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Articles Section

# Mathematics Education Subjects: How do they impact teacher education and practice?

## Disciplinas da Educação Matemática: quais as repercussões para a formação e a prática de professores?

## Disciplinas de la Educación Matemática: ¿qué repercusiones tienen en la formación y la práctica docente?

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## Abstract

The study aims to understand whether, and in what ways, the subjects in mathematics education taken in initial teacher education contribute to their teaching practice. We also intend to identify whether and how mathematics teachers who are graduates of the State University of Montes Claros apply the knowledge they developed in these undergraduate subjects in their teaching practice. Methodologically, we chose qualitative research, through a literature review, class observation and interviews with two mathematics teachers who graduated from this institution. The analyses, based on the bibliographic material studied, the speeches of the interviewed teachers, and class observations indicate that the mathematics education subjects have repercussions mainly in the choice of investigative methodologies, use of games and digital technologies, and the organization of the class with a focus on student protagonism.

**Keywords:** Didactics. Mathematics education. Teaching degree in mathematics. Teacher education.

## Resumo

O estudo tem o objetivo de compreender se, e de que maneira, as disciplinas da Educação Matemática cursadas na formação inicial do professor de Matemática contribuem para sua prática docente. Além disso, buscamos identificar se, e de que maneira, os professores de Matemática, graduados na Universidade Estadual de Montes Claros, levam para a sua prática docente os conhecimentos construídos nessas disciplinas da graduação. Metodologicamente, optamos pela pesquisa de abordagem qualitativa, por meio de revisão de literatura, observação de aulas e entrevistas com dois professores de Matemática egressos dessa instituição. A partir das análises, relacionando o material bibliográfico estudado, as falas dos professores entrevistados e as observações de aulas realizadas, os resultados indicam que as disciplinas de Educação Matemática repercutem principalmente em escolha de metodologias investigativas, uso de jogos e tecnologias digitais e organização da aula com foco no protagonismo discente.

**Palavras-chave:** Didática. Educação Matemática. Licenciatura em Matemática. Formação de Professores.

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## Resumen

El estudio tiene como objetivo comprender si, y de qué manera, las disciplinas de Educación Matemática cursadas en la formación inicial del profesor de Matemáticas contribuyen a su práctica docente. Además, buscamos identificar si, y de qué manera, los profesores de matemáticas graduados en la Universidad Estatal de Montes Claros aplican en su práctica docente los conocimientos adquiridos en estas disciplinas de la licenciatura. Metodológicamente, optamos por una investigación de enfoque cualitativo, mediante la revisión de la literatura, la observación de clases y entrevistas con dos profesores de matemáticas graduados en esta institución. A partir de los análisis, relacionando el material bibliográfico estudiado, las declaraciones de los profesores entrevistados y las observaciones de las clases realizadas, los resultados indican que las disciplinas de Educación Matemática repercuten principalmente en la elección de metodologías investigativas, el uso de juegos y tecnologías digitales y la organización de la clase con un enfoque en el protagonismo del estudiante.

**Palabras clave:** Didáctica. Educación Matemática. Licenciatura en Matemáticas. Formación de Profesores.

## 1. Introductory Words

Before addressing the importance of mathematics education (ME), the first author would like to explain how she became interested in the topic. In the following lines, the narrative shifts to the first person to describe the subjective impressions of her formative trajectory. After graduating from the mathematics teaching degree course, in the trajectory followed to date, many experiences led me to the ME area.

In the scientific field, ME has been consolidated as an area that investigates the teaching and learning processes of mathematics, articulating didactic, methodological, epistemological, and social dimensions of mathematical knowledge. According to Fiorentini e Lorenzato (2012), ME involves not only understanding the content but also analyzing how it is taught, learned, and re-signified across different educational contexts. Muniz (2009) adds that this movement arises from the need to rethink the teachers' role, understood as a mediator in the production of students' mathematical knowledge.

The subjects involving ME have been part of the course since the beginning of undergraduate studies. In them, there is a lot of discussion about how *to teach mathematics*. We learned that it is much more important to question students than to simply give answers and solutions, thereby stimulating each one's instinct for investigation.

However, this remained only in theory until the day I had my first contact with teaching, through the Nucleus of Activities for the Promotion of Citizenship (Núcleo de Atividades para Promoção da Cidadania - NAP) project[1] in 2022, when I was attending the 2nd period of the course. The following year, in 2023, I completed the Supervised Practicum I.

