tres profesores de Matemáticas de una escuela pública de São Paulo (Brasil) participaron en el estudio. Los datos se generaron a partir de la retroalimentación de los estudiantes, se discutieron en reuniones formativas con los profesores y se analizaron mediante Análisis Textual Discursivo. El análisis se basó en cuatro categorías. Los resultados indican que los profesores, al reflexionar sobre la retroalimentación de los estudiantes, activaron procesos de reflexión sobre sus acciones en el aula, repensando estrategias, reconociendo debilidades y desarrollando alternativas más adecuadas a las necesidades de los estudiantes. Además, el estudio presenta la retroalimentación de los estudiantes como un recurso para la formación continua en servicio, cuya eficacia depende del apoyo institucional y la valoración de la comunidad escolar.

Palabras clave: Educación Matemática. Formación en Servicio. Comentario Estudiantil.

Feedback estudantil e práticas docentes: análise da reflexão pedagógica em Matemática

Resumo: O artigo focaliza a avaliação institucional realizada por estudantes e seu impacto na reflexão dos professores sobre as práticas de ensino em Matemática. O estudo fundamentou-se nas concepções de professor reflexivo e escola reflexiva, pelas quais a prática docente é analisada criticamente no contexto escolar. Participaram do estudo três professores de Matemática de uma escola pública estadual de São Paulo. Os dados foram produzidos a partir das devolutivas dos estudantes, discutidos em encontros formativos com os professores e analisados com base na Análise Textual Discursiva. A análise foi produzida a partir de quatro categorias. Os resultados indicam que os professores, ao refletirem sobre o feedback dos estudantes, ativaram processos de reflexão sobre suas ações em aula, repensando estratégias, reconhecendo fragilidades e elaborando alternativas mais adequadas às necessidades dos estudantes. Além disso, o estudo apresenta o feedback discente como um recurso da formação continuada em serviço, cuja efetividade depende do apoio institucional e da valorização da comunidade escolar.

Palavras-chave: Educação Matemática. Formação em Serviço. Feedback de Estudantes.

1 Contextualization

The study presented in this article is the result of postdoctoral research conducted within the scope of the Research Group on Curriculum in Mathematics Education (GPCEEM), affiliated with the Postgraduate Program in Education at the State University of Montes Claros (Unimontes). The research's central objective was to problematize the extent to which institutional evaluations conducted by students — which address aspects related to classes, teaching strategies, student participation, approaches to content, the school environment, among others — impact teachers' continuing in-service education, especially when these professionals have access to feedback and discuss it critically and collaboratively. The study focused specifically on Mathematics teachers.

This concern with the impact of student listening on teaching practice is consistent with studies that focus on student-centered pedagogical approaches, such as mathematical modeling and problem-solving, which foster students' construction of meaning and encourage teachers to reflect on their practice based on students' knowledge and experiences (Belo & Burak, 2020; Costa, 2023; Silva & Côco, 2018). According to Silva et al. (2014), teacher self-reflection strengthens continuous professional development, allowing teachers to adapt their pedagogical practices to the specific demands of the class and classroom dynamics, promoting a more inclusive and effective education. The first author's management experience contributed to the understanding that the school is, par excellence, the space where teachers continue to learn to be teachers, in line with Zeichner's (1993) perspective, for whom the true process of learning to teach is consolidated throughout professional practice, in a continuous, reflective, and contextualized manner.

In this context, it is important that teachers have access to systematic moments of study and reflection, both individual and collective. We emphasize, above all, the value of the collective dimension of these moments, as we understand that teacher learning is strengthened through peer exchanges, through the sharing of experiences, knowledge, and challenges. Placco & Souza (2008) corroborate this view by emphasizing that any formative process and any educational practice only advance significantly when founded on collaborative work. This concept is reinforced by Rocha et al. (2021), who emphasize the role of collaborative practices in the continuing education of Mathematics teachers; is also reinforced in Costa (2023), where it is shown how training processes mediated by collaborative methodologies, such as problem-solving, favor the reconstruction of teaching methodological conceptions based on the reflective analysis of practice and interaction with peers, promoting situated, contextualized

and effective training.

Furthermore, it is essential to recognize the role of critical reflection on one's own practice as a constitutive element of in-service teacher education. In this sense, it is important that school management, through the work of pedagogical coordinators and principals, foster spaces and times that allow teachers to reflect on their actions, pedagogical choices, and results, contributing to the continuous improvement of teaching. As Souza, Isaia, and Scremin (2020) point out, reflection-on-action, combined with collective dialogue and the use of evidence from practice, is an essential formative process for the development of teacher autonomy and didactic competence. One of the tools that can enhance this process are institutional evaluations carried out by students, whose analysis, when appropriate and contextualized, can significantly contribute to the improvement of pedagogical practice and the professional development of teachers (Rocha et al., 2021; Silva et al., 2014).

