

Exploratory Teaching in Basic Education: learning and challenges experienced by Mathematics teachers

O Ensino Exploratório na Educação Básica: aprendizados e desafios vivenciados na formação continuada por professores de Matemática

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RESUMO

Este artigo apresenta uma investigação que tem como foco o Ensino Exploratório (EE) no contexto de um mestrado profissional em Matemática. O objetivo é compreender a apropriação da abordagem do EE por dois professores de Matemática da educação básica pública do Distrito Federal, em formação continuada, que integrou um processo formativo no contexto de uma disciplina de orientação. O estudo enquadra-se na perspectiva qualitativo-interpretativa, sendo os dados constituídos de falas, tarefas matemáticas, planejamento e desenvolvimento de aulas. Apresentam-se, neste estudo, as ações das formadoras/orientadoras, bem como os materiais adotados ao longo do processo formativo. Os resultados evidenciam que o EE é uma prática complexa, que exige muito do professor que a desenvolve, mas, ao mesmo tempo, é transformadora. Por fim, defende-se que processos formativos dessa natureza se mantenham ativos e em constante avaliação para que sejam aprimorados e alcancem, cada vez mais, os resultados almejados.

PALAVRAS-CHAVE: Formação Continuada. Ensino Exploratório. Educação Básica Pública.

ABSTRACT

This article presents research focusing on Exploratory Teaching (ET) in the context of a professional Master's degree in Mathematics. The objective is to understand the appropriation of the ET approach by two mathematics teachers from the Federal District's public basic education, system in continuing education, which integrated a formative process in the context of a supervising course. The study is framed within a qualitative-interpretative perspective, with data consisting of statements, mathematical tasks, lesson planning and development. This study presents the actions of the teacher educators as well as the materials adopted throughout the formative process. The results show that ET is a complex

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practice that demands a lot from the teacher who develops it, but at the same time is transformative. Finally, it is argued that formative processes of this nature should remain active and under constant evaluation so that they can be improved and increasingly achieve the desired outcomes.

KEYWORDS: Continuing Education. Exploratory Teaching. Public Basic Education.

Introduction

Current research in education has been driven by an increased awareness of the importance of teachers improving and/or developing distinctive teaching and learning practices that consider the interests and needs of students. This involves not only questioning classical approaches to teaching as a hegemonic practice, but also presenting proposals that are viable to develop, attract students to mathematical practice, and contribute to their learning (Cyrino & Estevam, 2023; Ponte, 2014; Schoenfeld, 2022).

In this sense, it is appropriate to create opportunities for students to actively engage in mathematical tasks (MT) of a high cognitive level (Stein and Smith, 2009). That is, tasks that mobilize more than memorization, repetition of procedures, or application of formulas, but above all, reflection and exploration of ideas and concepts. This means promoting active, collaborative, dialogic, and investigative learning, aiming at a deeper and more lasting comprehension of mathematics (Dörr; Lutz-Westphal, 2020).

The Brazil's National Common Core Curriculum (BNCC) highlights the importance of developing, in Basic Education students, skills to produce mathematically based arguments, use various problem-solving strategies, and promote interaction among peers (Brazil, 2018). These guidelines highlight the intrinsic need for constant updating in the practice of mathematics teachers. Such professional improvement covers the different areas of knowledge essential to teaching, in order to promote effective learning among students (Ball; Thames; Phelps, 2008; Ponte, 2014).

In this context, the Exploratory Teaching (ET) emerges as a didactic approach, through the proposal of MT that arouses curiosity and encourages exploration, communication among students, and investigation of the applications and the relationship of mathematics with other areas of knowledge. MT must be carefully selected, adapted, or created by teachers, always considering the learning needs of students (Ponte 2005; 2014). In other words, as Canavarro (2011, p. 11) highlights, regarding MT in the context of ET, student learning is directly linked to engagement in “valuable tasks that discuss the need for or advantage of systematized mathematical ideas in collective discussion.” The proper development of these MT requires detailed

planning that considers, among other topics, the anticipation of potential student questions and the teacher's actions in response to them, in addition to delimiting the time dedicated to each phase of their development.