The literature on teacher education has noted a gap between what is studied at the university and the experience lived in school. Thus, Ponte (2002) states that it is not enough to know theories and methodologies; it is necessary to know how to mobilize them in the context of teaching. Similarly, Tardif (2012) shows that teaching knowledge is built on the articulation between academic education, experience, and reflection on practice.

In these contexts, I had the opportunity to live the experience of the application of what we were taught. Through these ME, it was possible to perceive that each student has difficulties in different areas and different skills. These subjectivities show the relevance of understanding learning methods, as different situations call for specific approaches that yield better results in teaching and learning.

From this, the need arises to apply in practice what is discussed in theory, as well as knowledge of learning theories and other concepts in the field of ME. This experience aroused in me admiration and interest in deepening my studies in the field and its effects on the professional life of the mathematics teacher.

The teaching and learning processes are intrinsically related to how we approach the content, taking into account students' subjectivities. For this to occur, it is necessary to analyze several aspects,

[1] This project proposes to assist elementary and high school students in improving school performance while involving undergraduates from various courses in activities related to their supervised school practicum. The university students themselves act as monitors and conductors of the reinforcement classes.

such as didactics of the mathematics, teaching methodologies, learning theories, and ethnomathematics, among others. All these aspects stem from the same field: mathematics education (ME). Thus, we highlight the relevance of this research to demonstrate the benefits that studying subjects in this field can bring to teaching practice.

We chose the topic after noting during the supervised practicum that the ME content studied in undergraduate programs, when applied in practice, could improve the teaching process. In addition, these contents are little valued by teachers in universities and in basic education, as well as by academics. Therefore, it is necessary to highlight the importance of studying subjects in the ME field in initial teacher education during undergraduate studies.

The interest in research on teacher education arose because we believed in the value of the ME subjects to the mathematics teaching degree course. This field is considered indispensable for the teaching and learning processes of a curriculum component as relevant as mathematics.

We conducted the research to understand whether, and how, the subjects in mathematics education taken in initial mathematics teacher education contribute to their teaching practice. In this scenario, the following research problem emerges: How do the subjects of mathematics education taken in initial education affect the teaching practice of mathematics teachers, especially regarding class organization, the choice of methodologies, and conceptions of teaching and learning?

In this text, the theme is privileged through a literature review, establishing a dialogue with authors who study it and striving to analyze the relevance of ME in the education of mathematics teachers. We also watched classes and interviews with two elementary school 6th-grade teachers.

The text is presented in three sections, each organized into subsections. In the first, we contextualized ME, teacher education, identity and teaching practice, and the definition of the ME field, and their importance for teacher education and teachers' classroom performance. In the second section, we discussed the methodological procedures of the research. Finally, we analyzed the interviews with the 6th-grade teachers. We also address the convergences and divergences between their narratives and the meanings attributed to ME in their practice and education process. Finally, we discussed the results of the work.

## 2. Contextualizing: Mathematics education, teacher education, teacher identity and teaching practice

Considering the objective of understanding whether, and how, the ME subjects taken in the initial education of the mathematics teacher contribute to their teaching practice, we carried out a documentation analysis, supported by curriculum references for the education of mathematics teachers, with a focus on the research.

### 2.1 Mathematics Education

It is pertinent to emphasize that, to date, students perceive mathematics as a complex, difficult-to-understand discipline. Therefore, mathematics teachers must seek ways to demystify the teaching

and learning of the subject and students' predominant perceptions. Thus, it is possible to promote the construction of mathematical knowledge efficiently while taking into account each student's subjectivity. It is also possible to identify ways to make these constructions assertively, based on studies in the ME field.

For Fiorentini e Lorenzato (2012), the study of ME is essential in teacher education, as this field encompasses several lines of research, including methodologies for teaching mathematics, learning theories, ethnomathematics, and mathematical didactics, among others. All of them seek improvements for the teaching and learning of mathematics.

About the teachers' specific and initial education, Muniz (2009, p. 25) shows that "the mathematics education movement arises from the need to rethink the teacher's role in relation to the child, seen as a producer of mathematical knowledge", which caused, as a result of this movement, the foundation of the Brazilian Society of Mathematics Education (Sociedade Brasileira de Educação Matemática—SBEM).