In the institutional evaluation — a central point in teacher feedback in our study — students respond to a series of questions covering different dimensions. Initially, questions are presented that promote a kind of self-assessment, in which they reflect on their own commitment in class, their study routine outside of school, their dedication to school activities, among other aspects. Next, the questions seek to highlight students' motivation in relation to the subjects, for example, in math classes. Students are asked to evaluate how classes are conducted; to describe what they consider a *good class*; and to suggest actions that teachers could take to encourage class engagement. Finally, there are questions related to the relationship between family and school, investigating whether students feel supported and whether the school provides opportunities for their concerns to be heard. The evaluation concludes with a score assigned to the school, ranging from 0 to 10.

The study focused on responses related to Mathematics classes, with particular attention to how teachers interpreted and reflected on the feedback they received. The specific objective of the study was to analyze the extent to which institutional evaluations completed by students can contribute to the continuing education of in-service teachers when the data are discussed critically and collaboratively. The study is qualitative in nature and based on the analysis of teachers' statements during feedback sessions.

2 The meaning of reflective teacher

The concept of a reflective teacher is based on the human capacity to think critically and analyze one's own professional practice, recognizing the teacher as a creative agent, not a repeater of external ideas and procedures. Alarcão (2011) emphasizes that this perspective attributes to the teacher the role of a professional who, faced with often uncertain and unpredictable situations, acts intelligently, flexibly, and contextually, adapting to the demands of the moment.

The reflective teacher is expected to be able to observe and analyze the environment in which they work, adjusting their actions to promote meaningful and contextualized learning for their students. This concept presupposes a continuous process of learning from practice, which allows for improvement in the face of everyday teaching challenges.

In the school environment, it is essential that teachers not limit themselves to developing lesson plans, but rather that they make this a constant and structured practice. Planning goes beyond bureaucracy, becoming a reflective exercise on the various aspects of teaching and learning. When planning, teachers must consider the concepts involved in the content, the objectives to be achieved, the class organization, and the possible interactions in the classroom.

Careful planning allows teachers to establish clear guidelines for lesson development and adopt strategies that best meet students' needs. Considering educational demands, teachers can opt for progressive approaches, creating opportunities for students to take on argumentative roles while acting as coordinator of the process (Januario, Perovano & Lima, 2024). In this way, teachers act reflectively, anticipating solutions and fostering a participatory and dialogic learning environment.

Costa (2017) investigated the use of mathematical modeling in teaching trigonometric functions and found that planning guided by real-world contexts allows students to establish connections between mathematical content and everyday situations, fostering greater engagement and fostering meaningful learning. Thus, the lesson plan becomes an important tool for the continuous improvement of pedagogical practice, as it organizes and guides teaching, encouraging a critical and adaptive stance that aims to constantly refine teaching strategies.

Schön (1983) reinforces the importance of this reflective stance by highlighting the growing complexity of problems faced in teaching practice, many of which are unprecedented and cannot be solved through theories or techniques learned in initial training. In these situations, teachers cannot simply employ previously learned procedures; they must adapt knowledge and, in certain cases, develop new ones to address challenges that conventional approaches do not address.

While theories are important, they must be complemented by practical and contextual reflections throughout one's professional career. In this sense, our study emphasizes that, although initial training is essential to prepare future teachers for their teaching careers, it does not meet all the demands of educational practice. Ongoing training in the school environment becomes essential. We follow Zeichner (1993) in stating that learning to teach is an ongoing process throughout the teaching career, and that even the best initial training programs only prepare teachers to begin practicing.

We argue that reflective teacher training must be grounded in collective practices, as proposed by Nóvoa (1995) and Silva et al. (2014), for whom training goes beyond the mere acquisition of techniques and knowledge. It is a crucial moment of socialization and professional development, in which knowledge sharing and collective reflection are essential. Imbernón (1998) and Rocha et al. (2021) corroborate this view by considering teacher training to be, by nature, a collective and situated practice. While self-education has its value, priority training activities should occur collectively in the school environment.

Therefore, reflective teacher training must prioritize moments of collective study, focused on analyzing and improving pedagogical practices, always with the central goal of promoting student learning and developing professional teaching knowledge. As Placco & Souza (2008, p. 27) point out,

> any educational process and practice can only progress if approached from the perspective of collective work. This presupposes the integration of all school professionals, the non-fragmentation of their actions and practices, and, fundamentally, a commitment to student development.

It is also important to highlight the role of individual reflections on teaching practice, as it is through them that teachers identify challenges, develop solutions, and contribute to the constant improvement of their performance. Schön (1983) presents three main types of reflection expected of the reflective teacher:

- *Reflection-in-action*: occurs during pedagogical practice, when the teacher realizes that a strategy is not working and makes immediate adjustments.

- *Reflection-on-action*: occurs after the experience, allowing the teacher to analyze what occurred, identify successes and failures, and plan modifications for future situations.

- *Reflection-on-reflection-in-action* (meta-reflection): involves reflecting on one's own reflective process, evaluating how and why certain decisions were made, promoting a critical analysis of one's own actions.