In this teaching approach, the teacher assumes a dynamic and essential role in fostering the students' investigative process based on MT. The purpose is to build an environment in which they feel safe to express their doubts, explore ideas, dare to make decisions, and formulate conjectures (Polman and Scornavacco, 2022). Furthermore, supervision and intervention during the MT require the teacher to observe and understand the students' difficulties without providing direct answers. This allows the teacher to take notes, ask questions, and make other needed interventions to support learning (Canavarro, 2011; Oliveira, Araman, and Trevisan, 2022).

Inserted in a broader context of ongoing research that contemplates the continuing education of mathematics teachers, with ET as its object and a focus on exploratory and investigative MT, this article analyzes aspects of the trajectory of ET appropriation by two teachers enrolled in the Professional Master's Programme in Mathematics in National Network (PROFMAT) at a public institution in Brazil's Midwest region, throughout a formative process organized by the docents/supervisors within the scope of the supervising course, with a view to conducting empirical research and writing a dissertation. To this end, they conducted studies and experienced teaching practice situations, relying on readings on ET and MT (Canavarro, 2011; Ponte, 2014).

They were instructed to access up-to-date and specialized literature as a way to promote the comprehension of teaching approaches, among which ET and Traditional Teaching stand out, improving their abilities to plan, develop, and evaluate mathematics classes in a conscious and critical manner (Gonçalves, Ribeiro, & Aguiar, 2022). In parallel with theoretical studies, and seeking to put new knowledge into practice, participating teachers studied specific topics in the geometry curriculum, accessed curriculum documents, and then adapted and developed MT in high school classes from an ET perspective.

In this scenario, this article seeks to understand the appropriation of the ET approach by two mathematics teachers from the Federal District's public basic education system, who are enduring continuing education. To this end, fundamental elements of the approach are brought together, specifically in teaching and learning situations. Next, the actions of the teacher educators, the materials adopted throughout the formative process, and the moments in the teachers' trajectories that demonstrate the learning construction are highlighted, while challenges faced and the strategies

used to overcome them are also revealed. Finally, it is argued that the formative processes of this nature should remain active and under constant evaluation in order to be improved and increasingly achieve the desired results. Regarding teacher education, the practice aimed to provide professional learning opportunities through the incorporation of an alternative teaching approach to expository teaching, which was not part of the teachers' teaching repertoire (Ferreira, Ponte & Ribeiro, 2023).

Theoretical framework

The continuing education of mathematics teachers has been widely researched, covering various contexts of teaching practice. Some studies have focused on restructuring the way teachers participate in research, actively integrating them into these processes. In this scenario, there has been an expansion of groups or communities of practice and research with the purpose of building collaborative spaces that promote understanding and improvement of teaching practices, from basic education to higher education (Fiorentini, 2001; 2013). This collaboration is understood as a formal grouping of teacher educators and teachers, both of whom are researchers, who share the common goal of improving mathematics teaching and collaboratively seeking learning with a focus on professional dialogue in order to design MT (Boavida & Ponte, 2002; Borko & Potari, 2019).

In this context, when education occurs collaboratively and is based on school practice, it takes on a new dimension, capable of amplifying the results of the teaching practice. By encouraging critical discussions and the collective construction of knowledge, this type of training allows teachers and researchers to become active agents of their own professional development (Costa & Januário, 2025). It should be noted that “collaboration transports teachers' professional development to a scenario in which they can learn from each other, share experiences, fears, and thoughts; however, this must be spontaneous” (Perin, 2009, p. 45).

We understand, as does Wenger (1998), that learning is negotiating meanings, which occurs through two processes: participation and reification. Thus, “while in participation we recognize ourselves in each other, in reification we project ourselves into the world, and not having to recognize ourselves in these projections, we attribute an independent existence to our meanings” (Wenger, 1998, p. 58). In other words, engagement modes can be understood as participations, which are the learning processes that occur in communities of practice. The result of our actions, our attitudes, and the processes we establish (participations) are reifications, which imply learning that takes place in these communities (Honorato, 2024; Honorato; Fiorentini, 2025).

In this collaborative perspective, experiences with mathematics teacher education practices, based on exploratory or investigative MT, in the ET approach, have been developed at different educational levels. Research has expanded its themes and scope in both initial and continuing education contexts (Costa & Januário, 2025; Ferreira, Ponte & Ribeiro, 2023; Homa, Groenwald & Llinares, 2023; Winsløw & Huo, 2023).