In the same period, there was an increase in researchers' interest in conducting more in-depth studies of various aspects of mathematics learning and teaching, culminating in the creation and institutional recognition of the ME research field.

In view of this aspect related to ME, we observed the importance of improving mathematics teaching, especially after the emergence of SBEM. Consequently, opportunities for discussions and research emerged, along with the dissemination of their outcomes, to help professionals working in the classroom.

## 2.2 Teacher Education

Given that the focus here is on the ME subjects in the curriculum matrix of the mathematics teaching degree course, we will address initial teacher education. This education process aims to prepare professionals for teaching practice in basic education.

A mathematics teacher should not only master the mathematical content but also develop personally and socially to work effectively and maintain good relationships with students. Besides, the teacher must *know how to teach*. For what is the good of a teacher's knowledge if they cannot awaken the construction of that same knowledge in the other, in view of what teaching is?

In this regard, Ponte (2002, p. 2) points out that "Teachers should not only know theories, perspectives, and research results. They must be able to build adequate solutions for the various aspects of their professional actions" and, to this end, they must mobilize and articulate various types of knowledge, as well as the ability to articulate them to deal with situations in the classroom. We understand that these skills develop progressively throughout education and professional performance.

On the articulation among the knowledge necessary for the teacher, studies such as Shulman (2014, p. 5), define knowledge as "a codified and codifiable aggregate of knowledge, skills, understanding, and technologies, of ethics and disposition, of collective responsibility — and also a means of representing and communicating it". Therefore, knowledge should be the basis for teachers' performance.

According to the author, these professionals need to amalgamate three types of knowledge, i.e.: (i) *knowledge of specific content*: related to the understanding of facts, concepts, procedural processes of an area of knowledge; (ii) *pedagogical knowledge*: the understanding of the teaching and learning processes, human development and cognition, knowledge of contexts; knowledge of educational disciplines and principles, and curriculum knowledge; (iii) *pedagogical content knowledge*: articulated to the combination ofspecific content and pedagogy, showing how disciplinary knowledge is organized, represented, and adapted to different teaching situations.

Particularly in the education of mathematics teachers, it is necessary to articulate mathematical content with social development.Oliveira e Almeida (2025b) state that a mathematics teacher must not only know and have conceptual and procedural mastery of historically produced mathematics, but also pedagogical knowledge, as students internalize teachers' procedures and pedagogical approaches.

In mathematics teaching, what differentiates a mathematician from a math educator is the ability to stimulate and mediate the construction of a thought in the other. For mathematics educators, doing mathematics involves valuing activities that support the student's articulation of theory, practice, experience, and intuition, as stated by Paula (2014).

From these discussions, we can relate ME to teacher education, since ME subjects, inserted in the curriculum matrix of the teaching degree course, play a fundamental role. They are part of the teacher education process, helping teachers articulate theory with practice to develop pedagogical work with students during their classes.

When starting a teaching career, the teacher faces several scenarios, including the structure of each school, the social, economic, and cultural context of each place, and the variables that affect the makeup of each student in the teacher's class.

Personal experience, the student-teacher relationship, and all previous contacts the student has had with mathematics can influence how the student learns. Therefore, it is up to the teacher to find strategies to adapt to each scenario so they can carry out their work.

In addition, according to Pavanello (1993, p. 12), the teacher must take into account "the intellectual development of the student and their reasoning processes; they must be aware of individual differences and be prepared to face them". Also, it should be an objective of this professional "to provide opportunities for their students to become aware of their own reasoning processes (it is recognized that the goal of education is to train autonomous individuals)".

Therefore, initial mathematics teacher education, with an emphasis on ME subjects, is essential to prepare qualified professionals to meet the challenges of teaching. The articulation between theory and practice, the understanding of students' diversities, and the development of methodologies.

In this regard, em Oliveira e Almeida (2025a, p. 5) discuss that "teacher education must be guided by a critical-reflective conception, giving rise to the development of autonomous thinking by the prospective teacher". Therefore, entering an initial education requires personal and intellectual investment, because the construction of an academic identity is also a form of professional identity construction.

## 2.3 Teacher Identity

The concept of identity amalgamates both the personal and collective dimensions of a person. Identity is not something one owns; rather, it is built over a lifetime. It is also not a stable but relational characteristic. Its development is characterized as an evolutionary process and as na interpretation of itself within a given context.

