

**Training mathematics teachers from an inclusive perspective: analyzing practices conceived in a context of collaboration between university and school**

**Formación de profesores de matemáticas desde una perspectiva inclusiva: análisis de prácticas concebidas en un contexto de colaboración entre la universidad y la escuela**

**Formation des enseignants de mathématiques dans une perspective inclusive : analyse des pratiques conçues dans un contexte de collaboration entre l'université et l'école**

**Formação de professores de matemática em uma perspectiva inclusiva: analisando práticas concebidas em um contexto de colaboração entre universidade e escola**

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**Abstract**

This paper is the result of a research project focusing on the knowledge mobilized by future mathematics teachers who experience training practices from an inclusive perspective. Based on a qualitative approach, the research was characterized as a research-in-training, whose data was produced in the context of two subjects with a total workload dedicated to practice as a curricular component. The subject of this paper is the analysis of training practices from an inclusive perspective, especially those that value the presence of the basic education teacher as a co-trainer and/or that consider the inclusive school context as a field for this training. The aim is to identify the contributions of these practices through the theoretical perspective of knowledge in, of, and for practice, according to Cochran-Smith and Lytle. The results show that practices based on conversation circles about inclusion contribute to problematizing the school based on the reality experienced and narrated by experienced teachers, especially those

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who research inclusion. The practice of planning mathematics lessons from an inclusive perspective, in a context of collaboration between university and school, contributes to the mobilization of knowledge for practice, especially when considering real, regular classrooms with students who are the target of Special Education. The practice of carrying out and narrating these lessons constitutes a real training experience, which contributes to the articulation of knowledge for practice, in practice, and from practice. In this process, the trainees can reflect on the reality of the school, the obstacles to inclusion, and the scope of the lessons they have planned, comparing them with the theory they have studied.

**Keywords:** Teacher training, School inclusion, Mathematics.

### **Resumen**

Ese artículo es sobre la investigación con foco en los conocimientos de los futuros maestros de matemáticas y sus experiencias de prácticas de formación en una visión inclusiva. La pesquisa tiene carácter cualitativo y se caracteriza en una pesquisa de formación, ya que sus datos fueron producidos en las disciplinas dedicadas a las prácticas de manera integral como componente del currículo. El objeto de ese artículo es el análisis de prácticas de formación con una visión a inclusión, en especial las que valorizan la presencia del maestro de la educación básica como alguien que ayuda en la formación y/o que consideran el contexto de la escuela inclusiva como espacio favorable para que esa ocurra. Tiene la intención de identificar como esas prácticas contribuyen basadas en los conocimientos teóricos de Cochran Smith y Lytle. Los resultados evidencian que las prácticas que se utilizan de círculos de conversación acerca de la inclusión ayudan a traer la problematización a la escuela, a partir de la realidad compartida por los maestros más viejos y con más experiencias, sobre todo los que estudian el tema de inclusión. El planeamiento de clases de matemáticas con una visión inclusiva, contribuyen para movilizar los conocimientos para las prácticas, principalmente cuando llevan en consideración las clases de aula reales, de enseñanza regular y con estudiantes que hacen parte de nuestro público en la Educación Especial. Las acciones de ejecutar y narrar esas clases son una verdadera experiencia, contribuyendo para la articulación del conocimiento con la práctica. En ese proceso, los futuros maestros pueden reflejar acerca de la realidad de escuela, acerca de las dificultades para la inclusión y sobre hasta donde las clases planeadas por ellos pueden llegar, en comparación con la teoría.

**Palabras clave:** Formación de profesores, Inclusión escolar, Matemáticas.

## Résumé

Le présent article découle d'une recherche axée sur les connaissances mobilisées par les futurs enseignants de mathématiques qui vivent des pratiques de formation dans une perspective inclusive. De nature qualitative, la recherche s'est caractérisée comme une recherche-formation, dont les données ont été produites dans le cadre de deux disciplines avec une charge horaire entièrement dédiée à la pratique en tant que composante du programme. L'objet de cet article est l'analyse des pratiques de formation dans une perspective inclusive, en particulier celles qui valorisent la présence de l'enseignant de l'éducation de base en tant que co-formateur et/ou qui considèrent le contexte scolaire inclusif comme un champ de cette formation. L'objectif est d'identifier les contributions de ces pratiques à travers les prismes théoriques de la connaissance dans la pratique de Cochran-Smith et Lytle. Les résultats indiquent que les pratiques basées sur des cercles de discussion sur l'inclusion contribuent à problématiser l'école, à partir de la réalité vécue et racontée par les enseignants expérimentés, en particulier ceux qui font des recherches sur l'inclusion. Les pratiques de planification de cours de mathématiques dans une perspective inclusive contribuent à la mobilisation des connaissances pour la pratique, en particulier lorsqu'elles tiennent compte des salles de classe régulières réelles qui accueillent des élèves en situation de handicap. Les pratiques de mise en œuvre et de narration de ces cours constituent une véritable expérience formatrice, qui contribue à l'articulation des connaissances dans, de et pour la pratique. Dans ce processus, les étudiants en licence peuvent réfléchir à la réalité de l'école, aux obstacles à l'inclusion et à la portée des cours qu'ils ont planifiés, en les comparant avec la théorie étudiée.

**Mots-clés** : Formation des Enseignants, Insertion Scolaire, Mathématiques.

## Resumo

O presente artigo decorre de investigação com foco nos conhecimentos mobilizados por futuros professores de Matemática que vivenciam práticas formativas na perspectiva inclusiva. A partir de uma abordagem qualitativa, a pesquisa se caracterizou como uma pesquisa-formação, cujos dados foram produzidos no âmbito de duas disciplinas com carga horária totalmente dedicada à prática como componente curricular. O objeto deste artigo é a análise de práticas formativas na perspectiva inclusiva, em especial aquelas que valorizem a presença do professor da educação básica como co-formador e/ou que considerem o contexto escolar inclusivo também como campo dessa formação. Busca-se identificar as contribuições destas práticas a partir das lentes teóricas do conhecimento na, da e para a prática, de Cochran-Smith e Lytle. Os resultados apontam que as práticas pautadas em rodas de conversa sobre inclusão contribuem para

problematizar a escola a partir da realidade vivida e narrada pelos professores experientes, em especial aqueles que pesquisam sobre a inclusão. As práticas de planejar aulas de matemática na perspectiva inclusiva, em um contexto de colaboração entre universidade e escola, contribuem para mobilização de conhecimentos para a prática, principalmente quando consideram salas de aulas reais, regulares e que possuem alunos Público-alvo da Educação Especial. As práticas de executar e de narrar essas aulas constituem uma verdadeira experiência formativa, que contribui para a articulação de conhecimentos para prática, na prática e da prática. Nesse processo, os licenciandos conseguem refletir sobre a realidade da escola, sobre os obstáculos para a inclusão e sobre o alcance das aulas planejadas por eles, comparando-os com a teoria estudada.