As discussed in Costa & Januario (2025), reflection-in-action can occur during the teaching of a first-degree polynomial equation, when the teacher realizes that some students are struggling with the concept of transposition and, at that moment, decides to use an analogy with the balance of a scale to facilitate understanding. Reflection-on-action, on the other hand, occurs after the lesson, when the teacher realizes that the analogy was not sufficient for the entire class and plans a practical task to revisit and deepen the concept. Meta-reflection occurs when the teacher analyzes the reasons for choosing that approach and evaluates whether other strategies could be more effective, expanding their pedagogical awareness based on the objective set for that lesson. These forms of reflection were also observed in Costa (2023), who focused on in-service teacher education, in which teachers began to review and reorganize their teaching strategies based on listening to students and collaboratively monitoring their lessons.

Reflective practice, according to Schön (1983), is not an isolated act, but a continuous approach to analyzing, evaluating, and transforming teaching. In Mathematics teaching, this approach is essential for addressing the specific challenges of the discipline, adapting to students' needs, valuing pedagogical knowledge built through experience, and constantly improving practice.

In the context of Mathematics Education, the concept of a reflective teacher takes on specific contours, as teaching this area requires not only mastery of conceptual and procedural content but also the ability to mobilize it didactically, critically, and contextually (Lima, Bianchini & Gomes, 2018). It is important for mathematics teachers to interpret students' difficulties, develop varied strategies, relate abstract concepts to everyday situations, and reflect on the effects of their practice on learning.

Being a reflective Mathematics teacher involves revisiting content and critically analyzing how students form concepts. This requires constant observation, reworking teaching strategies, and being open to error as an indicator of non-learning, questioning, and active listening. The teacher understands that presenting content and solving exercises mechanically is not enough; it is necessary to consider students' construction of meaning and the conceptual obstacles they face.

Furthermore, reflection on mathematical practice must consider the language specific to the subject. The use of symbols, expressions, graphic representations, and models requires not only technical mastery from the teacher, but also didactic sensitivity to identify which mediations facilitate or hinder understanding. Reflecting on how to present an equation or interpret a graph involves analyzing the clarity of communication, the resources used, and their impact on students' knowledge construction.

Another important aspect is reflection on pedagogical relationships in Mathematics teaching. Often seen as difficult or uninteresting (Bueno, Alencar & Oviedo, 2017; Oliveira & Lopes, 2023), the subject demands that reflective teachers be sensitive to strategies that make learning more meaningful and engaging, with contextualized problems, the use of digital technologies, investigative activities, and collaborative learning. Teachers are constantly

analyzing their pedagogical practices, seeking to understand why certain approaches work better in certain contexts.

We understand that developing a reflective approach in Mathematics teaching also depends on valuing ongoing education. Schools should be spaces for study, the exchange of experiences, and the collective construction of knowledge. When teachers discuss practices, analyze real-life situations, and explore new methodologies with colleagues, they expand their critical and transformative capacity. Thus, the training of reflective teachers transcends the individual level, strengthening itself in collective educational environments that recognize the complexity of mathematics teaching.

Finally, as highlighted by Schön (1983), a reflective teacher is one capable of thinking and acting critically about their practice, autonomously and consistently. This reflection aims for more intentional teaching that engages students and promotes meaningful learning. However, important questions arise: Is it possible for a teacher, alone, without institutional support or ongoing training, to become reflective? And, furthermore, how can such a teacher be trained? What strategies can foster this approach? These questions guide the following sections, in which we explore ways to build a teaching practice grounded in reflection.

3 Methodological procedures

The study was qualitative in nature, an approach considered most appropriate for the goal of understanding, in depth, the meanings and implications attributed by teachers to the formative process triggered by feedback from institutional assessments completed by students. This choice is based on the understanding that educational phenomena are complex, situated in specific contexts and permeated by subjectivity, requiring a sensitive approach to the multiple dimensions involved, and in no way seeking to establish standards.

According to Goldenberg (2011), qualitative research does not seek to establish universal laws or make statistical generalizations, but rather to build consistent and contextualized understandings of the phenomena studied. It is an investigation focused on interpretation, aiming to capture the meanings people attribute to their experiences, actions, and relationships within the social context in which they are inserted.

This conception converges with the use of the natural environment as a direct source of data, the emphasis on processes rather than results, and the centrality of the meaning constructed by the participants. In this approach, the researcher combines different sources and perspectives to construct a dense, interpretative, and critical narrative of the phenomenon under study.

Thus, the qualitative approach adopted in this study is guided by an interpretative logic, aimed at a comprehensive understanding of the phenomenon. The feedback provided to teachers was designed as spaces for listening, reflection, and formative dialogue, in which meaningful statements emerged. When transcribed and analyzed, they enabled a critical interpretation of the meanings attributed to teaching practice. Data analysis was performed using Discursive Textual Analysis — DTA (Moraes & Galiazzi, 2006), a methodology that allows for immersion in discourses, respecting their social and cultural contexts, and fostering the emergence of categories representative of the complexity of the object under investigation.