Teacher identity is no different: it is a multifaceted concept that develops throughout the teacher's education and professional career, and is influenced by several personal, social, and contextual dimensions. It is also built on the relevance that each professional gives to their own teaching activity, through their performance, and through interpersonal relationships within schools, unions, with peers, and with other educational agents, as pointed out by Pimenta (1996).

In relation to these concepts, we understand that the process of constructing personal identity, in general, is shaped by moments of crisis, phases in which the person is in question, and internal and external conflicts. According to Oliveira (2004), , teaching professional identity is usually associated with the concept of social identity, which involves identifying a subject with a social group, in this case, the professional class.

We argue that the teaching professional identity is a dynamic and interactive process of constructing an image of oneself as an educator. This construction is influenced by the school context, relationships with colleagues and students, and current educational policies, which reflect the profession's relational and contextual nature.

The construction of this identity involves the interactions among pedagogical knowledge, beliefs about teaching and learning, and reflection on practice. Gohier *et al.* (2001) present another view of teacher identity, focusing on a psychosociological model integrated with the individual, rather than a purely sociological one.

Nesse processo, os autores compartilham duas dimensões: *a autoimagem pessoal* e as *percepções sobre os professores e a profissão.* Embora não pretendam ser abrangentes, mencionam aspectos como conhecimentos, opiniões, atitudes, valores, projetos e aspirações que uma pessoa confirma como parte de sua identidade, independentemente do contexto profissional, ou, ao menos, pela afirmação da sua singularidade face às normas profissionais impostas.

However, the construction of professional identity requires understanding the social, cultural, and political contexts in which the teacher's activity is situated, since working conditions directly affect their professional satisfaction and sense of integration into the school. Hargreaves e Goodson (1996, p. 16), , for example, argues that school contexts influence "how teachers see their students, their colleagues, their work, and their own effectiveness".

Another aspect of the formation of the teaching identity that deserves to be highlighted is the confrontation with the challenges and tensions inherent in the profession. Tardif (2012) points out that teachers throughout their careers face contradictory expectations from various stakeholders, such as students, parents, and the school administration, which leads them to redefine or adapt their professional identity.

Therefore, we understand that initial and continuing education play a fundamental role in shaping the teacher's professional identity. It is during teacher education that teachers begin to internalize their initial conceptions of themselves as educators. However, it is through practice and critical reflection on teaching that their identity is consolidated and evolves.

## 2.4 Teaching Practice

Teaching practice is a complex and varied process that goes far beyond the transmission of knowledge. It involves integrating theoretical knowledge, personal and contextual experiences, and constant adaptation to students' needs and the educational environment. According to Tardif (2012), teaching practice is composed of several knowings that teachers mobilize daily, i.e., disciplinary, pedagogical, and experiential knowings, which are articulated to guide decisions and actions in the teaching environment.

One of the central elements of teaching practice is the ability to reflect on pedagogical action. Schön (1992), states that the concept of *reflective practice* refers to the ability of teachers to critically analyze their pedagogical actions and decisions, put themselves in the students' shoes, and to continuously seek practices that aim to improve the quality of teaching, learning from everyday experiences.

This reflection is essential for professional development and enables teachers to adjust their practices in response to new challenges, such as curriculum changes, students' learning difficulties, and technological innovations. Moreover, teachers' institutional and social contexts shape their teaching identity, thereby influencing their teaching practice. The school environment, educational policies, and interpersonal relationships with colleagues and students shape pedagogical choices and, at times, impose limitations on the teacher's autonomy.

Teaching practice is also emotionally charged, as teachers daily deal with students' successes and failures, parental expectations, and institutional demands, which can evoke feelings of frustration, satisfaction, insecurity, or fulfilment.

Another important aspect to consider in teaching practice is the use of pedagogical strategies that promote effective learning, as adduced by Almeida e Miskulin (2019). When choosing a teaching methodology, the teacher should consider students' characteristics, learning objectives, and available resources.

Active methods, such as problem- or project-based learning, have been increasingly valued for their ability to involve students in the process of knowledge construction. However, the choice of methodology is directly related to the teacher's conceptions of the teaching and learning processes they support, which reflect their professional identity.