***Palavras-chave:*** Formação de Professores, Inclusão Escolar, Matemática.

## **Training mathematics teachers from an inclusive perspective: analyzing practices conceived in a context of collaboration between university and school**

The purpose of this paper is to present an excerpt from a master's degree research project which analyzed the knowledge mobilized by future mathematics teachers (Shulman, 1986, 1987; Castro Martínez, Rico, 2013; Cochran-Smith & Lytle, 1999) in the context of two subjects with a full course load dedicated to practice as a curricular component, with a focus on formative practices from an inclusive perspective. The second author, the research supervisor, in partnership with the researcher, taught the subjects. For this section, the decision was made to analyze the training practices developed during the research, especially those which included basic education teachers as co-trainers and/or which considered the inclusive school context as a training field, seeking to identify their contributions to teacher development from an inclusive perspective.

The hypothesis raised is that this working perspective aligns with the conceptions of knowledge in and of practice (Cochran-Smith & Lytle, 1999). The research carried out was characterized as training research, understood by Longarezi and Silva (2013, p. 223) as a process of professional development, in which effective changes occur in the educational practices of all those involved, because

all subjects involved take an active part in the process, examining problem situations to find answers and solutions; it encompasses academic research and pedagogical practice as a cohesive unit. All members develop it through various discussions and interactions, starting from the real needs of those involved, which gives meaning to their experiences. This process occurs within the school context, taking pedagogical practice as the core of the training process, respecting the diverse existing forms of knowledge, and, fundamentally, it serves as a process of political training. (Longarezi and Silva, 2013, p. 223).

In addition, Longarezi and Silva (2013) point out that research-in-training is defined as a type of study that denies the research paradigm that reduces teachers to “samples”, seeking to make them subjects in training and enabling changes in practices.

For data production/collection, we used the researcher's field diary, audio recordings of the discussions that took place in the subjects and in the work of lesson plans in small groups, images taken during the lessons, and all the students' productions related to the training practices from an inclusive perspective.

The training practices consisted of: (1) discussions with teachers specializing in the inclusion of students with visual impairments, Autism Spectrum Disorder (ASD) or Down's

Syndrome; (2) theoretical studies on disabilities and disorders; (3) seminars with suggestions for practical activities for PAEE students; (4) planning lessons for real classes, in classes with a Special Education Target student (PAEE); (5) writing a narrative to socialize the results of these planned lessons.

Given the potential of the training practices provided during the research that made this paper possible, the fourth topic of this text will describe and analyze the contributions of practices 1, 4, and 5 for the future mathematics teachers participating in the research. Before that, the next topics will present the theoretical references that underpin these analyses, as well as the results of other research into training practices from an inclusive perspective.

### **Teacher training from an inclusive perspective**

According to Morin (2006, p. 55), “it is the responsibility of the future of education to ensure that the idea of the unity of the species does not suppress the idea of diversity and that the idea of diversity does not suppress the idea of unity”. This means that education needs to take into account the individual and collective aspects of its students, catering for each (and everyone) according to their needs. Considering that, in 2020, data from the Basic Education Census recorded 1.3 million enrollments of students with Special Education Needs (PAEE) in the education system and that, of these, 90% attend regular education classes, it is important to emphasize that the training of teachers trained to deal with this reality is an urgent topic for debate.

It is known that the teacher is not the only agent responsible for the school inclusion process of PAEE students, but they do play a central role. In this sense, it is worth pointing out that one of the factors in overcoming obstacles (architectural, pedagogical, and attitudinal) to inclusive education is related to teacher training. In this regard, there are a number of normative documents that guide the inclusion of topics related to inclusive education in undergraduate curricula. These include the National Education Guidelines and Bases Law (Brazil, 1996), the National Guidelines for Special Education in Basic Education (CNE, 2001), the National Curriculum Guidelines for Basic Education Teacher Training (CNE, 2002), Decree No. 5.626 of December 22, 2005 (Brazil, 2005), the National Special Education Policy from the Perspective of Inclusive Education (Brazil, 2008) and the National Curriculum Guidelines for Initial Teacher Training for Basic Education (CNE, 2019).

Although there is support in official documents for teacher training to be comprehensive and for the subject of Special Education from the perspective of inclusive

education to be included in the curriculum of teacher training courses, what we see is a reality that is far removed from practices that cater for diversity.

Given this, the school is expected to be a plural space and, more than guaranteeing access to PAEE students, it is necessary to ensure that these students remain in school with quality and learn effectively. As teachers are the agents responsible for a close relationship with the students, for knowing their singularities more closely, as well as their potential and progress, it is becoming increasingly necessary to think of initial teacher training as one of the pillars for a school for all.

Beyond the rhetoric of public educational policies, it is necessary to provide concrete conditions for transformations in the school environment. Carmo et al. (2019) report a lack of harmony between the school inclusion policy for PAEE students and what is actually being done to qualify the teachers who will work within this perspective. According to Pletsch (2009, p. 150) “undergraduate programs are not prepared to perform the function of training teachers who know how to deal with the heterogeneity posed by inclusion”. Torres and Mendes (2019) point out those even teachers who specialize in the subject feel unprepared to deal with different disabilities.

Faced with this reality, it is understood that it is not enough for the school to have architectural accessibility, Libras interpreters, Braille signage, among other resources, if, even so, the democratic principles of a school that does not discriminate, that respects diversity and welcomes everyone are not respected and put into effect. Thinking of a teacher who is trained to deal with differences, Mello and Mozzi (2019) argue that teacher training should offer all the experience of an ordinary teacher, as well as knowledge and experience with students with special educational needs. These authors also point out that training should be based on principles, defined as follows:

the inseparability between theory and practice; the contemplation of knowledge, of knowing how to do things and of how to be; a real commitment to students' learning and development; and attention to their social, cultural, and personal diversities (Mello and Mozzi, 2019, p. 14036).

With the significant increase in the number of PAEE students enrolled in regular classrooms due to changes in legislation over the last 20 years, various studies have looked into the problem of teacher training from an inclusive perspective. Some of these studies, especially those based on surveys of Pedagogical Course Projects or on interviews and questionnaires, point to training gaps rather than paths taken. More recently, some research has tried to point out ways to remedy these gaps.

Vioto and Vitalino (2013), using questionnaires and interviews, investigated the perception of pedagogy students about the initial training they received to promote the inclusion of PAEE students. The results pointed to the need to restructure the curriculum, taking into account the importance of interdisciplinarity between Special Education subjects and other subjects, to promote opportunities for future teachers to work in inclusive classrooms, especially during their internship. Another suggestion is collaborative work between the trainers who work in these internships and the trainers in the field of Special Education. In addition, the authors highlight an important reflection for this research: the difficulty of addressing teacher training in the context of inclusive education in all its breadth, which led the researchers of this work to propose and investigate training practices focused on the inclusion of PAEE students, without prioritizing a single disability or disorder, as is usually the case.