The study used the results of institutional assessments from the first two academic months, completed by students in grades 6-9 at a state school in São Paulo. The assessments took place between April 8th and 12th, 2024, and covered various aspects of daily school life, such as teaching, teaching strategies adopted by teachers, student engagement in class, and the school environment as a whole.

Based on these assessments, individual feedback sessions were organized with three Mathematics teachers responsible for the assessed classes. These meetings took place between May 2nd and 16th, 2024, and lasted approximately two hours each. During the feedback sessions, the teachers were invited to discuss the comments and perceptions expressed by the students, which led them to develop hypotheses, critically reflect on their pedagogical practices, discuss student behavior, and other elements highlighted in their statements.

The study thus adopted a qualitative approach focused on analyzing the feedback provided between the trainer (first author) and the participating teachers. These sessions were designed as formative conversations, of a dialogical nature, and were fully recorded, transcribed, and later textualized. The textualizations underwent a process of DTA, which allowed for an in-depth interpretation of the teachers' statements, considering the social, cultural, and historical contexts in which they are embedded.

DTA, as proposed by Moraes & Galiazzi (2006), is a qualitative methodological approach focused on the interpretative understanding of the meanings present in texts produced (utterances) in research contexts. It is a constructive-interpretative process that develops through the articulation between the texts produced by the research participants and the theoretical frameworks that guide the analysis, in a continuous dynamic of approximation and distancing, deconstruction and reconstruction of meanings.

The DTA analytical process is guided by three main methodological movements: unitarization, categorization, and the construction of metatexts. The first step, *unitarization*, consisted of breaking down the raw texts — teachers' utterances — into units of meaning, that is, fragments that, in our view, are relevant to the study. This selection did not follow criteria of quantity or form, but rather was related to the excerpts' ability to provide meaningful elements for the study's objective.

These units of meaning were then grouped by thematic and conceptual similarities, giving rise to the *categorization* stage, which was dynamic, provisional, and revisable. At this stage, we began the process of reorganizing and interpreting the material, based on attentive and sensitive listening to the meanings that emerged from the statements. The categories were not predefined; they were constructed throughout the analysis, continually reformulated as the statements were reread and compared with theoretical frameworks.

Finally, we *constructed metatexts*, which are interpretative texts designed to clarify the meanings constructed in the previous stages. In this phase, we sought to connect the emerging categories with the literature in the field, fostering a dialogue between the three professors' statements and the theoretical framework. The metatexts represent the interpretative synthesis of the analytical process, revealing broader and deeper understandings of the phenomenon under investigation.

4 Data and Analysis

Based on the textualizations of teachers' statements, produced in the formative feedback sessions conducted by the teacher trainer, data analysis was conducted based on the assumptions of Discursive Textual Analysis (DTA), as proposed by Moraes & Galiazzi (2006). Initially, excerpts considered pertinent to the object of study were excerpted, configuring the so-called units of meaning. These units, in turn, were grouped based on their thematic and conceptual approaches, giving rise to emerging categories constructed dynamically, revisable, and iteratively throughout the interpretative process.

The construction of the categories did not follow a pre-established model, but resulted

from a process of immersion in the teachers' statements, considering the meanings they produced in relation to the feedback from the institutional assessments conducted by the students. Attentive listening, sensitive to the singularities of each statement (enunciation), allowed for the reorganization of the empirical material in light of the theoretical frameworks that underpin the study.

This process culminated in the definition of four emerging categories, which summarize central aspects of pedagogical practice and teacher education mobilized through active listening with students: (1) Reflection on pedagogical practices and continuous improvement; (2) Creation of a safe and stimulating learning environment; (3) Challenges and adaptations in mathematics teaching; and (4) Teaching strategies used by teachers.

These categories were discussed through the construction of interpretative metatexts, which connect the teachers' statements with the literature in the field and the theoretical assumptions of reflective teacher education. The following sections present the units of meaning and metatexts related to each category. It is important to emphasize that the units of meaning used in the following subsections were obtained throughout each feedback session with the teachers; they did not emerge from specific questions, but rather from the overall mix of questions and interventions.

4.1 Reflection on pedagogical practices and continuous improvement

This category gathers statements that demonstrate how teachers reflected on their teaching practices based on student evaluations, which express their perceptions of how teachers develop the curriculum, that is, when promoting learning situations. It is directly related to continuing education, as it reinforces the formative nature of active listening and self-reflection.