Castro e Amorim (2015) add that teaching practice cannot be dissociated from a continuing education process. Both initial and continuing education play a key role in updating and improving teachers' pedagogical practices. Education research enables teachers to stay up to date with new methodologies, technological advances, and changes in educational policies, ensuring innovative and effective teaching practice.

Para Silva *et al.* (2025), affirm that continuing education is fundamental in professional contexts, as it supports teaching and learning. It contributes to improving pedagogical practices, enabling the development of new approaches, strategies, and proposals that align with the demands and transformations of contemporary times.

## 3. Methodological Procedures

Considering that the objective of the study was to understand whether, and how, the ME subjects taken in the initial education of the mathematics teacher contribute to their teaching practice, as a methodology, we opted for qualitative research, based on materials already prepared and published, such as books, articles, and critical texts. Through a literature review, we engaged in dialogue with authors who study ME, to analyze its relevance to the education of mathematics teachers.

Although the literature review is a dimension of the work, the research is empirical, as it draws on data collected in the field, from in-class observations, and from interviews with teachers. Thus, the study amalgamates theoretical analysis and empirical investigation, yielding an understanding of how the knowledge of ME subjects in undergraduate courses *materializes* in teaching practice.

At first, to understand issues relevant to the theme, we watched classes and interviews with two 6th-grade elementary school teachers to determine whether the ME subjects they studied as undergraduates had any impact on their education and performance. Before conducting the interviews and observations, the objectives of the investigation were clarified with the teachers, and all terms used were explained in detail to ensure participants had a clear understanding.

We emphasize that class observations focused on the organization of mathematical tasks, the methodological strategies used, the interactions between the teacher and the student, and the use of didactic resources. The records were made in a field diary, including descriptions of the teacher's actions and the didactic references used in the classroom.

From the data analysis, it was possible to determine whether and how teachers use the studies they conducted as students of the mathematics teaching degree course in their professional practice. It is important to note that the study was approved by the Ethics and Research Committee involving Human Beings of the State University of Montes Claros (Unimontes) under Opinion number 6.819.773, dated May 13, 2024.

We collected information and evidence, a semi-structured interview script, and class observations as research instruments. To analyze and understand the collected data, we used discursive textual analysis. According to Moraes and Galiazzi Moraes e Galiazzi (2006), discursive textual analysis is a methodology for analyzing qualitative data and information to produce new understandings of phenomena and discourses.

According to these authors, the discursive textual analysis comprises three components: the deconstruction of the texts of *corpus* 5, unitization; the establishment of relationships between the unitary elements, categorization; and the capture of the emerging, in which the new understanding is communicated and validated.

The research took place in two public schools in Montes Claros, Minas Gerais, in the second half of 2024. We decided to resume the previous themes focused on, namely teacher identity, mathematics teacher education, mathematics education, and teaching practice, articulating them with the answers obtained during the interviews, as well as through class observations.

## 4. Analysis and discussion

In this section, we will discuss the research findings from class observations and interviews with two mathematics teachers. To this end, we present the analyses across four categories: *Teacher Identity*; *Teacher Education: before and after*; *Mathematics Education: outlining concepts*; *Teaching Practice: sayings and deeds.*

The reasoned analysis articulates the speeches of the interviewed teachers and the records of class observations, seeking to show, through excerpts, how knowledge stemming from the ME subjects manifests in these professionals' teaching practice.

### 4.1 Teaching Identity

To study the effects of ME on teaching practice through the analysis of interviews, it is important to present the characteristics of the interviewees, to verify how teachers identify themselves in their professional journey, and to examine the relationship between this identity and their respective practices. Thus, below, we present the profiles of the teachers, identified as teacher A and teacher B.

Teachers A and B are between 28 and 38 years old, both graduated in 2013 from Unimontes, and have been working as mathematics teachers since then (with 6–11 years of experience). The two teachers were trained under the same Pedagogical Course Project (PPC) and the same curriculum matrix, which was updated in 2009, when ME subjects were added.

Both interviewees were selected for their experience as mathematics teachers and, primarily, because they graduated in the same class of the mathematics teaching degree course at Unimontes, which began in 2009 and ended in 2013.