Along the same lines, the research by Bazon et al (2016) sought to analyze and understand the conceptions and experiences of future teachers participating in the Institutional Teaching Initiation Scholarship Program (PIBID), in the cities of Araras-SP and Alfenas-MG, regarding inclusive education. The study showed that, of the 37 undergraduates who answered the questionnaires, 57.1% of those from Araras and 60.9% of those from Alfenas indicated that they were aware of the legislation that supports inclusive education. In Araras: 76.9%, and in Alfenas: 60.9% of the students took part in events and courses aimed at special or inclusive education, but 76.9% and 82.6% of the students, respectively, consider themselves unprepared to work in inclusive classrooms.

The authors defend the need to “focus on professional training and actions that insert educators into new spheres of understanding and experience of the inclusive proposal [...], which underpin the professional authenticity of each teacher” (Bazon et al., 2016, p. 1500), so that new meanings about inclusion can be configured. In their considerations, they point out that “a significant proportion of these students do not consider themselves responsible for implementing inclusive pedagogical practices” (Bazon et al., 2016, p. 1514) and justify that “the fact that they have not inclusive experiences, with the necessary support and backing, can favor positions like this” (Bazon et al., 2016, p. 1514).

A more recent study (Uliana, de Souza Mól, 2021), carried out in the context of the initial training of Chemistry, Physics and Mathematics teachers, asked students to study a teaching case, to analyze the contributions of this type of practice in the process of initial teacher training concerning teacher development for the inclusion of students with disabilities. According to the authors, the students



had the opportunity to learn about the process of inclusion/exclusion of students with disabilities in primary school classrooms, the particular demands of blind and deaf students in the teaching-learning process, and the teacher's responsibility in promoting quality education for every student. The teaching case study has also enabled many discussions, doubts, concerns, and reflections on the complexity of teaching in the reality of 21st-century classrooms to emerge, thus becoming a rich teaching methodology for teacher learning. (Uliana, de Souza Mól, 2021, p. 1).

In a perspective closer to the one adopted in the research on which this paper is based, Moura et. al. (2021) offered students on a Pedagogy degree course a pedagogical workshop on magnitudes and measures. In addition to discussions about Mathematics Education, this initiative provided an opportunity during their initial training to experiment with situations involving the inclusion of students with physical and visual disabilities and high abilities. During the workshops, the students themselves simulated these disabilities so that their group mates could find ways to include them in the proposed activities. According to the authors, “the participants were able to understand and experience situations that can help in possible pedagogical interventions in everyday school life that have inclusion as their premise” (Moura et al., 2021, p. 20).

This research reinforces the importance of training practices from an inclusive perspective, which combines theory and practice, even at times when it is not possible to experience the concrete reality of the classroom. It is these practices that this paper will deal with, but to analyze them, it was also necessary to turn to two authors who talk about teachers' conceptions of knowledge.

### **A perspective for analyzing the contributions of training practices from an inclusive approach**

Cochran-Smith and Lytle<sup>4</sup> (1999), by presenting different conceptions of knowledge, help us to understand the contributions of training practices from an inclusive perspective. The authors warn of the need to link theory and practice and, to this end, present three conceptions of teaching knowledge: “knowledge-for-practice”, “knowledge-in-practice”, and “knowledge-of-practice”. The authors understand that

there are radically different conceptions of teacher learning, including varying images of knowledge; of professional practice; of the necessary and/or potential relationships that exist between both; of the social, intellectual and organizational contexts that

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<sup>4</sup> The Study and Research Group on Mathematics Teacher Training (GEPFPM-FE/UNICAMP) translated quotations from this work.

underpin teacher learning; and in how this learning connects with educational change and the purpose of the school. (Cochran-Smith and Lytle, 1999, p. 1).

From this perspective, there is a defense that different conceptions of teacher knowledge lead to very different ideas about how to improve teacher training and professional development, how to effect curricular and school changes, and how to evaluate and certify teachers throughout their professional lives. In this sense, analyzing training practices through this theoretical perspective makes it possible to understand how much they can contribute to the adoption of an inclusive perspective by future mathematics teachers.

The authors thus propose a distinction between these three prominent conceptions of teacher knowledge, presenting the various initiatives related to teacher training which, according to Cochran-Smith and Lytle (1999, p. 1), “although they are sometimes described similarly and even present alike methods and organizational arrangements, are quite different in their purposes and have very different consequences for the daily lives of students and teachers”.

Cochran-Smith and Lytle (1999, p. 5) also explain that the first conception “is based on the understanding that the relationship between knowledge and practice can be thought of as knowledge-to-practice”. This conception generates formal knowledge and theories so that teachers can use them and, consequently, improve their professional practice. For them,

the knowledge for teaching consists primarily of what is called “formal knowledge”, that is, the general theories and research findings from a broad spectrum of fundamental and applied topics that together constitute the basic domains of teaching knowledge, which educators call the “knowledge base”. (Cochran-Smith and Lytle, 1999, p. 5).

From this point of view, according to Cochran-Smith and Lytle (1999, p. 6), the basic domains of knowledge include subject content, knowledge about the disciplinary foundations of education, human development, classroom organization, pedagogy, assessment, the social and cultural context of the school, and knowledge specific to the teaching profession. Furthermore, Cochran-Smith and Lytle (1999, p. 6) add that

teachers learn this knowledge through various training experiences that give them access to the knowledge base. To improve teaching, teachers need to implement, translate, or put into practice what they acquire from experts outside the classroom.

The authors clarify that it is through training experiences that basic knowledge is learned, showing the importance of disciplines that allow this knowledge to be developed. Cochran-Smith and Lytle (1999, p. 7), based on Shulman (1987), warn that the “knowledge

base needs to include a range of categories and sources of knowledge” and that the wisdom of practice is generally absent from the literature.

According to Cochran-Smith and Lytle (1999, p. 8), implicit in the knowledge-to-practice relationship is an image of “practice as the way, when and what teachers do with the formal knowledge base on a day-to-day basis in the classroom”. Within this knowledge, there is how the teacher organizes his or her lesson, the units of study, the activities and materials used for each group of students, the sequence of the contents of a subject and how lessons and interactions in the classroom are structured, as well as the methods of assessing the progress of each class.

Finally, Cochran-Smith and Lytle (1999, p. 10) explain that

knowledge for practice emphasizes the acquisition of knowledge for both primary and secondary teachers. It also maintains a clear distinction between novice and experienced teachers, as well as between those who are competent and those who, although experienced, simply do not know enough to teach effectively.