> *Actually, I hadn't considered group work before this feedback. [...] With this feedback, maybe it's time to try something different. Some students don't feel comfortable asking questions in front of the class. [...] I ask them to come and ask questions individually. My table fills up like a market. The feedback makes me rethink: Maybe my ironic tone was misinterpreted. I need to adjust it to encourage more questions.* [8th and 9th grade teacher]

> *One area for improvement was the approach of threatening the entire class for an individual mistake. [...] I realize it's essential to avoid collective threats. Receiving feedback from students helped me reflect: I'm going to implement productive pairs next semester.* [7th grade teacher]

> *After our conversation, I see the need to think of different approaches to engaging shy students. I'm open to suggestions from colleagues: If something worked for one teacher, it might work for others.* [6th grade teacher]

The teachers' statements indicate a clear willingness to revise their practices based on student evaluations, demonstrating a reflective stance that is sensitive to classroom dynamics. When one teacher mentions that he *"hadn't considered group work before this feedback",* the formative impact of student feedback is evident, triggering a movement of analysis and adaptation of one's own pedagogical practice. This process is consistent with what Schön (1983) calls reflection-on-action, through which teachers revise their teaching choices based on the experience.

Active listening, in this context, functions as a formative tool. An example of this is the statement *"The feedback makes me rethink: Perhaps my ironic tone was misinterpreted"*, which demonstrates sensitivity to the mediation of language in the pedagogical relationship. This

practice resonates with the understanding that "any formative process and any educational practice only advance if approached from the perspective of collective work" (Placco & Souza, 2008, p. 27), since reflection does not occur in isolation but is intensified when shared and mediated in collaborative spaces.

Furthermore, teachers' openness to sharing with colleagues — *"I'm open to suggestions from colleagues: if something worked for one teacher, it can work for others"* — reinforces the importance of collective moments in teacher training, as emphasized by Imbernón (1998) and Rocha et al. (2021), who state that training is essentially collective and contextualized. In this category, the analysis shows that teachers, by accepting student feedback, activate self-evaluation mechanisms that bring them closer to a pedagogical practice that is more conscious, critical, and committed to learning, as well as committed to the relationships and interactions that occur between them, teachers, and students.

Teacher reflection is fundamental for professional development and for improving pedagogical practices, especially when mobilized by student feedback. Silva et al. (2014) emphasize that self-reflection favors teachers' adaptation to the diverse demands of the classroom, enabling more inclusive and effective practices. In this sense, the process of actively listening to students (evaluative feedback) acts as a formative mechanism that triggers critical analysis and a review of teaching strategies, aligning with the concept of reflection-on-action proposed by Schön (1983). Furthermore, collaboration among teachers enhances this reflection, as collective exchange intensifies the construction of knowledge and the overcoming of common challenges (Rocha et al., 2021).

This collective reflective stance becomes an essential strategy for continuing education, in which teachers not only revisit their practices but also actively participate in a shared process of professional learning. Souza, Isaia & Scremin (2020) emphasize that contemporary methodologies strengthen this reflection, valuing dialogue and evidence from daily practice. The teachers' willingness to accept students' assessments and share their experiences reveals a commitment to critical and committed pedagogical practice, contributing to the advancement of a Mathematics Education that is more contextualized and sensitive to the real needs of teaching.

4.2 Creating a safe and stimulating environment for learning

This category focuses on the statements of the three teachers participating in the study regarding their perceptions and reactions to student involvement, motivation and participation in Mathematics classes, as well as their strategies to promote an environment favorable to learning and the formation of concepts incorporated into teaching objectives.

> *I try to win them over as a person first. If they like the teacher, they become more engaged in the subject. I create activities like cupcakes to show that math can be fun. Some started paying more attention after that.* [8th and 9th grade teacher]

> *I make it clear that making mistakes is part of learning. The time to make mistakes is now, while I'm here to help. I encourage them to go to the board to overcome their fear. At first, some cried; now they do so calmly. I allow conversation, as long as it's respectful. I only require silence during roll call and explanations.* [7th grade teacher]

> *I work with respect agreements signed by students and parents. I rearrange seating arrangements to maintain focus and prevent bullying. I contextualize the content based on their prior knowledge. This way, they feel part of the construction of knowledge.* [6th grade teacher]

Teachers demonstrate awareness that the emotional and relational environment of the classroom directly influences student engagement and performance in solving tasks and developing concepts related to Mathematics, a subject often marked by feelings of insecurity and rejection. By stating that *"if they like the teacher, they engage more in the subject"* or *"I make it clear that making mistakes is part of learning"*, they reveal practices aimed at building a space of trust and mutual respect.

These attitudes reflect the principles of the reflective teacher who, according to Alarcão (2011), acts intelligently, flexibly, and in a situated manner, adapting to the context and responding to the demands of the moment. The intentionality of creating a welcoming environment can also be seen in the strategy of promoting gradual exposure of students, as indicated by the statement *"I encourage students to go to the blackboard to overcome their fear. At first, some cried; today they go with ease"*. In this excerpt, the teacher assumes an affective role, aware that learning requires emotional security.

The adoption of strategies such as *"respect agreements signed by students and parents"* and the reorganization of physical spaces reinforce the idea of a teaching practice sensitive to the uniqueness of individuals, in this case, students, as advocated by Lima, Bianchini & Gomes (2018) and Oliveira & Lopes (2023) when discussing the complexity of mathematics teaching. Furthermore, this approach aligns with the concept of school as a space for comprehensive development, where "a commitment to student development" should guide educational actions (Placco & Souza, 2008, p. 27).

