Movement for the constitution of the professional identity of prospective mathematics teachers within the scope of the Pibid and the Supervised Teaching Practice

Movimiento del constitución de la identidad profesional de los futuros profesores de Matemáticas en el ámbito del Pibid y Prácticas Curriculares Supervisadas

Mouvement pour la constitution de l'identité professionnelle des futurs enseignants de Mathématiques dans le cadre du Pibid et du Stage Curriculaire Encadré

Movimento de constituição da identidade profissional de futuros professores de Matemática no âmbito do Pibid e do Estágio Curricular Supervisionado

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Abstract

This article discusses actions in the context of the Institutional Teacher Initiation Scholarship Program (Pibid) and the curriculum component Supervised Teaching Practice, which promoted the movement to constitute the professional identity of mathematics teachers. Interpretative qualitative research was conducted based on interviews, discussions, and written productions of students of the mathematics teaching degree course at the State University of Londrina. The results reveal that the contexts of initial education analyzed provided prospective teachers with: experiencing their first experiences as teachers; experiencing situations of vulnerability and being able to operate their sense of agency; getting to know basic education students and identifying cognitive and relational demands; reflecting on teaching behaviors in the teaching process; experiencing teaching methodologies different from directive teaching; and reflecting on their teaching practice based on the elaboration of reports of the activities developed. Such actions promoted the movement for the constitution of the PI of prospective mathematics teachers. They pointed out the need to establish processes of initial education that open spaces that encourage reflections on topics such as professional self-knowledge, emotions in teaching work, and mathematics teachers' social roles and responsibilities. Such processes are promising

for the constitution of critical and solidary teachers, aware of the implications of their professional performance.

***Keywords*:** Mathematics education, Mathematics teacher education, Professional identity of teachers who teach mathematics, Formative context actions.

Resumen

Este artículo tiene como objetivo discutir acciones en el contexto del Programa Institucional de Becas de Iniciación a la Enseñanza y de la Práctica Curricular Supervisada que promovieron el movimiento del constitución de la Identidad Profesional (IP) de los profesores de matemáticas. Se realizó una investigación cualitativa interpretativa, a partir de entrevistas, discusiones y producciones escritas de estudiantes de el curso de matemáticas de la Universidad Estadual de Londrina. Los resultados revelan que los contextos de formación inicial analizados permitieron a los futuros docentes: vivir sus primeras experiencias como docentes; experimentar situaciones de vulnerabilidad y siendo capaces de operar su sentido de agencia; conocer a los estudiantes de la educación básica e identificar demandas cognitivas y relacionales; reflexionar sobre los comportamientos docentes en el proceso de enseñanza; experimentar metodologías de enseñanza distintas a la enseñanza directiva; y reflexionar sobre su práctica docente a partir de la elaboración de memorias de las actividades realizadas. Tales acciones impulsaron el movimiento del constitución del IP de los futuros profesores de matemáticas y señalaron la necesidad de promover procesos de formación inicial que brinden espacios que provoquen la reflexión sobre temas como el autoconocimiento profesional, las emociones en el trabajo docente, el rol social de los docentes de matemáticas y sus responsabilidades. Tales procesos son promisorios para la constitución de un docente crítico, solidario y consciente de las implicaciones de su desempeño profesional.

***Palabras clave*:** Educación matemática, Formación de profesores de matemáticas, Identidad profesional de los profesores que enseñan matemáticas, Acciones del contexto formativo.

Résumé

Cet article vise à discuter des actions menées dans le cadre du Programme de bourses institutionnelles d'initiation à l'enseignement et du Stage curriculaire supervisé qui ont favorisé le mouvement de constitution de l'Identité professionnelle (IP) des enseignants de mathématiques. Une recherche qualitative interprétative a été réalisée, basée sur des entretiens,

des discussions et des productions écrites d'étudiants du cursus de mathématiques de l'Université d'État de Londrina. Les résultats révèlent que les contextes de formation initiale analysés ont permis aux futurs enseignants : de vivre leurs premières expériences en tant qu'enseignant ; vivre des situations de vulnérabilité et être en mesure d'exploiter son sens de l'agence; connaître les élèves de l'éducation de base et identifier les exigences cognitives et relationnelles; réfléchir sur les comportements d'enseignement dans le processus d'enseignement; faire l'expérience de méthodologies d'enseignement différentes de l'enseignement directif; et réfléchir sur leur pratique pédagogique à partir de l'élaboration de bilans des activités développées. De telles actions ont favorisé le mouvement de constitution de la propriété intellectuelle des futurs enseignants de mathématiques et ont souligné la nécessité de promouvoir des processus de formation initiale qui offrent des opportunités pour des espaces qui provoquent des réflexions sur des sujets tels que la connaissance de soi professionnelle, les émotions dans le travail d'enseignement, le rôle social du professeur de mathématiques et de ses responsabilités. De tels processus sont prometteurs pour la constitution d'un enseignant critique, solidaire et conscient des implications de sa performance professionnelle.