In light of the first concept, it is understood that the concept of knowledge-to-practice is essential for understanding some of the inclusive training practices offered during the research, in which undergraduates take part in theoretical discussions and prepare to go into the classroom. However, this conception is not enough to understand and analyze the contributions of training practices that seek a closer relationship with the profession, that is, with the school, with basic education teachers, and with the real problems they face at school. To do this, it is necessary to understand the other two concepts: knowledge-in-practice and knowledge-of-practice.

According to Cochran-Smith and Lytle (1999, p. 15), knowledge-in-practice is prominent in many initiatives to improve classroom practice. In this conception, “the emphasis is on knowledge-in-action: what competent teachers know, insofar as it is expressed or conveyed in the art of practice, teacher reflections on practice, research into practice and narratives about practice”. The authors also consider that for this knowledge-in-practice, teachers need to have experience and be able to reflect on it. Cochran-Smith and Lytle (1999, p. 15) point out that teachers

learn when they have the opportunity to examine and reflect on the knowledge implicit in good practice - in the continuous actions of experienced teachers as they choose strategies, organize classroom routines, make decisions, create problems, structure situations, and reconsider their thought processes.

Cochran-Smith and Lytle (1999, p. 15) argue that “to improve teaching, then, teachers need opportunities to amplify, make explicit, and articulate the tacit knowledge present in the experience and conscious action of the most competent professionals”. Furthermore, the authors add that in environments composed of more and less experienced teachers, in collaborative contexts, this learning is facilitated, allowing reflection on practice for all. For the authors, “the concept of knowledge-in-practice drives many initiatives to professionalize and improve teaching by recognizing the teacher as a valid knower of practical knowledge” (Cochran-Smith and Lytle, 1999, p. 24). Reflecting on this concept, it is worth highlighting its importance to analyze the contributions of the participation of experienced teachers who work in classes with students with PAEE and who were able to share their experiences with future teachers (novices).

It is also worth highlighting the importance of the concept of knowledge-in-practice to analyze and understand the moment when the trainees put into practice the lesson plans they had developed, implementing activities from an inclusive perspective in a regular classroom, as well as their reflections on these practices through writing and socializing the narrative in which they report on this process.

In light of this concept, Arroyo (2013) states that when educator-training programs are based on reality, students are given faces and their diverse identities are recognized, influenced by social, ethnic-racial, gender, sexuality, generation, disability, and other factors. The author argues that knowledge of individuals in their own experiences is an essential principle for promoting more humanized relationships between teachers and students.

The third concept of knowledge-of-practice is certainly the most difficult to achieve in initial training. According to Cochran-Smith and Lytle (1999, p. 2), the knowledge taught by teachers:

is generated when they consider their classrooms as sites for intentional inquiry, while at the same time considering the knowledge and theory produced by others as generating material for questioning and interpretation. In this sense, teachers learn when they generate local knowledge “from” practice by working within the context of communities of inquiry, theorizing and constructing their work in ways that connect it to broader social, cultural, and political issues.

Cochran-Smith and Lytle (1999, p. 28) point out that the basis of this conception is that teachers, “throughout their lives, play a central and critical role in generating knowledge about practice, since their classrooms are sites of inquiry, and by connecting their work in schools to broader issues, they assume a critical point of view on the theory and research of others”. The

context in which this conception takes place, according to Cochran-Smith and Lytle (1999), is teacher networks, communities of inquiry, and other collective environments in which two or more teachers construct knowledge, with the focus being on teacher learning in this context.

Due this, it is difficult to achieve the assumptions of this concept in the context of initial training, in which future teachers generally do not yet have their classes or consistent practices to the point of being investigated in collaboration with other teachers. However, it is understood that they can make small reflections on the practices carried out at school. Thus, the fact that the trainees go to school and then reflect on their practices makes it possible to say that these training practices were close to the third conception, even though it was a small experience.

According to the aforementioned authors, teacher-training programs that adopt a knowledge-from-practice perspective try to adjust the courses and connect the learning of trainee teachers with that of experienced teachers and teacher trainers. In this sense, it is understood that the practices investigated in this research moved in this direction, linking theory and practice, as well as enabling moments of experiencing the school and sharing information between trainees and experienced teachers.

This framework is important for understanding the contributions of training practices, so that future teachers mobilize knowledge for, in and from practice from an inclusive perspective, whose training needs have been pointed out by various studies (Skovsmose, 2020; Viana and Manrique, 2019; Fernandes and Healy, 2007; Souza, 2016).

### **Contributions of training practices from an inclusive perspective that considers the teacher as a co-trainer and the school as the locus of training**

As mentioned above, five training practices were carried out during the research, described below in Table 1.

Table.

#### *The training practices examined*

Formative practice	Description
(1) Conversation circles with teachers specializing in the inclusion of students with visual impairments, Autism Spectrum Disorders (ASD), or Down Syndrome.	Four primary school teachers who research and/or work with special education students were invited (one of them was the researcher herself). The teachers, who suggested readings and brought materials for the undergraduates to explore, coordinated the conversations. The trainer acted as a mediator, proposing that the undergraduates ask questions and raise doubts. In these discussions, different topics

	were covered, such as resources and materials for the inclusion of deaf students in math class; digital games for the inclusion of students with intellectual disabilities; a didactic sequence for the inclusion of students with Down syndrome; and a didactic sequence on equations, to include students with ASD.
(2) theoretical studies on disabilities and disorders.	Readings on all disabilities and disorders were proposed in order to equip the undergraduates to think about important aspects for planning inclusive classes.
(3) seminars with suggestions for practical activities for PAEE students.	These seminars involved theoretical studies of a disability or disorder, according to the participants' interests. It involved reading articles on teaching mathematics to this audience. During the seminars, the undergraduates presented proposals for activities to be carried out by their classmates, simulating a lesson from an inclusive perspective, focusing on a disability or disorder.
(4) lesson planning for real classes with a Special Education Target Student (PAEE).	These lessons were planned taking into account an actual regular primary school class that had a student with a disability or disorder. The aim was to propose an activity that would involve the whole class, enabling the active participation of the students and the whole class. The topic was negotiated with the teacher in charge, and the lesson was prepared in small groups on the subject, under the supervision of the teacher trainer.
(5) writing a narrative to socialize the results of these planned lessons.	These narratives were written by the undergraduates as a way of reporting on the process of implementing the lessons. Some of them have even been published in the annals of events in the field of mathematics education.

Although the potential of the five training practices offered during the research will be considered, training practices 1, 4, and 5 will be described and analyzed, as they involve the participation of basic education teachers or more direct contact with schools. This is necessary to understand the contributions of training practices from an inclusive perspective, which values the presence of the primary school teacher as a co-trainer and/or which also considers the inclusive school context as a field for this training, which is the aim of this paper. In these

analyses, the decision was made to briefly report on the practices and, where possible, to include excerpts from speeches and/or productions that would allow us to highlight the contributions of these practices to the training of future teachers from an inclusive perspective. The analyses are based on the conceptions of knowledge and the references on inclusion and teacher training presented here.