Creating a safe environment is more than a disciplinary measure; it is a well-founded pedagogical decision that recognizes the student as an active participant in the learning process and the teacher as an agent of listening, welcoming, and mediation.

Building a safe and emotionally supportive environment is essential for student engagement in Mathematics learning, a subject that often provokes insecurity and anxiety. As discussed in Pereira & Schlünzen Jr. (2020), creating spaces where students feel emotionally safe fosters overcoming fear and active participation in activities. Strategies such as valuing mistakes as part of the learning process and teacher-assisted affective mediation contribute to the development of a relationship of mutual trust, essential for cognitive and socio-emotional progress (Scolari et al., 2024). Furthermore, establishing agreements of respect and reorganizing the classroom's physical spaces strengthen students' perceptions of themselves as active and respected individuals.

Recognizing students' uniqueness and diversity requires teachers to be sensitive to ethically and responsibly managing the relational environment, as highlighted by Scolari et al. (2024). By assuming the role of affective coordinator, teachers create conditions for the gradual overcoming of fear of exposure, promoting meaningful learning and emotional security. This stance goes beyond the disciplinary aspect and constitutes a well-founded pedagogical decision, aligned with a conception of school that prioritizes the integral development of the student and the construction of positive mathematical identities.

4.3 Challenges and adaptations in teaching Mathematics

It concerns the difficulties faced by teachers in planning and conducting classes, especially due to the demands of the official curriculum (prescription) and the specific needs of students.

The state curriculum drastically reduces content. It's like receiving a summary. [...] I need to balance the schedule with depth; I can't always complete the 35 lessons. The accumulated gap

from previous years is demotivating. I want to review, but the curriculum's pace prevents it. [8th and 9th grade teacher]

Unsatisfactory schedules, such as after lunch, affect concentration. In 7th grade, the lack of respect among students requires meetings with parents before implementing any pedagogical strategy. Technology can be distracting: students open parallel tabs. I have to keep a close eye on them to maintain focus. [7th grade teacher]

6th grade students are restless and childish, which disrupts focus. We need differentiated strategies for each class. The 6th grade classroom is very long, making it difficult to hear. I bring students to the front and constantly change seats. [6th grade teacher]

The statements highlight the obstacles teachers face in their daily school life, ranging from curriculum limitations to structural and contextual issues. The statement that summarizes these difficulties states that *"the state curriculum drastically reduces content. It's like receiving a summary"*, revealing a tension between official prescriptions, which operate as impositions, and the reality of the daily classroom environment in which students' learning processes take place. The statement highlights the teacher's representation of the curriculum and the guidelines and prescriptions incorporated within it, understanding it as a limitation on the selection of content that can comprise the list of topics to be studied during the school year. It is the teacher's responsibility to implement a reduced list of content that can reflect choices made by agents external to the contexts in which students' educational demands emerge, namely, the classroom, the school, and its surroundings.

The need for constant adaptation, as when the teacher states, *"I bring students forward and constantly change places"*, is an example of reflection-in-action (Schön, 1983), in which the teacher makes decisions in real time, creatively and adjusted to the demands of the moment. In this sense, pedagogical practice assumes an investigative character, as argued by Alarcão (2011), in which the teacher observes, interprets, and modifies their actions based on evidence of learning, or evidence of its absence.

The challenges faced by Mathematics teachers encompass not only the limitations imposed by the official curriculum, but also structural issues, such as inadequate schedules and physical spaces that are unfavorable for student concentration and participation. Silva & Côco (2018) emphasize the constant tension between curricular prescriptions and the real demands of the classroom, highlighting the need for flexibility and creativity to ensure access and meaningful content. In this context, the adaptations and reorganizations promoted by teachers reflect teaching practices that are sensitive to the context and particularities of the class, essential for addressing the difficulties of the school routine.

Reflective practice, as highlighted by Silva, Serrazina & Campos (2014), emerges as an indispensable resource for teachers to adjust their strategies in real time, making decisions based on continuous observation of students' needs and responses. Costa & Januário (2025) argue that overcoming structural challenges also requires the collective involvement of the school team, reinforcing the importance of training policies that consider the complexity and specificities of mathematics teaching in public schools. Thus, diagnostic capacity and didactic flexibility are central skills for promoting more effective and contextualized teaching.

4.4 Teaching strategies used by teachers

Teaching strategies involve teachers' conceptions, knowledge, and objectives regarding students' learning processes. They involve teachers' relationships with documents that guide curriculum development, planning, assessment, and assignment selection in textbooks, as well

as the organization of time and space. They also involve teachers' monitoring of students in the classroom and interventions to advance the class's knowledge.

In this category, the statements of the teachers participating in the study show similarities regarding the teaching strategies adopted in Mathematics classes, including content approaches, pedagogical support resources, and teaching organization methods.