Mots-clés : Enseignement des mathématiques, Formation des enseignants de mathématiques, Identité professionnelle des enseignants qui enseignent les mathématiques, Actions liées au contexte de formation.

Resumo

O presente artigo tem como objetivo discutir ações do contexto do Programa Institucional de Bolsa de Iniciação à Docência e do Estágio Curricular Supervisionado que promoveram o movimento de constituição da identidade profissional de professores de matemática. Foi realizada uma pesquisa qualitativa de cunho interpretativo, baseada em entrevistas, discussões e produções escritas de estudantes do curso de licenciatura em matemática da Universidade Estadual de Londrina. Os resultados revelam que os contextos de formação inicial analisados proporcionaram aos futuros professores: vivenciar as primeiras experiências como docente; vivenciar situações de vulnerabilidade e operar o seu sentido de agência; conhecer alunos da educação básica e identificar demandas cognitivas e relacionais; refletir a respeito de comportamentos docentes no processo de ensino; experienciar metodologias de ensino diferentes do ensino diretivo; e refletir sobre sua prática docente a partir da elaboração de relatórios das atividades desenvolvidas. Tais ações promoveram o movimento de constituição da IP dos futuros professores de matemática e apontaram a necessidade de promover processos

de formação inicial que oportunizem espaços que provoquem reflexões a respeito de temas como o autoconhecimento profissional, as emoções no trabalho docente, a função social do professor de matemática e suas responsabilidades. Tais processos são promissores para a constituição de um professor crítico, solidário e consciente das implicações de sua atuação profissional.

Palavras-chave: Educação matemática, Formação de professores de matemática, Identidade profissional de professores que ensinam matemática, Ações do contexto formativo.

Movement for the constitution of the professional identity of prospective mathematics teachers within the scope of the Pibid and the Supervised Teaching Practice

Connecting theoretical principles with practical applications remains a persistent challenge in undergraduate mathematics courses (Leite & Passos, 2020). When pre-service teachers (PTs) are given the opportunity to establish this connection, they can constitute the base of professional teaching knowledge and reflect on their professional development (Rodrigues & Teixeira, 2021).

Institutionalized programs and actions of teaching degree courses have been fertile contexts for such connections, notably the Institutional Teaching Initiation Scholarship Program (Programa Institucional de Bolsa de Iniciação à Docência - Pibid) and the mandatory curriculum component Supervised Teaching Practicum (STP) (Matos, 2016; Noffs & Rodrigues, 2016; Scalabrin, 2018; Souza & Almouloud, 2019; Rodrigues et al., 2019), and for enhancing other domains of the teaching professional identity (PI).

Barbosa and Lopes (2020), Rodrigues and Cyrino (2023), and Teixeira and Cyrino (2015), among other authors, point to the STP as conducive to mobilizing the PI domains of (pre-service) mathematics teachers, such as conceptions and knowledge regarding the profession, autonomy, self-knowledge, emotions, and political commitment. A survey by Marins et al. (2019) indicates that the Pibid fosters moments of reflection on teaching practice, the appropriation of methodological strategies, and the integration between theory and practice, besides contributing to raising the quality of mathematics teacher education. Despite this, the same work points out that research in this field has not sufficiently explored the constitution of teachers' PI.

Teachers' PI should not be understood as predetermined by in-service or pre-service teachers' personalities or exclusively by their context; it comprises individual and sociocultural factors (Schutz et al., 2018) and is in constant movement. This movement takes place at the confluence of personal and social aspects, taking into account a set of conceptions of prospective teachers, interconnected with their self-knowledge, emotions, and specific knowledge for teaching mathematics, all this linked with their autonomy and political commitment (Cyrino, 2017, 2018, 2021).

Therefore, this article discusses actions within the Pibid and the STP that foster the movement to constitute prospective mathematics teachers' professional identity (PI). Investigating these actions can contribute to organizing and managing such contexts to value processes that involve criticality, transformation, and active participation of prospective teachers in their professional practice. It is imperative to understand these contexts so that

public policies promoting prospective teachers' central role in their professionalization process can be improved, strengthened, and valued.