Before the analyses are presented, it is worth noting that the dissertation that led to this paper did not focus on formative practices per se, but rather on the specialized knowledge (Carrillo, et. al., 2013) mobilized by the undergraduates in this context. Thus, the researcher played a formative role by interacting with the trainees in moments of study, planning, and post-class reflection. She recorded these situations, allowing them to be analyzed from the perspective of specialized knowledge. Listening attentively, problematizing what was said and what was done in the classroom, as well as giving critical feedback to the undergraduates, proved to be essential not only for data collection but also as part of the training process itself for the participants involved. Although she did not follow the classes in the classroom, contact with the narratives enabled both the researcher and the other authors to understand the potential of the training practices narrated here, which motivated the writing of this paper.

### **Conversation circles as spaces/time to raise awareness and reflect on reality**

The first course aimed to inform and sensitize undergraduates about the importance of Inclusive Mathematics Education, to show important aspects of some disabilities and disorders, to present and discuss inclusive practices adopted by teachers working in basic education, and to encourage undergraduates to develop small activities for teaching mathematics from an inclusive perspective. Thus, in this subject, the undergraduates experienced training practices in which they were deprived of their sensory and communication channels; they were able to exchange experiences; clarify doubts and anxieties with basic education teachers who research and/or work in mathematics teaching for PAEE students; in addition to preparing seminars containing proposals for inclusive activities that were carried out with their classmates.

Of the three types of activity carried out in this first course, only the conversation circles on inclusion are the focus of this paper, as basic education teachers who research and/or work in inclusive classes attended them. This activity included the reading and discussion of texts on mathematics teaching from an inclusive perspective, which were discussed with three teachers in three rounds of conversations. It is worth mentioning that, before starting the studies planned for the second course; the undergraduates took part in a fourth round of discussions, which will also be reported on in this topic.

The first round was with the researcher herself, who recounted the experience of her research into the potential of a lesson plan for teaching equations in a class with students with Autism Spectrum Disorder (ASD) and Attention Deficit Hyperactivity Disorder (ADHD) (Ribeiro, Cristovão, 2018). On this occasion, the undergraduates discussed important aspects of teaching mathematics to regular classes with students with ASD and the Universal Design for Learning (UDL) framework (Nunes & Madureira, 2015).

The researcher emphasizes the need and importance of using different resources and means of representation, group and individual activities, and different forms of assessment to promote math teaching that is meaningful for everyone, highlighting that the strategy used in her research was in line with the proposals in the UDL. Among the PAEE, the ASD was the most evident in the groups' choices for carrying out the seminars with practical activities.

The second teacher presented the results of her master's research on the perspectives of teacher training for inclusion (Souza, 2016), based on an analysis of the Pedagogical Courses Projects (PCPs), as well as her experiences with visually impaired students. This researcher built an inclusive manual for teaching mathematics in classes with visually impaired students. In this manual, she presents various practical activities to be developed with visually impaired students, to promote equal learning opportunities for all, so that the teaching of mathematics becomes more meaningful.

In her talk, the teacher emphasized the importance of using concrete materials to teach mathematics to visually impaired students, to explore touch, their most developed sense. She also stressed the importance of the teacher knowing how to create and adapt materials, warning that not everything is ready-made and sometimes not accessible in terms of cost. This material aroused the interest of the undergraduates, so one of the groups designed activities with students with this disability.

On the subject of adapting materials, it is important to note, on the other hand, that under the false idea of “curricular adaptations and flexibilization”, segregating practices have been maintained about students with disabilities in regular classrooms (Dias, 2018). To exemplify this context, we refer to the case of Peter, described by O'Brien and O'Brien (1999), who, while his classmates were doing math activities, remained in the classroom coloring sheets of paper, under the false pretext that he would be doing activities “adapted” to his individuality.

The third teacher recounted her experiences with a class of PAEE students and the results of her Scientific Initiation research with students with Down's syndrome. Before this session, the graduates were instructed to read a chapter from a thesis on teaching mathematics to students with Down's syndrome (Yokoyama, 2012, p. 36-45). In the aforementioned excerpt,



the author presents the difficulties and the resources that can be used. This reading and the circle were also inspiring, leading one of the undergraduates taking part in the research to later develop her Final Course Work focused on caring for a student with Down's syndrome during the pandemic, which would come in the years following the research.

The fourth circle of conversation, which already took place in the second course, was programmed in response to a request from the undergraduates who, when writing the final evaluation of the previous course, highlighted the importance of these circles and suggested more opportunities like these. A teacher who has carried out master's research into the use of digital games for students with intellectual disabilities led the event. The teacher also shared her experiences as a computer class advisor for PAEE students. This circle completed a cycle of circles that gave the undergraduates contact with teachers who develop inclusive practices for classes with PAEE students with various disabilities and disorders. These workshops did not cover all the disabilities and disorders, but they did enable a wide range of discussions about teaching mathematics from an inclusive perspective.

When the trainer asked the trainees about the importance of the first subject in their training, several of them were pleased to be taking part in this experience, explaining that they were able to learn about examples that prevented them from leaving the course without any knowledge of inclusive practices in math teaching. They compared the experience with Libras classes, saying that they are interesting, but they only deal with one disability, and in a generic way, without a focus on mathematics. One of the undergraduates recalled the teachers' reports to compare with their own experience:

in their training, they didn't have a focus on inclusive training, and I think that for us, having this, even if it's only in one subject, in one semester, is at least something that makes us more concerned. When I go into my internship room, I see the student who has ASD, and I think it makes us want to think: what can I do for them? What can I build? [...] it is difficult, it is not easy... I imagine having to turn yourself inside out to do it, but just having an idea, having some examples of things to work on [...] you see other examples from the classroom, so we're not going to [start from] scratch. (Student 1).

According to Cochran-Smith and Lytle (1999, p. 6), "teachers learn this knowledge through various training experiences that give them access to the knowledge base". In addition, the trainees confirm the ideas defended by the references presented by affirming the need for inclusive training focused on teaching mathematics, which guarantees them and other teachers discussions such as those held in the discipline, made possible by this research training.

This result reinforces what other studies (Bazon et al., 2016; Uliana, de Souza Mól, 2021; and Moura et al., 2021) have pointed out about the need to provide training practices from an inclusive perspective that relate to the content to be taught and are closer to the reality of the school.