Teacher A specializes in Special and Inclusive Education and currently teaches four 6th-grade elementary school classes. During the interview, he mentioned concepts, approaches, and practices he studied as an academic: "*Problem Solving, History of Mathematics, Mathematical Games*", and added: "*I introduced manipulative materials and digital technologies into my practice*".

Class observations revealed that this teacher used dialogue, asking students to discuss possible problem-solving strategies. It was evident that he, in fact, works with students in a didactic way, using methodologies that support the teaching and learning processes. This type of choice highlights the value of research and student autonomy, principles discussed in ME subjects.

A main characteristic of his classes is that teacher A consistently encourages students to think, question, and solve mathematical problems more independently, giving them investigative autonomy in their learning.

In one of the classes observed on fractions, for example, the teacher asked students to represent different situations using concrete materials before symbolically recording them in their notebooks. In the field diary, we observed that students manipulated pieces and justified their choices orally, while the teacher mediated the discussions without immediately presenting the formal procedure.

Teacher B specializes in Didactics and Methodology of Higher Education and holds a master's degree in education. Currently, he is working with classes in 6th, 7th, and 8th grade of elementary school, and 1st, 2nd, and 3rd grade of high school. By observing his classes, we see him encouraging his students' protagonism, so they can independently build their knowledge based on the questions asked.

The speeches also reveal a resignification. Teacher A states: "*In undergraduate studies, I learned several methodologies, but only in the classroom did I understand what works with each class*". Teacher B points out: "*A lot of what we study only makes sense when we test it with the students*".

From the analysis presented, it is possible to infer that teaching practice is not an automatic reproduction of initial education but the result of resignification processes influenced by personal paths, classroom experiences, and formative choices throughout the career.

More than adherence to different methodologies, what is evident is a didactic intentionality that guides these teachers' work towards a critical, dialogical practice committed to students' autonomy and protagonism. In this sense, Perrenoud (2000) argues that developing professional skills implies not only mastering content but primarily mobilizing them in teaching contexts, with creativity and intentionality.

Students' investigative autonomy and the protagonism perceived in teachers' practices are in line with this perspective, insofar as they point to a teaching that goes beyond the transmission of content, seeking to promote students' critical thinking and learning — central aspects of a contemporary approach to ME.

The professional teaching identity, in this sense, emerges as a dynamic construction, sensitive to the demands of the school context and to each teacher's reflections on their pedagogical practice. This reinforces the idea that pedagogical practice cannot be understood in isolation from each teacher's personal and professional trajectory.

## 4.2 Teacher Education: before and after

As previously mentioned, teacher education is a developmental process involving a set of variables that unfold throughout this professional's life. For example, we can mention the experiences that shape their teaching identity. However, given that we aim to examine the possible contributions of the subjects in the ME field, we focused on initial teacher education.

When asked if they received guidance to work with more didactic activities that favor student learning, teacher A replied that "*Yes*", and commented: "*We had classes of mathematics practice*". Teacher B, in turn, said: "*I had some subjects that proposed the investigation and elaboration of this type of activity; however, we did not know if it was applicable*".

Teacher B's speech leads us to realize the importance of Supervised Practicum subjects and projects that enable the application of pedagogical interventions to teach mathematical content in schools. As an example of projects at Unimontes that offer these possibilities, we highlight the project *Tecnologias e Atividades Matemáticas Aplicadas às Escolas Públicas* (Tamaep) [Technologies and Mathematical Activities Applied to Public Schools][2] and the *Programa Institucional de Bolsa de Iniciação à Docência* (PIBID) [Institutional Teaching Initiation Scholarship Program], offered by the *Coordenação de Aperfeiçoamento de Pessoal de Nível Superior* (CAPES) [Coordination for the Improvement of Higher Education Personnel], in which students have the possibility of taking theory into practice.

These references to institutional projects also emerged in the interviews, when teachers mentioned experiences that brought the university closer to basic education. Therefore, integrating theory and practice is not only a goal of initial teacher education but also a necessity, ensuring that this education is committed to student learning.

This integration demands that universities expand spaces where future teachers can experience, reflect on, and (re)build their pedagogical practice. In this way, educators can be equipped for social and contextual transformation, so that the classroom becomes a space for investigation, dialogue, and emancipation.

From these teachers' comments, it was evident that both had ME in their education, i.e., they had guidelines on how to teach mathematics, with theories focused on the teaching and learning processes articulated to the content.