I use concept maps, Wordwall, and hands-on activities (like cupcakes) for proportionality. [...] But time is short: we only have four weekly classes, plus Matific. [8th and 9th grade teacher]

I integrate math into everyday life: angles with clocks, movie scenes. I use GeoGebra and Khan Academy in group competitions. I do group readings to develop interpretation, a crucial math skill. [7th grade teacher]

Gamification is the engine of motivation! Thursday classes, aligned with the week's content, are the most anticipated. Various methods: slides, productive pairs, group discussions. Healthy competition in the 6th grade boosts engagement. [6th grade teacher]

These statements reveal a diverse and intentional pedagogical repertoire on the part of teachers, who seek to make mathematics teaching more meaningful and connected to students' realities. The statement *"gamification is the engine of motivation"* and the use of *"cupcakes to teach proportionality"* illustrate the attempt to approach the content in a concrete, playful, and accessible way, bringing mathematical knowledge closer to students' daily lives. This practice is in line with the proposal for a critical, contextualized Mathematics Education that is sensitive to students' needs, as advocated by Silva & Côco (2018), Gonçalves & Lima (2023), and Costa (2023), which emphasizes the importance of problem-solving and active methodologies to foster student engagement and the construction of meaning.

Furthermore, the diversity of pedagogical strategies adopted by teachers, such as the use of technology, group readings, and collaborative activities, reinforces the concept of Mathematics teaching as a dynamic and flexible process that values student interaction and empowerment. This approach aligns with the principles of reflective teaching, which recognizes the limits of traditional solutions and develops new strategies based on critical analysis of practice (Gonçalves & Lima, 2023; Costa, 2023). Thus, teaching is configured as a legitimate space for the production of knowledge, grounded in teacher training oriented toward innovation and autonomy.

The use of technologies such as GeoGebra and platforms like Khan Academy and Wordwall, in addition to collective reading, productive pairs, and group discussions, demonstrates an effort to promote diverse interactions that foster both conceptual development and student engagement and engagement in the learning process. This methodological diversity is valued by Zeichner (1993), who states that teachers also have theories that can contribute to a codified base of teaching knowledge, highlighting the importance of considering teaching practice as a legitimate space for knowledge production.

This pursuit of innovation also reflects the stance of the reflective teacher, who, according to Schön (1983), recognizes the limits of previous solutions and develops new strategies based on critical observation of their reality. The connection between content and everyday life, such as the use of clocks to teach angles or films to address mathematical topics, is consistent not only with relevant literature in the field of Mathematics Education, but also with guidelines incorporated into the *Base Nacional Comum Curricular* [National Common Curriculum Base — BNCC] (Brazil, 2017), which emphasizes the importance of making Mathematics relevant to students' lives.

The teaching strategies adopted by Mathematics teachers reflect a diverse and intentional repertoire that seeks to connect the content to students' daily lives, promoting greater meaning and engagement in the learning process. Silva & Côco (2018) emphasize that the incorporation of active methodologies and technological resources, such as gamification and digital platforms, enhances motivation and facilitates the understanding of mathematical concepts. Integrating Mathematics into real-world contexts, through practical examples and familiar situations, contributes to the appropriation of knowledge in a more concrete way, as discussed by Gonçalves & Lima (2023).

Furthermore, adopting multiple methodological approaches demonstrates a reflective approach on the part of teachers, recognizing the needs and unique characteristics of each class and adapting their strategies to maximize learning (Silva & Côco, 2018). This diversity, which includes hands-on activities, group discussions, and digital resources, fosters not only conceptual development but also student interaction, promoting collaborative and critical learning. This practice is consistent with teacher training that values autonomy and innovation, fundamental pillars of contemporary Mathematics Education.

5 Discussion

The teachers' statements, organized into four categories, reveal a clear movement toward establishing a reflective teaching practice that is situated and responsive to the complexities of Mathematics teaching. Empirical evidence shows that teachers are mobilizing knowledge, strategies, and attitudes consistent with the concept of the reflective teacher, as advocated by Schön (1983), Alarcão (2011), and Zeichner (1993). This approach involves a teaching practice that connects theory and action in a continuous and contextualized manner, characterizing the process of ongoing professional learning.

Active listening to students emerges as a central element of professional development. When teachers reflect on their actions based on student feedback — as in the case of a teacher who rethinks the use of irony or decides to abandon collective threats — they activate processes of reflection-on-action, as proposed by Schön (1983). This self-reflection contributes to the reconfiguration of strategies and attitudes, indicating that the teacher is learning from their practice and promoting critical and formative changes. Such a movement is only possible in educational contexts that value the analysis of practice and the collective construction of knowledge, as emphasized by Placco and Souza (2008) and Rocha et al. (2021). The collective dimension emerges in the statements of teachers who recognize the importance of exchanging experiences with colleagues, listening to suggestions, and observing practices that work in other classes, reaffirming the principles of in-service learning situated in the daily school environment (Imbernón, 1998).