It should also be noted that, according to Cury (2016), one of the main foundations for promoting the transition towards inclusive education is the initial training of mainstream teachers. This is especially important as these educators play an essential role in establishing a continuous and direct connection with students who have just arrived at school, which allows them to closely monitor their unique characteristics and progress. Along the same lines, Rodrigues (2014, p. 13) highlights that teachers, as the primary driving force behind transformations to improve education, have their training conceived as a “crucial opportunity” to initiate, support, supervise, and evaluate these changes in the educational landscape.

### **Planning mathematics teaching from an inclusive school perspective**

The second course required the undergraduates to make contact with schools (especially through their internship and PIBID [Institutional Program of Teaching Initiation Scholarship] ) to define the project's target audience, and consisted of four stages: (a) studying articles and/or narratives involving inclusive practices with the content to be worked on, (b) drawing up lesson plans, (c) implementing the proposals in mainstream schools or similar contexts and (d) writing a narrative or article about the whole process of planning and implementing the proposals.

At the stage of drawing up the lesson plans, the reading and discussion of the UDL (Nunes and Madureira, 2015) was resumed, with a focus on how to use the intervention planning grid, provided by the authors, in this process. According to Nunes and Madureira (2015, p. 26), the framework makes it possible to

emphasize the need and importance of developing planning processes that provide diversified ways of motivating and involving students, that consider multiple processes for presenting the content to be learned, and, finally, that make it possible for students to use different forms of action and expression.

After planning in small groups, there was a time to socialize the lesson plans, which made it possible to share ideas. In this way, they were able to count on contributions from colleagues and the critical view of the researcher and trainer. After implementing these lesson plans in regular classes with at least one PAEE student, the last stage of the course consisted of writing a narrative or article reporting on the process of drawing up the lesson plan and

analyzing/reflecting on the experience of implementing it in the classroom. Some students even presented their narratives at Mathematics Education events.

Unlike the first practice, which was analyzed based on the participation of the undergraduates in general, the contributions of the training practices were analyzed based on the data from one of the groups of undergraduates, since the volume of material generated made it impossible to analyze all the productions and subsequently transcribe all the speeches.

The team, composed of members Kim, Lulu and Woody<sup>5</sup>, used their lesson plan to cover the areas content for a 6th grade class at a public school in Itajubá, Minas Gerais, which consisted of 23 students, three of whom had ASD. The class was known to graduate student Woody, who had done his first internship at the school and had come into contact with the students' math teacher. In this way, he knew the students with ASD, which would make it easier to get to know the class to implement the lesson plan.

The undergraduates in the team carried out all the activities proposed in Practice VI. For the first stage, which involved the theoretical studies provided for in the subject, the group carried out: a comparative study of the curricular proposals from Minas Gerais and São Paulo; reading 12 books<sup>6</sup>, 10 of which were didactic (6th grade), one paradidactic and one teacher's pedagogical material (7th grade/8th grade); studying an article on teaching the areas of flat figures in different environments, i.e. paper and pencil, manipulative material and dynamic geometry software. The team chose the article that sought a proposal with different strategies and methodologies as facilitators of learning for students with ASD, as indicated in the UDL and in various studies (Ramos, 2018; Silva, 2017; Cintra, 2014; Uliana, 2015).

During this preparatory study, the undergraduates got to grips with important concepts and topics that should be covered when teaching the content of Areas. They realized that students needed to know some preliminary content, such as basic operations, length measurements, measurement transformations and perimeter, and they took a position on measurement transformations. They also analyzed textbooks and realized that, although these are extremely important for teaching, they present some problems with the content of Areas, especially with regard to the presentation of formulas, as in the following excerpt:

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<sup>5</sup> An ethics committee approved this research and, in order to preserve the identity of the undergraduates, fictitious names have been used.

<sup>6</sup> It is important to clarify that the number of books studied by the team was not imposed. In the course, students were simply asked to look for information on the subject, comparing two curricular proposals or comparing a proposal and a book, or even comparing more than one book. The team then had to carry out further studies, based on articles and/or reports involving the chosen approach, resource or content, if possible related to the needs of the students in the class, especially the PAEE students.

One thing that goes very much against both proposals is that 8 of these books present the formula, there are books that start like this: put a square and put the formula, there are books that even put some rectangles and then the student will calculate how many squares there are in the rectangle [...] there are books that are two pages of area content and then it's like, just formula and that's it. What is a square meter; there is that little table [...] and the formulas for the area of a rectangle and a square. [...] for sixth graders this isn't very useful, not that they can't learn it, but I think the most important thing for them is to understand the concept of area and the concept of standard unit, [...] for example, what am I comparing this room to? (Woody).

When analyzing a textbook, they carefully reflect on the case of students with ASD, but also perceive contributions to everyone's learning in the sense of understanding the concept of area, and not just memorizing formulas

The paradigmatic brings an investigation and it gets away from the formula, from memorizing methods, for example. [...] We read that, really, if you have this for students with ASD, this work of memorizing methods and applying methods is not good for the student, it is not effective for learning. When the book brings this into the investigation, comparing the Tangram figures, [...] it helps the student to understand that area is more than a formula; it is a comparison (Woody).

The discussions about the needs of these students were crucial for Woody to criticize the way of teaching presented in textbooks and to make his first reflections on ways to overcome the limitations and difficulties of these students. He began to think about strategies that could be used in teaching so that students with ASD could have meaningful learning, even without being in contact with them, since he had only observed the class.

This knowledge “for” practice (Cochran-Smith & Lytle, 1999) is essential for teachers to be prepared and aware of their role in teaching mathematics from an inclusive perspective (Amorim, 2012; Silva, 2017; Cintra, 2014; Uliana, 2015; Mendes, 2017; Souza, 2016). In this regard, Souza (2016, p. 97) reaffirms that initial training courses for mathematics teachers “need to be attentive to the reality of the school environment, because today they welcome everyone and teachers need to be prepared for this”.

To plan the lessons, the undergraduates studied students' difficulties in distinguishing the concepts of area and perimeter, in understanding the meaning of the formulas, and had contact with authors who advocated the use of manipulative materials and software to make these concepts easier and more meaningful. When presenting the lesson plan and talking about the resources to be used and the strategy of putting the students in groups, Woody showed that he understood the importance of these methodological options for all the students, especially when he said that

the manipulative materials would really help both the student with ASD and the other students to perform the activities we want them to do. In addition, doing it in pairs brings interaction with other students, which is very important for students with ASD, because two of our students with ASD have a lot of difficulty (Woody).

The team planned the use of various resources in order to enable meaningful learning for everyone, as presupposed by the UDL (Nunes & Madureira, 2015). They divided the area content into five themes to be explored:

1. Concept of area and comparison;
2. Concept of standard unit of measurement of area;
3. Standard unit of measurement of area, conversion of multiples and submultiples;
4. Agricultural measurements;
5. Measures of geometric figures (area formula).