In response to one of the interview questions, Teacher B commented: "*The mathematics course at Unimontes makes us think.*" However, we ask: How do these studies impact our work as teachers? We can conclude through Teacher B's answer that ME subjects play a necessary role in the initial education of mathematics teachers, contributing to the construction of their identity and pedagogical practices.

The speeches by teachers A and B reveal that although they have received theoretical guidance on teaching mathematics, the practical application of this knowledge still presents challenges. The importance of concrete experiences, such as those offered by the university's projects and programs, is evident, as they enable students to translate theory into practice.

From these statements, it is possible to engage in dialogue withSchön (1992), who asserts that professional knowledge is built, above all, through action and reflection on action. That is, it is not enough to offer disciplines that address teaching methodologies and theories; it is necessary that prospective teachers have the opportunity to experience, live it, and re-signify this knowledge in classroom contexts.

### 4.3 Mathematics Education: outlining concepts

Mathematics teaching has undergone several transformations, incorporating new methodologies and technologies that aim not to transmit content but to foster an environment where students

[2] This project seeks to improve mathematics learning in basic education in Montes Claros, aiming at fruitful student results in national and international assessments and competitions, as well as providing continuing education for mathematics teachers. It aims to enable a workspace that allows students of the mathematics teaching degree course to reflect on how mathematics teaching is configured and how basic education students learn it.

can build, understand, and apply mathematical concepts. This knowledge and these methodologies are used with prospective mathematics teachers during initial teacher education through the ME subjects.

One of the main challenges in this field is ensuring that concepts are taught in an accessible, understandable way to students, regardless of how difficult or easy they find them. For this, a balance between theoretical rigor and practical application is necessary, which can be achieved through interdisciplinary activities and the use of visual and technological resources, among other methods.

In the semi-structured interview script, a question asked teachers to discuss the importance of ME subjects studied during their undergraduate courses for the effectiveness of mathematics teaching and learning processes.

Teacher B replied that these subjects give rise to "*a theoretical foundation*" and that he misses a "*link*" between these theories and practice. Teacher A, on the other hand, explained that: "*Mathematics education subjects are fundamental, as they allow the development of methodologies that meet students' needs*".

When deepening the answer, Teacher B adds: "*We learn a lot of theory, but sometimes we need to show how this turns into activity in the classroom*". Teacher A, in turn, states: "*These subjects help us think about the class, it is not only to present an exercise, but it is also to think about how the student will build reasoning*".

In the observations, this conception emerged when teacher A asked students to formulate hypotheses before formalization, and when teacher B used everyday situations to problematize mathematical concepts.

We understand ME as a field of research that plays an important role in the education of prospective teachers, fostering an environment in which students can effectively understand mathematics. Transformations in teaching, which prioritize knowledge construction over content transmission, require educators to be prepared to meet the challenge of making these concepts accessible to all students.

The speeches of the interviewed teachers point to the need for curricula that not only convey the fundamentals of ME but also establish dialogue and convergence with the practice of teaching. Shulman (2014), suggests, pedagogical content knowledge is the ability to transform content into something understandable, accessible, and meaningful for students — and this skill is not developed solely through theory, but through the mediation between theory and practice.

The reflections of teachers A and B highlight the importance of ME subjects in initial education. While one teacher recognizes the need to develop adaptive methodologies, the other points to the lack of connection between theory and practice as an area for improvement.

This need for integration suggests that, to maximize the effectiveness of teaching and learning, educational institutions must continue investing in strategies that promote this articulation, such as interdisciplinary activities and the use of technologies.

### 4.4 Teaching Practice: sayings and deeds

To observe the results that the applications of theories studied in the subjects in the field of ME bring to the practice of the interviewed teachers, we focused, in this category, on the teachers' answers to the question: Is it possible to list the results that these applications bring to the teaching and learning processes with students?

Teachers A and B, in their answers, explained that by applying more engaging methodologies, they gain students' attention and are well accepted, involving them in the subject being studied. Teacher B replied, "*I noticed that students engage better. I observe them in class, which allows me to follow their process.* "

This movement from the centrality of the content to the centrality of the student's experience aligns with the propositions of authors such as Oliveira e Lopes (2023), who defend a critical and dialogical approach to mathematics, meeting the characteristics of the teaching of knowledge transmission, mobilizing the subject as an agent of the learning process.