The engagement of students with the proposal of a MT depends on the didactic approach adopted and the quality of the organization of the teaching work. For that reason, research has shown that training activities focused on ET favor the transformation of pedagogical practices by enabling reflection on one's own teaching performance, which can result in total or partial changes in this performance (Ponte, 2014; Schoenfeld, 2022; Dörr; Pina Neves & Ribeiro, 2023).

Regarding the distinction between mathematical activity and task made by Ponte (2014), it is essential to understand that the former has been associated with an active character in the moments a student engages in work in a given context proposed by a task. In other words, a task has a broader character, since it can give rise to various types of activities. Furthermore, tasks have an organizing character for the actions intrinsic to the activities that enable the understanding of the student's thinking. Also, according to Ponte (2014), when working with tasks, student learning is linked to two factors: the type of task and the teaching situation organized by the teacher. Therefore, teachers are expected to adopt exploratory or investigative MT, described as open mathematical proposals, in order to provide opportunities for exploration, in which students are encouraged to use their own methods and arguments to solve problems. Consequently, they will be able to activate their creative potential for self-confidence and autonomy (Ponte, 2005; Ponte, Quaresma, Mata-Pereira & Baptista, 2015).

Considering this scenario, ET has been presented as a viable alternative to traditional mathematics teaching, which is still very teacher centered. To illustrate this idea, we have observed that teaching practices based on ET deal, for example, with specific mathematical content integrated into different practical situations, broadening the learning of mathematical objects and the comprehension of mathematics itself as a human production intended to respond to sociocultural demands. The works of Cerqueira (2023), Figueiredo (2023), and Freitas (2024) describe important experiences in Basic Education from this perspective. The first had combinatorial

analysis as its mathematical object; the second, the affine function and the notion of volume; and the last, Financial Education.

ET has a unique structure involving three main phases: presentation of the task; exploration of the task by students; and a collective discussion with a systematization of the main mathematical ideas (Canavarro, 2011; Stein, Engle, Smith & Hughes, 2008). The initial moment of the presentation of the task involves reading and interpreting it with the students to ensure that the context and objectives of the proposed task are clearly understood. This part is decisive for the success of the subsequent actions, since, usually, in this approach, the tasks require more effort and care in interpretation, as emphasized by Canavarro, Oliveira, and Menezes (2014). In the next stage, the teacher needs to monitor the independent work of the students, who are usually divided into small groups. At this stage, it is expected that some solutions will be selected for sharing with the whole class. This moment will define the conduction of the discussions that compose the third and final phase.

The final part of the systematization of knowledge takes place in what has been called "a collective discussion" conducted through the "orchestration" of conversations about the essential elements of the task (Stein et al., 2008), in order to consolidate the learning proposed in the objectives. At this stage of the approach, success depends on the opportunities for discussion offered and the participation of students. Thus, this moment at the end of the class needs to be marked by communicative and oral interaction between students and the teacher (Canavarro, 2011; Stein et al., 2008). In this context, we agree with Guerreiro, Tomás, Menezes, and Martinho (2015) that success in students' mathematical learning is directly associated with classroom practices marked by communicative moments, since they impact the relationship between teacher and students and, consequently, the way students construct their knowledge.

Characterization of the study

Given that this research aims to understand the appropriation of the ET approach by two mathematics teachers in the Federal District's public basic education system and to highlight the importance of continuing professional development specifically designed to introduce and develop this approach, which constitutes a pedagogical alternative to traditional classes, we will now move on to its methodological characterization.

The study is qualitative-interpretative in nature (Crotty, 2003), developed throughout a formative process that brought together various registers from the

participants, including: speeches, descriptive/reflective texts, mathematical tasks, lesson planning, and analyses of lesson development. The organization and analysis of the data were conducted by coding the work generated in interaction with the field notes and reflective writings of the teacher educators at different moments of the study, configuring an interpretative analysis of the available material (Gil, 1999).