There is no way to present the analysis of each proposed theme in this paper, but in general, when analyzing each of the resources and activities prepared by the team, it can be seen that the undergraduates used the principles of UDL (Nunes & Madureira, 2015), seeking to involve and motivate the students, using different ways to promote learning, namely: work in pairs and individually, as well as multiple actions related to the representation and presentation of the content.

Throughout all the planned lessons, the undergraduates planned assessment activities, according to them, to get a sense of whether or not the students were making progress. This procedure is related to the third principle of the UDL, which states that “the process of assessing students must be coherent, both with the way in which each one is involved in learning and with the way in which they reveal what they have learned” (Nunes & Madureira, 2011, p. 35).

All the moments of reflection, study, preparation and planning promoted by this formative practice gave the trainees experiences that were essential to the development of knowledge-for-practice (Cochran-Smith & Lytle, 1999). However, although this formative practice was still developed in the context of initial training, it is close to a concept of knowledge-in-practice, since the trainees were preparing a lesson for a real class, with the commitment to contribute to the development of learning for all students, especially those with ASD, especially Woody, who was following the class as a trainee, but began to look at it with the eyes of a teacher, sensitive to inclusion.

It should be noted, therefore, that although the disciplines that deal with pedagogical dimensions are of great importance, inclusive education should not be limited to mere instrumental purposes, focused only on the creation of resources and teaching materials. In this

sense, especially in the field of mathematics teaching, there is a need for subjects that encompass discussions that go beyond the merely propositional approach, also addressing the social dynamics that lead to exclusion (Michels, 2017).

### **The narrative of the experience makes it possible to reflect on the school, the obstacles to inclusion and practice**

In the first topic (Concept of area and comparison) of the team's lesson plan, the undergraduates were supposed to ask the class about the concept of area. One of the excerpts from the narrative shows the result of this discussion:

The class seemed excited when they were asked, “what is an area?” They responded by writing it down on the board, such as:

Student C: Where the dog pees, that is its area.

This first answer sounded strange, shattering all our expectations. It came from one of the students with ASD who understood the area in these respects, but even though at first it was an answer that seemed difficult to relate to the topic, we managed to find a way forward after other answers (Team narrative).

In this excerpt, we see that the undergraduates try to understand the possible ways of learning for all students and discuss the answer given by the student with ASD with the rest of the class, recognizing the way this student reasoned to give his answer. This situation was not foreseen, but they were sensitized enough to be able to deal with a context that was new, since their focus was the inclusion of students with ASD.

When developing the activity that required comparisons between areas, the undergraduates came across another delicate situation in relation to one of the students with ASD, who felt satisfied with just visually comparing some figures, establishing size relationships (bigger and smaller), without thinking about the concept of area. In the same activity, other students were decomposing the figures to compare their areas even though they had not yet discussed this strategy. The team conducted the activity respecting each student's way of thinking and, after solving the problem, asked him or her to share their answers, allowing everyone to share their experiences. In their narrative, the undergraduates concluded that

With this simple activity, applied in a different way, giving the students space to raise hypotheses, not giving answers and just questioning them, at the end we were able to finish the exercise and explain concepts such as decomposition and recomposition of surfaces for calculating area and a principle of standard units of measurement, which was the central theme of the second activity (Team narrative).

By implementing an activity that allowed the students to play a leading role, they concluded that not giving ready-made answers and questioning them is fundamental to building mathematical knowledge for all students. In the written narrative, the undergraduates also talked about the experience of building the Tangram, proposed in the second theme (Concept of standard unit of area measurement):

The initial idea was to bring the ready-made Tangram, which would take up less class time, but after the application, we saw that the idea of building it with the students was very useful for discussing concepts and bringing us closer to the class, especially student B, who always called us for help with folding and cutting out (Team narrative).

The team chose to build the Tangram instead of bringing it in ready-made, and this change made a difference to the lesson, enabling a better discussion of the concepts with the students. In addition, the moment of construction facilitated the exchange of information with the undergraduates, who got closer to the class, especially the students with ASD. The undergraduates' reflections reinforce the importance of studying proposals and articles so that they can provide activities of this kind, especially since they were inexperienced in that environment, and these studies made them feel more secure, interfering in the integration that the team was able to establish, as well as providing essential contact between teacher and student. The proposed activity allowed them to mobilize knowledge for, in and of practice in an articulated way, as they studied to prepare that lesson, organized the activity with the students' expectations and interests in mind (knowledge for and in practice), but had to adapt to the reality and difficulties imposed by inclusion (knowledge in practice), and were able to reflect on these practices (knowledge of practice), drawing important lessons from them.

Finally, knowledge about teaching mathematics from an inclusive perspective came about for, in and from practice, given that the activity had been planned with the interaction of students with ASD in mind, and the undergraduates were able to see the importance of this type of exercise in promoting learning for all students.

In another excerpt, they explain that, in practice, they realized the ideal moment to discuss that the same figure can have different values for its area, depending on the unit of measurement used.

When we realized that the large triangle, measured with the small one, had an area of 4, but measured with the medium triangle it had an area of 2, we saw the perfect moment to discuss how it was possible for the same figure to have two different area values, which was easily answered by the students that it was different because we were comparing the initial figure with different figures. From there we were able to extract the concept of the standard unit of measurement more intensely, telling the students that

the measurement of the area changes value depending on the unit of measurement we use and so it was possible to explain about the square meter, its multiples and submultiples, and why, on different surfaces, we use different units of measurement (Team narrative).

Again, the knowledge for, in and of the practice is articulated, because they only realized it because they were preparing for this lesson, and they only reflected on its importance because they wrote about their experience.

In the third topic (Standard unit of measurement of area, conversion of multiples and submultiples), when the students constructed a drawing using a sheet of paper and then calculated the area, the team made an important reflection:

Following this activity allowed them to put their creativity into practice, but on the other hand, it did not really help them understand the concept. With non-regular drawings, such as a copy of the notebook cover drawing, it was difficult to estimate the area of the figures properly (Team narrative).

The undergraduates' reflection was important in mobilizing knowledge of practice, of the obstacles faced by the students and of the processes and strategies they used when choosing drawings arbitrarily. To provide a fun and open activity for the students, the undergraduates made the mistake of leaving the activity too open, making it difficult to understand the concept.

This episode shows how much classroom practice can teach teachers, allowing them to adapt to their activities in the future. At this point, the knowledge-in-practice and of-practice (Cochran-Smith & Lytle, 1999) that the course proposal provided is evident. Perhaps if the team had made it a rule to draw only polygons or proposed the same irregular figure for everyone, it would have been possible to discuss strategies with the class. Reflections like these are fundamental for future teachers and reinforce the importance of training practices establishing contact with the classroom.