The movement to constitute the professional teaching identity, the Pibid, and the Supervised Teaching Practicum

In this work, we assume Cyrino's (2021) typification of the movement to constitute the PI of teachers who teach mathematics (TTM): "A set of beliefs/conceptions of prospective teachers, interconnected with their self-knowledge, emotions, and specific knowledge for teaching mathematics, all this linked with their autonomy and with political commitment" (p. 4).

According to Cyrino (2021), the word "movement" is used due to the understanding that this identity is not predetermined, fixed, and static; on the contrary, it is continually constituted throughout life, involving its multiple domains, such as conceptions; self-knowledge; emotions; specific knowledge for teaching mathematics; autonomy (vulnerability and sense of agency); political commitment, among others. Therefore, these domains cannot be considered in a hermetic, separate, disjoint way, but rather, inseparably interconnected (Cyrino, 2017, 2018, 2021), in addition to being influenced by a range of personal, cultural, psychological, social, contextual and political factors (De Paula & Cyrino, 2020).

The mathematics teacher's knowledge is not limited to knowledge of the content; it encompasses any knowledge necessary to effectively exercise the teaching profession, including "knowing how to learn."

The way (prospective) teachers deal with this knowledge is permeated by conceptions about "mathematics, their (future) profession, what it means to be a teacher who teaches mathematics, the type of teacher they want to be, how they must teach, their role in mathematics teaching, and the learning processes" (Cyrino, 2017, p. 704) among others, arising from experiences as students, family experiences and other contexts that directly influence who they are.

Thus, discussing such conceptions connected to knowledge about the profession can contribute to professional self-knowledge and, consequently, autonomy development.

Autonomy concerns how individuals govern themselves, their freedom and ability to make decisions, make choices, conduct their actions, perform, and assume a critical character for themselves (Freire, 2000); that is, teachers' autonomy is associated with how they make their decisions regarding their profession. In teaching work, political relationships also permeate interactions with students, the context, school organization, and public educational

policies with which the teacher needs to deal. Therefore, this autonomy is related to situations of vulnerability inherent to the profession and how it seeks its sense of agency (Cyrino, 2017, 2018; Oliveira & Cyrino, 2022; Rodrigues; Cyrino & Oliveira, 2022).

We are not referring to the vulnerability that paralyzes and weakens in-service or pre-service teachers but to the one that helps them put their convictions on hold and question themselves. Such vulnerability may help them have a valuable moment of reflection. This vulnerability allows them to recognize their limitations and legitimize their actions and decisions (Oliveira & Cyrino, 2011). It is closely linked to agency, that is, how teachers act when faced with situations of vulnerability based on what they believe (Kelchtermans & Hamilton, 2004; Oliveira & Cyrino, 2011; Oliveira & Cyrino, 2022), and is practiced when teachers make choices; make decisions that affect their work; exert influence on students and peers; and reveal their professional, political, and moral commitment.

Teachers' political and moral commitment, another aspect of the TTMs' PI, involves actions aimed at social transformation, recognition of power and interest relationships, reasons that lead them to teach, teacher's moral purposes, and their responsibility to future generations. Finally, consider that every teacher's action is political and can be used to transform society.

Discussing teachers' moral and political commitment in formative contexts, associated with conceptions and knowledge, can enhance their professional self-knowledge. For Kelchtermans (2009), professional self-knowledge:

> […] refers to the understanding of one's *self* at a given moment in time (product), as well as the fact that this product is the result of a continuous process of making sense of one's experiences and impact on *oneself* [emphasis in original]. (p. 261).

The author highlights that professional self-knowledge comprises *self-image, self-esteem, perception of duties, motivation for work, and perspectives*. *Self-image* concerns how the teacher sees themselves based on their self-perception, but influenced by how others see them. *Self-esteem* refers to an evaluative component, that is, how they evaluate themselves, and once again, others' feedback is very relevant. Kelchtermans (2009) states that if, on the one hand, positive self-esteem is crucial for teachers to feel satisfied at work, on the other, negative public judgment can have a devastating impact on them, which strengthens the idea that emotions are a strong influence on teaching and TTMs' PI.

Closely linked to *self-esteem* is the *perception of duties*, namely, what the teacher or prospective teacher thinks is necessary to do a good job. Thus, once again, emotions are highlighted, given that, in this component, in-service and pre-service teachers' deepest

conceptions of what constitutes a good education, duties, and moral responsibilities towards students can be questioned. According to Kelchtermans (2009), the emotional impact is significant when such conceptions are challenged, as "teachers often feel that their moral integrity as a person and as a professional is questioned" (p. 262).