The formative process was conducted within the scope of the Professional Master's Degree in Network Mathematics (PROFMAT) at a public university in the Brazilian Midwest between August 2024 and June 2025, in the supervising course, planned and developed collaboratively by the teacher educators (authors of this text) over 18 meetings, each lasting two hours, covering the conception to the development of empirical research, the writing and defense of the dissertation, with collective and individual moments of supervision. Two permanent teachers from the Federal District State Department of Education (SEEDF) participated in this process, deciding for themselves the research topics and for the supervisors: a 39-year-old woman with 15 years of experience as a mathematics teacher and a 42-year-old man with 8 years of experience as a mathematics teacher. Both chose to conduct empirical research in elementary school classrooms, developing a geometry research lesson for high school students in classes of peers, since they were on leave from teaching to pursue their master's degrees. In this text, for organizational purposes, the female teacher will be referred to as PA, and the male teacher as PR. It should be noted that these teachers had no previous contact with this subject and the proposed practices.

The actions of the teacher educators in designing, developing, and evaluating the formative process in question are a continuation of an initial formative process, held between August 2022 and March 2024, which inaugurated the theoretical and practical study of ET as a teaching approach and the practice of shared and collaborative teaching in the organization of the pedagogical work of teacher educators in the aforementioned program, using the elective course Topics in Mathematics and the supervising course as a space. All of this has enabled mathematics teachers who are part of the formative processes to understand this teaching approach and, at the same time, to see it as an opportunity for professional development (Dörr, Pina Neves; Ribeiro, 2023; Pina Neves; Dörr, 2024).

Therefore, in the second edition of the supervision course and based on the results achieved, the teacher educators strengthened shared and collaborative teaching, acting to choose, organize, and mediate the process of study and initiation into PA and PR research through scientific articles, live streams, observation/critical

analysis of classes, participation in scientific events, and in-person and virtual meetings. The following table summarizes the objectives and nature of the materials adopted.

Table 1: Objectives and materials adopted in the supervising course

Objectives	Characteristics and functions of the materials
1) To promote initiation into teaching research.	Texts that characterize research in Mathematics Education and its different types and present an overview of experiences, especially those developed in classroom contexts by Basic Education teachers.
2) To understand the structure of a scientific article in the field of education.	Texts that illustrate the organization of the processes of construction, analysis, and socialization of knowledge in the field of education and present data constructed in research situations with students and teachers in basic education.
3) To expand knowledge about the Exploratory Teaching approach.	Texts and live streams discussing the Exploratory Teaching approach, highlighting the demands and challenges related to its phases, and sharing real experiences, successes, and difficulties encountered by Brazilian and Portuguese teachers in approaching and initiating the adoption of the Exploratory Teaching in their mathematics classes.
4) To comprehend the Exploratory Teaching approach in classroom practice.	Acompanhamento do planejamento, desenvolvimento e análise crítica de aulas de matemática na Educação Básica, realizadas por professores egressos do processo formativo; simulação de aulas na perspectiva do Ensino Exploratório em situação de laboratório; Planejamento, desenvolvimento e análise crítica de aulas na educação básica na perspectiva do EE.

Source: Course data

Throughout the 18 meetings, the teacher educators met with PA and PR, alternating between in-person and virtual sessions, attended by the four of them and teachers who had completed the formative process. At these meetings, each teacher's research topics were discussed in order to clarify doubts about the mathematical content and the lesson plan under development (from the choice/adaptation/production of the mathematical task to the lesson planning, anticipating students' conceptual doubts and possible teacher mediations).

To broaden PA and PR's comprehension of the teaching approach under study, they observed classes taught by graduates of the teacher education program, following the entire process — from studying the content to choosing the MT, planning, developing, and critically analyzing the class. They conducted class simulations for the purpose of improving the planning of the research classes. These moments were decisive to better define the time for each stage and structure the teacher's actions in

terms of: anticipating students' questions based on their knowledge of various solution strategies; sequencing strategies from the simplest to the most complex in terms of mathematical concepts/procedures; orchestrating discussions; simulating possible paths for when collective discussion occurs; systematizing concepts; and simulating possible mediations and organization of the knowledge produced throughout the previous stages, including the organization of notes on the board.