The next topic, concerning the teaching of agricultural measures, was not addressed in the narrative or when the reflections on implementation were presented. It is therefore believed that the trainees were unable to complete this stage of the lesson plan.

In theme five, the students used Geoboard to arrive at the area formula. According to the students' narrative:

This was the activity that seemed to work best and, in fact, it contributed a lot to the class, since it was an investigative activity and an observation of patterns, in which the students had to process the information in a table they had created themselves. [...] The creation of the table [...] enabled the students to see the pattern for filling it in. The students did the activity in groups, and it was possible to see some groups saying “oh



just do times”, indicating that it was enough to multiply base and height to find the value of the area (Team narrative).

In this excerpt, the articulation between knowledge for, in and of practice is once again evident. The undergraduates knew about the potential of the investigative approach adopted, because they had studied it in practice, realizing that it really works, which is clear when they write their narrative, after all, in it, they concluded that this activity contributed to the classroom.

The activity with this material was very promising, it allowed all the students, both those with ASD and those without any disorder, to manipulate and understand what needed to be done when filling in the table (Team narrative).

Finally, regarding the last activity, consisting of a series of exercises, the team wrote the following observation:

An important reflection related to assessment is, firstly, the fact that it is very important to think about questions that enable all the students to get involved and that make sense with what has been worked on in the classroom, because applying questions that deviate too much from the standard of what has been worked on in the classroom can be detrimental to the students, especially those with ASD (Team narrative).

In the excerpt, the undergraduates were concerned with bringing adapted questions to the students, thinking about those that had been worked on in the classroom, allowing a better understanding for all the students. In their reflections on the implementation, the trainees demonstrated the knowledge to analyze difficulties, benefits, resources that were or were not essential, and activities that could be improved. These reflections show the importance of the link with the classroom to promote the development of knowledge-in-practice and the beginnings of knowledge-of-practice, since they are making small reflections on their actions (Cochran-Smith & Lytle, 1999).

Specific knowledge about teaching mathematics from an inclusive perspective was evidently the most mobilized in this context, so much so that the trainees reflected on their search to see if the lessons they had implemented had enabled meaningful learning for these students too.

The narratives written by the undergraduates and briefly discussed here have contributed to their reflection on practice. By reporting on the planning process, executing and evaluating math classes from an inclusive perspective, they become important formative and reflective

tools. By writing these narratives, future teachers have the opportunity to critically reflect on the challenges faced, the strategies used, and the results obtained, articulating knowledge for, in and of practice. In addition, the socialization of these experiences, both within the course and at events, as happened in some cases, broadens the formative scope of the practice experienced, promoting the sharing of knowledge among peers and contributing to the consolidation of a teaching culture that is more sensitive to school inclusion. These written productions, therefore, not only document the students' educational trajectory, but also constitute spaces for the collective construction of knowledge by giving visibility to inclusive educational practices and fostering dialog between theory and practice.

### **Final considerations**

The training practices analyzed here contributed to training based on the construction and mobilization of Pedagogical Content Knowledge (Shulman, 1986, 1987), from an inclusive perspective, in a context that provided articulation between knowledge for, in and of practice. According to Rodrigues (2014) and Rodrigues and Lima-Rodrigues (2011), the experiences had in undergraduate course activities should be consistent with what is expected of the future professional. For example, instead of studying collaborative work through texts, it would be more efficient for students to experience this strategy in order to develop competence in teaching.

In this sense, Rodrigues and Lima-Rodrigues (2011) discuss the contradiction that exists in this principle, as higher education institutions generally use traditional teaching methods, expecting future teachers to work in the future with diversified teaching practices that are very different from those they experienced during their undergraduate studies. By discussing inclusion with primary school teachers, planning and implementing lessons for real classes from an inclusive perspective, as well as reporting on this process through narratives, the undergraduates were able to think about and experience inclusion in a much deeper way, in a context of collaboration between university training practices and the reality of schools.

Although there is legislation that recommends initial teacher training to deal with PAEE students, this has not been effectively carried out in undergraduate courses. As pointed out in

the research discussed here, there are isolated actions or only theoretical discussions taking place in the degree courses, which do not allow progress to be made towards perspectives of knowledge in and of practice, especially in a regular classroom context with PAEE students. For this reason, it is important for undergraduates to have contact with subjects that deal with Inclusive Mathematics Education, linking theory and practice, if possible in conjunction with the school.

Not all subjects will guarantee this contact or link the contents of basic education with what is being taught, which would be ideal, but this link can be present in discussions about classroom practices, both in the context of internships and in subjects that focus on Practice as a Curricular Component.

Through the research and training presented, it was possible to officially restructure the syllabus of a subject, which now focuses on training practices from an inclusive perspective for teaching mathematics, especially in regular classrooms with PAEE students. These practices provide opportunities to build knowledge for, in and from practice, generating a reflective and critical attitude towards inclusion.

It can be seen that, in all the moments experienced, there were profound reflections on teaching PAEE students, constituting knowledge for teaching mathematics from an inclusive perspective. Based on the undergraduates' participation in the discussions and their reports, it was also possible to see that they understood the relevance of inclusive practices at school, the need for continuous training of education professionals (teachers and other school agents) so that inclusion can take place. They also noted the importance of teachers working in partnership with support teachers and Libras interpreters, who need training. They also concluded that studying, experiencing, researching, designing, creating and developing new methodologies and resources can help in the process of teaching and learning mathematics for PAEE students.

The two subjects analyzed played an important role in building knowledge for-practice, in-practice and of-practice for future teachers in classes with PAEE students. The training practices from an inclusive perspective, with the presence of teachers working in basic education, and the moments of insertion in the school were a favorable context for the development of specific knowledge of the profession from an inclusive perspective and

provided “‘of-the-practice’ reflections on inclusion processes,” as highlighted in this paper. However, it is worth noting that offering training in this direction requires a lot of dedication, but it also allows the trainer to build new knowledge and reflect on their practices.

There are still few studies about training practices from an inclusive perspective in the initial training of mathematics teachers, but it can be said that this research is a relevant contribution to building this path. Even so, research is needed to broaden our understanding of how to build knowledge that contributes to improving the professionalization of mathematics teachers and the processes of teaching and learning mathematics from an inclusive perspective.

To conclude, it is essential to note that initial teacher training alone does not have the capacity to solve all the obstacles facing the implementation of inclusive education in Brazilian schools. The general lack of resources, the fragility of teaching careers, the absence of well-developed public policies and the lack of awareness within the school community about educational inclusion are some of the barriers that need to be overcome in this area.

Furthermore, it is recognized that if society continues to be based on relationships marked by prejudice and inequality, in which certain groups prosper at the cost of the deterioration of the living conditions of others, the achievement of an inclusive society will remain difficult to achieve. However, it is understood that by revealing this cruel dynamic in society, a significant step is taken towards promoting critical awareness and change.

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