The observations demonstrated, for example, that teacher A used a board game to work on multiples and divisors, organizing the students into groups and asking them to justify each move orally. In the case of teacher B, the use of digital resources to explore graphs was observed.

These methodologies are not limited to traditional content delivery; on the contrary, they involve pedagogical practices such as games, interactive activities, and the exploration of educational technologies. These approaches are attractive and promote greater interaction between students and content, making the learning process more meaningful.

Regarding the use of educational technologies, Oliveira e Almeida (2025a) discuss that their incorporation must consider the multiple socio-cultural and educational contexts in which they are inserted, making it necessary for the teacher to develop or expand their digital competence focused on teaching, especially in modern times, marked by technological influence on daily life. From an educational perspective in mathematics, using digital technologies in classes is important, as they offer significant potential for mediation and support for teachers in the teaching process and for students in the learning process (Evangelista *et al.* 2025).

The teachers' effort does not merely make classes more interesting. There is, at the same time, a search for the construction of knowledge, in which the student not only understands mathematical concepts superficially but is also encouraged to explore their applications, reflect on the solutions to the proposed problems, and develop critical and analytical skills. The methodological diversity mentioned by teachers serves precisely to facilitate learning, recognizing that students respond differently to the various pedagogical strategies.

Therefore, the results presented not only validate the importance of initial education anchored in ME but also reinforce that its effectiveness in basic education classes is closely linked to teachers' ability to reinterpret and adapt the knowledge built to the realities of their students.

## 5. Final Considerations

This study aimed to understand whether, and how, the subjects in mathematics education taken in initial teacher education contribute to their teaching practice. From class observations and the responses of the interviewed teachers, the empirical evidence suggests that, when theoretical approaches are articulated with practice, the results in the students' teaching and learning processes are positive.

The empirical analysis allowed us to identify some concrete movements of this articulation between initial education and teaching practice. Class observations showed that teachers mobilize investigative strategies learned in mathematics education, such as initial problematization of the content, encouragement of students' argumentation, and mediation.

Teacher A and Teacher B reported that using more dynamic methodologies increases student involvement, promoting active participation and knowledge construction. The classes become more interesting and interactive, facilitating the learning process.

However, an important reflection also emerged on the need for a deeper articulation between the theory studied in the degree and its application in basic education classes. Although the teachers interviewed reported having been exposed to theories and methodologies during their undergraduate courses, one teacher reported a gap in their practical applicability in the school context.

This point underscores the importance of strengthening supervised practicums, participation in pedagogical intervention projects, and initiation into teaching, which allow undergraduates to test and improve their teaching skills in teaching and learning situations.

Projects such as Tamaep and Pibid play a formative role in this process, offering prospective teachers the opportunity to put into practice, in public schools, what they learned at university, experiencing the challenges and rewards of mathematics teaching and learning.

These initiatives are essential for undergraduates to understand the demands of pedagogical practice in the classroom and build the confidence and autonomy necessary to face the challenges at school, a place that, in theory, they will work after completing their undergraduate studies.

We infer that ME plays a fundamental role in the education of the mathematics teacher, being responsible for fostering in the future professionals not only the necessary theoretical knowledge, but also the didactic-pedagogical knowledge to promote meaningful learning with the students.

We conclude that, when the theories studied and discussed in academia are articulated with the practices and processes of knowledge construction, considering the specificities of the contexts in which they unfold, the results in the teaching and learning processes are effective for the development of both teachers and students, as reported by the study participants.

The use of dynamic, interactive approaches in the classroom can leverage students' attention and encourage participation, promoting a collaborative, engaging learning environment. In this context, ME constitutes a fruitful field for teacher education, translating the complexity of mathematical concepts into pedagogical practices.

It is important to recognize that the findings of this research are limited to a small number of participants and a specific context and, therefore, do not allow broad generalizations. Still, the study contributes by explaining, based on empirical data, how subjects and knowledge of ME taken and built in initial education *materialize* in teaching practice, especially how teachers organize the class, promote student participation, and articulate theory and practice.

We emphasize that this research has the potential to make important contributions to both the field of ME and the education of mathematics teachers. By investigating the relationship between initial education and the practical application of pedagogical theories and methodologies in mathematics teaching, this study provides a reflection on how undergraduate courses can be improved to prepare prospective teachers.

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