Experiencing all these actions created opportunities for PA and PR to learn, in detail, about the ET teaching approach, access teaching research, read reports of experiences that adopted this teaching in classroom contexts, and experience an introduction to teaching research, integrating a group that included professional colleagues and supervisors. In addition, they were able to experience, collectively and collaboratively, the process of research, data analysis, and dissertation writing. In this text, we focus on their comprehension of the lessons learned and challenges experienced throughout the construction, development, and evaluation of MT in Basic Education from the perspective of ET.

At the end of the formative process, participants were asked to report their major learnings. To this end, they answered a structured questionnaire. In this article, we present and analyze some of the responses from two teachers who gave their formal authorization for the publication of their statements.

Learning Exploratory Teaching in Master's degree Research Practice: Elements of the Trajectory of Two Mathematics Teachers in the Federal District

Throughout the formative process, PA and PR had the opportunity to learn the differences between the concepts of mathematical tasks and activities, with the support of study materials, discussions, and practical activities. Similarly, they learned about exploratory and/or investigative tasks, and discussed how much they encourage teachers to recognize and consider students' thoughts and/or discoveries in the classroom. As a result, they became more familiar with ET and reflected on the practices they developed in their classrooms.

I always looked for classes that were more interesting, with varied approaches, and I was committed to ensuring that students learned. I created some characters and developed beautiful, animated PowerPoint presentations for my classes. I created board games and used online gaming platforms. I used to enjoy teaching classes like this fairly often, but most of the time they were based on a formal presentation of the content beforehand. I did group work, even if it was just solving a list of exercises, and I already had better results with this format. I really liked feeling the students involved in my classes. PA

Completely dependent on the textbook, the focus was on the exercises presented within it... It was geared toward problem solving, but easy problems that fit into exercises. (PR, questionnaire record collected on 07/15/2025)

Looking at their own practice prompted them to identify actions that brought them closer to EE, such as the concern for student learning, the willingness to group work, the diversification of teaching tools and resources, and many others. In contrast, they observed some shortcomings, such as the formal presentation of content, which kept the class very teacher-centered; the extensive use of exercises and problems as a type of mathematical task in class; the uncritical adoption of the textbook, among others.

The theoretical study, combined with classroom experiences, led to comparative analyses between the practices they already conducted, those they observed their colleagues conducting, and those they aspired to conduct at the time of the research class. The fact that their colleagues opened their classroom to them, exposing their practice, their successes, and mistakes in relation to ET, strengthened their sense of community, mutual respect, and appreciation for the presence and company of their colleagues throughout the work. These moments helped them understand that they were immersed in a collaborative study and research dynamic and that everyone was at different stages of learning but learning every day. All of this gave them the courage to try, but it did not spare them from the difficulties common to all who dare to learn something new.

Choosing the MT and how to adapt it was one of the biggest challenges for me. As the approach depends on student involvement and their interaction with the task, I felt it carried a lot of responsibility. Another challenge was coming up with more than one solution strategy, because when we prepare a proposal, we usually already have a solution in mind, and it is very difficult to look beyond that. In addition, after the MT was properly prepared and the possible strategies were listed, thinking about its development by the students was like putting myself in their shoes, wondering what interactions would occur during practice and how I could mediate in order to value their reasoning, or in order to reflect that perhaps this hypothesis would not be valid in this situation, and they could adopt another approach. (PA, questionnaire record collected on 07/15/2025)

The way the formative process was developed encouraged the welcoming of newcomers and the clarification of doubts, either by former colleagues or by mentors. In most cases, this process happened in groups, either in person or virtually, based on work in progress or on a class observed by them and by the MT who integrated it.

I shared the strategies raised in the MT resolution with my supervisor and other colleagues. I asked if they could think of other ways of

approaching the task that I hadn't thought of. For each strategy or difficulty raised, I prepared a way to mediate without giving direct answers. (PA, questionnaire record collected on 07/15/2025)

There were many moments that preceded the development of the PA and PR research lesson. They had the opportunity to present the MT, improve it collectively, simulate it, and structure the lesson plan, using the four phases of ET as a reference, namely: the introduction; the development; collective discussion; and systematization of learning. Each phase has its own demands that need to be learned by teachers.