At the same time, the strategies adopted by teachers to promote a safe and stimulating environment, such as encouraging mistakes as part of the process and creating playful dynamics, demonstrate that learning is understood as a collective construction. This sensitivity aligns with the perspectives of Pereira and Schlünzen Jr. (2020) and Scolari et al. (2024), who emphasize the importance of the emotional environment in mathematics learning. For teachers, teacher education is, by nature, a collective and situated practice (Imbernón, 1998), and student engagement depends largely on the relationships established in the classroom. Thus, creating a positive environment is an intentional pedagogical choice and an integral part of reflective practice.

The analysis also highlights that teachers face concrete challenges in delivering quality instruction: rigid curriculum, heterogeneous classes, inadequate physical structures, and

problematic use of technology. However, by reporting strategies for reorganizing classrooms, observing behavior, and adjusting lesson delivery, they demonstrate an ability to act intelligently, flexibly, and in a situated manner (Alarcão, 2011), demonstrating practical-reflective thinking that responds to the demands of everyday school life. These experiences reaffirm that initial training is not sufficient to address the complexity of teaching practice, as highlighted by Zeichner (1993). Teaching involves a continuous learning process, with in-service training being an essential component, and the school a fundamental space for this training (Souza & Isaia & Scremin, 2020).

Finally, the teaching methodologies described by the teachers indicate a clear attempt to make Mathematics meaningful, concrete, and relevant to students' realities through diverse content, strategies, and approaches. The choices of gamification, the use of digital technologies, contextualized activities, and collective reading converge toward a break with traditional practices, highlighting a search for more active and integrative approaches (Silva & Côco, 2018; Gonçalves & Lima, 2020; Costa, 2023). Teaching Mathematics thus also promotes a critical reading of the world, which is only possible with teachers who continually reflect on their didactic choices and their impact on learning.

The analysis reveals that the three teachers are in a process of continuous professional development, connecting theory and practice, listening and action, content and context. This movement confirms what Alarcão (2011) proposes when he states that the formation of a reflective teacher goes beyond individual action: collective training is necessary, and to achieve this, schools need to be reflective spaces. Thus, a virtuous cycle is formed in which teachers learn from experience, learn from their peers, and transform their practice to benefit student learning.

6 Considerations

Through this study, we understand that institutional assessments conducted by students can be an important training tool, provided they are critically, reflectively, and collaboratively adopted by teachers. Far from being a bureaucratic instrument, student feedback, when analyzed in depth and contextualized within pedagogical practice, has the potential to mobilize significant transformations in teaching.

The study showed that the participating teachers, upon encountering student feedback, activated processes of reflection on their classroom actions, rethought strategies, recognized weaknesses, and sought alternatives better suited to their students' needs. This movement reveals a compatible stance, which can be termed reflection-on-action and reflection-in-action, demonstrating that teaching knowledge is not technical or theoretical, but continually constructed in and through practice, in dialogue with people and contexts.

The four categories emerging from the analysis — reflection on pedagogical practices and continuous improvement; creation of a safe and stimulating environment for learning; Challenges and adaptations in Mathematics teaching; and teaching strategies used by teachers — reveal a complex set of knowledge mobilized by teachers, ranging from technical competencies to relational and ethical skills. Sensitive listening to students' perceptions, combined with a willingness to self-question and openness to collective work, demonstrate that reflective practice is, in fact, a structuring axis of in-service training and teacher professionalization.

We understand that the development of this reflective stance does not occur spontaneously or in isolation. It depends heavily on institutional conditions that foster dialogue, listening, the sharing of experiences, and the problematization of everyday school life. The

school must establish itself as a formative space, promoting times and spaces for collective study where teachers can critically analyze their practices, build new knowledge, and strengthen their professional identity. This is where continuing education takes center stage: not as a one-off event, but as an ongoing, situated process committed to improving the quality of education. Furthermore, the study reinforces that Math teacher training requires special attention, given the history of difficulties and rejection associated with the discipline. The statements show that teachers have sought more creative, contextualized, and dialogic methodologies in an attempt to make teaching more meaningful for students. These actions indicate a broader understanding of the teacher's role, which is not limited to content delivery but also involves mediation, listening, adaptation, and sensitivity to students' needs.

Another important aspect is the need for public policies and training proposals that recognize the real challenges faced by teachers in the classroom, such as academic underachievement, curriculum limitations, structural problems, and the impact of the socio-emotional context on learning. Teacher reflection is only sustainable when supported by an institutional culture that values teachers as knowledgeable individuals, capable of learning from experience and contributing to the collective construction of pedagogical knowledge. By highlighting that the three participating teachers are engaged in training processes anchored in listening to students, critical analysis of practice, and peer collaboration, the study reaffirms the importance of strengthening schools as spaces for research, reflection, and ongoing development. Becoming a reflective teacher is not a destination, but a continuous training journey that requires support, time, recognition, and, above all, a commitment to student learning.

Conflicts of Interest

The authors declare no conflicts of interest that could influence the results of the research presented in the article.

Data Availability Statement

The data produced and analyzed in the article will be made available upon request to the authors.

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