Yet, the *motivation for work* covers what leads (prospective) teachers to choose and stay in their profession, the *perspectives*, what motivates them, and their expectations for the future.

Cyrino (2017) understands that the components above highlight the complex, dynamic, temporal, and experiential character of the TTMs' PI (De Paula & Cyrino, 2020). In this sense, we reiterate that the complexity of the TTMs' PI is revealed in the tangle of its inseparable domains. Any attempt at separation is sometimes carried out in investigations for analytical purposes only.

During initial education, the movement to constitute TTMs' PI can be investigated and promoted in different contexts, such as the Pibid and the STP. Pibid was created by the Ministry of Education in 2007 and implemented by the Coordination for the Improvement of Higher Education Personnel (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Capes) in 2009 to develop relationships between the university and the school, inserting prospective teachers in the basic education classroom before taking the STP. The STP in undergraduate courses resulted from the National Education Guidelines and Bases Law (Lei de Diretrizes e Bases da Educação Nacional - LDB) n. 9394/96, and its purpose is to develop prospective teachers' practice in the classroom and provide reflections and discussions about what and how to teach based on methodological approaches and analyses of school reality.

Both fulfill the function of initiation into teaching and are intended to help undergraduate students get closer to their future workplace, know aspects of the context of action, make connections between theory and practice, reflect on the knowledge necessary to practice the profession (Rodrigues et al., 2019), and develop their professional identity (Teixeira & Cyrino, 2015).

Current investigations have discussed the role of the STP in the movement toward constituting the PI of prospective TTMs. Teixeira and Cyrino (2015), when analyzing the role of the teaching practicum guidance for the movement to constitute the TTMs' PI, highlight "the awakening of a critical sense in lesson planning, the development of a research attitude, the ability to reflect before the experience" (p. 676). Barbosa and Lopes (2020) discussed signs constituting the prospective TTMs' PI in a study group in the context of the STP. They highlighted emotional aspects, autonomy, vulnerability, and prospective teachers' political

commitment in that context. Caporale and Nacarato (2018) state that identity, created in the collective and social interactions shaped in different contexts throughout life, can be enhanced in formative spaces such as the Pibid and the STP, as they have multiple learning possibilities. When analyzing the formative contributions of the practices developed in the Pibid at a university in Bahia, França (2021) points out that the experience in everyday school life provided by the program contributed to the constitution of the TTMs' PI, enabling awareness, overcoming of gaps, and knowledge consolidation.

Aware of the potential of the STP and the Pibid for the movement to constitute the PI in initial education and the need to expand investigations in this field, we propose to research actions in the context of the Pibid and the STP that promoted the movement to constitute the prospective mathematics teachers' PI.

Research context and methodological directions

This study used a qualitative, interpretative approach with information obtained from eight prospective teachers (PT) attending the UEL mathematics teaching degree course. They were in the 3rd year of their degree and enrolled in the subject Mathematics Teaching Practice and Methodology I: Supervised Teaching Practicum (2EST314). Six undergraduates were engaged or had already been engaged with Pibid. The other two who did not participate in Pibid were chosen for the study because they were active in the discussions and presented different experiences from those who participated in the program when taking the STP.

Flávia, Talita, Wagner, and Marcele followed regular classes in Pibid, with the first three being scholarship holders for two years and Marcele for three years. Nelson was a former Pibid scholarship holder and participated in the program for a year. Breno was also a former Pibid scholarship holder and participated in the program for a month. Gabriel and Renata had not participated in the program or had teaching experience in the basic education classroom before the STP.

In this course, the Pibid was developed in five schools. The head teacher of each school (supervisor) was responsible for defining the work of the scholarship holder from their school in activities that consisted of monitoring classes, developing workshops, preparing and correcting activities, work, and assessments, and monitoring high-skills and school reinforcement groups.

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The STP had two phases,[1] which were composed of four stages: observation, preparation of workshop plans, teaching practicum, and preparation of the final teaching practicum report.

Information was collected from discussions held during subject 2EST314 classes (of STP), and semi-structured interviews with the eight PTs were recorded and transcribed[2]. To organize the interviews, we began with the PTs' written productions in the observation and conducting reports and workshop plans, and, for Pibid participants, in the portfolios delivered annually to the subproject coordinator.