Knowing what questions to ask students when they request support. And how to ask them. Providing reassurance during intentional mediation. Not giving direct answers. Performing many simultaneous processes: mediating discussions within groups, observing the ideas that arise, the hypotheses, the interactions with colleagues, listening attentively, taking notes, selecting the writing registers according to the intended learning objectives, managing time. An additional factor was the active presence of the teacher in charge. (PA, questionnaire record collected on 07/15/2025)

Similarly, they require students to adopt attitudes and behaviors that differ from those they usually display, including willingness to interact with classmates, sharing ideas and mathematical work, ability to present this work to the class, defending it mathematically when challenged by other classmates or the teacher, curiosity, and respect for classmates' work.

I believe it was one of the most complicated phases for me. In the video released by GIEM by Professor Ana Paula Canavarro, she draws a parallel between this phase and conducting an orchestra. Even after observing, in the position of a conductor, it is difficult. Students, unaccustomed to this, question teachers, wanting to validate each step. Some students were not used to such a degree of freedom. Selecting tasks while dealing with students' questions was challenging. (PR, questionnaire record collected on 07/15/2025)

Make students understand that the focus was not on judging answers as correct or incorrect. Another point was to have them explain the reasons for their choices, how they arrived at them, and how they worked or did not work for what was being asked. Learning to argue and listen in order to contribute to the ideas presented. Dealing with everyone wanting to show their answer. (PA, questionnaire record collected on 07/15/2025)

Since I am not the teacher in charge and this methodology is unfamiliar to the students, it is difficult to get them to come to the board, as they feel they are going to write the right or wrong answer. They are embarrassed to write something stupid (sic). The tasks have degrees of freedom, but even so, they look for a "correct" way to solve them. (PR, questionnaire record collected on 07/15/2025)

Regarding phase 4, systematizing learning was considered a very challenging task by teachers, especially because it requires a high capacity for synthesis and transition between more informal mathematical language—used by students when

working in groups and speaking in collective discussions—and formal mathematical language, which is, of course, appropriate for the level of education in question.

It is difficult to make the most of student collaboration so that the content worked on is formally presented in a way that is meaningful to students. (PA, questionnaire record collected on 07/15/2025)

The productions, although similar, were designed within the group. The systematization was to remind them that they could obtain the height measurement indirectly: Pythagorean theorem and trigonometric ratios. (PR, questionnaire record collected on 07/15/2025)

However, theoretical study situations, combined with practical experiences in classmates' classrooms, significantly helped teachers, and prepared them for the moment of systematizing learning in the research class they developed. As a result, they developed strategies to achieve greater success at that moment and to overcome a risk they had observed in other classes: due to lack of time, systematization can weaken the other phases when conducted in a rushed manner, even when they have been developed satisfactorily.

I asked for explanations during the presentations, so the systematization process had already begun along with the group discussion. I brought the table idea on the board so that the groups that had not been able to generalize the relationship would have the opportunity to do so. I formalized the geometric property we had worked on and asked them to validate it with me using the examples we had worked on. (PA, questionnaire record collected on 07/15/2025)

Writing the task development script on the board helped a lot. Having time slots for the introduction, the development, the systematization, and the conclusion helped the students understand and helped me. (PR, questionnaire record collected on 07/15/2025)

While developing strategies to improve the quality of systematization, they continued to reflect on what they had already achieved and identified possible improvements, showing that the investigative class remained alive as an object of research and analysis toward the appropriation of the teaching approach in focus.

Using a strategy that was not planned, but raised by some groups, as an alternative to the generalization of the desired regularity. I would have explored the sum of the internal angles of regular polygons, if there had been time. (PA, questionnaire record collected on 07/15/2025)

In the article on Célia's case, it is not mentioned, but anticipating what might happen in the classroom is something I felt was difficult. As I was not the teacher in charge, my anticipations were content-related and interpretative, but I believe that as the teacher in charge of the class, there could have been more to anticipate. (PR, questionnaire record collected on 07/15/2025)

When asked to reflect on their practices upon returning to the classroom after defending their dissertations, they were emphatic in stating:

Absolutely. I even saved tasks that I came across while reading to be used in class. These are opportunities for students to regain their belief that they can learn mathematics. I noticed that many students were excited about the small discoveries made during group work, and by following the dialogues exchanged, it is possible to see that these students are usually excluded in a class with a different format. (PA, questionnaire record collected on 07/15/2025)

I definitely intend to. The experience I had was excellent. The students' engagement, the developments that could be taken advantage of if I were the teacher in charge, and the change in the students' attitude during the development of the tasks lead me to believe that this approach greatly benefits the students. Especially in the teaching of geometry, as we can use different teaching resources. (PR, questionnaire record collected on 07/15/2025)

When it comes to having new colleagues starting the same formative process they went through, whether in the context of master's degree supervision or even approaching the group of graduates, they suggest, as strategies for those interested in learning about, observing the practice, and adopting EE, that they should be

Patient. Read extensively about the theory and reports from other teachers who are using this teaching approach. If possible, participate in classes using this format as an observer teacher, as this enhances your comprehension of the approach. Share the tasks you are preparing with other colleagues, as there is always room for improvement. From my point of view, a class from the perspective of Exploratory Teaching reaches most, if not all, students. (PA, questionnaire record collected on 07/15/2025)

Open-minded to new experiences. Don't be afraid to share your thoughts and concerns with others. Never stop studying. Develop a collaborative spirit. (PR, questionnaire record collected on 07/15/2025)

The teachers' initial contact with the ET approach proved to be consistent with their aspirations to expand pedagogical practices beyond traditional expository methodologies, as evidenced by their statements. Nevertheless, the group's previous research and experiences show that assimilating and mastering this approach requires a considerable investment of time in study and classroom experimentation.

Discussion and final considerations

Although for different reasons, the success of teachers in using MT, according to the ET approach, was a consequence of their willingness to learn about other trends in teaching practice (Canavarro, 2011), encouraged/supported by the formative process. One of them, PR, was able to add new elements to problem-solving practice. PA found in this approach the possibility of improving his attempts to engage his students in the tasks he created.

For both of them, the development of MT in the regular classroom required careful planning, which provided opportunities for various learnings related to the

organization of pedagogical work, time management, and the choice of teaching resources. In particular, one of the planning requirements was the description of anticipations and possible interventions, according to the characterization of task planning, as per the approach of Stein et al. (2008). Therefore, the data confirm that ET is a complex practice that demands a lot from the teacher who conducts it, while at the same time demonstrating its viability in real teaching situations, given its ability to transform students' relationships with mathematics and those of teachers and students in the classroom, by enabling a new dynamic of communication, production, socialization, and systematization of the knowledge produced (Dörr, Pina Neves & Ribeiro, 2023; Oliveira, Menezes & Canavarro, 2012; Fiorentini, 2001).

The challenges experienced by PA and PR corroborate many of those already described in the specialized literature, among which the following stand out: the choice/adaptation/elaboration of the MT; the anticipation of students' difficulties and possible teacher interventions; time management; the selection of solutions from groups/pairs that are representative of the class's mathematical production; collective discussions in a way that values production and, at the same time, raises mathematically desired levels in terms of formalization and use of appropriate language, among others (Martins, Mata-Pereira & Ponte, 2021; Pina Neves & Dörr, 2024).

As teachers advanced in their theoretical understanding of the approach—based on study, contact with reports, and analyses of mathematics classes taught by colleagues—they needed opportunities for practice so that the phases could be better understood and the challenges experienced and discussed. Therefore, it is envisaged that with each new lesson planned, taught, and analyzed, teachers will expand their repertoire of knowledge about this practice and, as a result, will be able to plan more cohesively, both in choosing the MT and in anticipating questions, responding to students' questions, conducting collective discussions, and systematizing content. In this way, their understanding of teaching practice, based on this approach, will be consolidated, helping not only them but also other teachers who will be able to learn about elements of this practice from a real experience, allocated in a public school context in the Midwest of the country (Canavarro, 2011; Cyrino & Estevam, 2023).

The results thus highlight that there is a demand in continuing education for spaces that offer ongoing support through a group that supports teachers, as well as specific formative spaces that align with more inclusive, collective, and collaborative perspectives. Only then will it be possible for knowledge to be produced, understood,

(re)created, and ultimately developed by the teachers themselves (Cyrino, 2016; Fiorentini et al., 2001; Pina Neves et al., 2015). The practices associated with MT according to the ET approach, despite being complex due to their intrinsic demands and challenges, need to be fostered in formative processes so that they can be evaluated and improved in order to achieve their objectives.

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