To analyze the information, we defined the final reports as the primary source, which contained reflections on the prospective teachers' classes, the discussions held on during the STP, and the interviews. In the reports and verbatims of conversations and interviews, we identified the PTs' impressions[3] concerning the situations experienced during their teaching, searching for signs of the movement for the constitution of the TTMs' PI.

In the analysis section, after the excerpts, we present the PT's fictitious name, the information source (interview – I, teaching practicum report – TPR, discussion about the practicum – DP), and the date the information was obtained. In bold, we highlight the actions in the formative context that promoted the movement to constitute the PI and wove a discussion about the investigated contexts to contribute to reflections on potential formative proposals for initial education that promote the constitution of teachers' PI.

Mathematics PTs' impressions of the Pibid and STP actions

Below, we present some of the mathematics PTs' impressions regarding the Pibid and STP actions that promoted the movement to establish the PI of the investigated prospective teachers.

In the interviews, Wagner and Talita were questioned about how easy they found teaching lessons during practicum and to what they attributed that factor.

> At first, when we do not have experience teaching classes, we feel a little intimidated. After you go to the classroom and the teacher gives you this opportunity, or you force yourself to teach and face the students, you learn their manners, their way of talking.

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[1] In the 3rd year of the course (2EST314), PTs complete the practicum in elementary school - final years and in the 4th year (2EST315) in high school.

[2] Those involved in the research, aware of the process to which they would be subjected, signed a free and informed consent form authorizing us to use the information for research without deadline restrictions. The names used are fictitious to preserve the participants' identity. This research was approved by the UEL Research Ethics Committee (CAAE: 54528116.2.0000.5231).

[3] This term refers to PTs' ideas and opinions about a subject.

And this experience was valuable for teaching. When I began teaching, it wasn't my first time in a classroom; it had already happened at Pibid. (Wagner, I, 12/01/2017)[4]
I think it was the very practice of doing it. Because first, we study, but if you don't go and do it, there's no point. I had already worked on equations in Pibid. In the equation workshop plan, I had an idea of possible resolutions, of recurring errors that I saw in Pibid students. (Talita, I, 11/24/2017)

Wagner and Talita **valued their first experiences in class** for the STP actions and a teaching career. Gabriel and Renata, who did not participate in Pibid, highlighted the importance of getting to know basic education students for lesson planning, that is, to expose students' possible doubts, resolutions, and referrals the teacher can assume.

Just having contact with students, seeing how they work, and seeing that there are different lines of thought already helps to think about different resolutions. I think it would contribute more in terms of people having contact, seeing that there isn't just one resolution. Everyone thinks differently. (Gabriel, I, 11/29/2017)
[...] a teacher who has already had contact with a classroom is not naive anymore to understand students, even if only a little, to know how students will behave. Of course, it's not a rule, but I would say that it does influence it a lot. Maybe even in the teacher's confidence. (Renata, I, 11/30/2017)

From the excerpts shown, we observed that, for **the PTs, the practicum increases the repertoire of knowledge of the profession.** Moreover, teaching practice at Pibid and the STP can provide PTs with the experience of vulnerable situations during lessons, as we identified in Talita's speech.

[...] during the Pibid, we must face unexpected situations. Sometimes we go without knowing what is happening in the room. The supervising teacher cannot always tell me what she's working on, and sometimes, I don't ask either. (Talita, I, 11/24/2017)

These **vulnerable situations** regarding the content and actions to be developed in class not only provide the PTs with tools to deal with similar experiences in the future but also **allow them to operate their sense of agency** (Oliveira & Cyrino, 2011; Oliveira & Cyrino, 2022; Rodrigues, Cyrino, & Oliveira, 2022) when they, in an agile way, think, choose, and execute previously unplanned teaching strategies –which is not recommended, but that can happen.

In this regard, their testimonies show decisions made outside of planning in different contexts, referring to methodological guidelines, class organization, and personal socialization with students.

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There was no time to discuss and correct the last problem regarding the division, but when we realized that there really wasn't time, we at least submitted the formalization so that the issue wouldn't remain just for the sake of it. (Renata, TPR, 11/10/2017)

[...] we did not think that the sizes of the cutouts (of the printed problems to be used in the teaching practicum) would be small and that students sitting at the back of the room would not see their details. The moment we realized it, we asked all students to sit at the first desks in the room, and when this was not enough for them to see, we took the pictures off the board and showed them (the graphics of the problems used) one by one. (Flávia, TPR, 11/10/2017)

What surprised me was the resolutions. One student only managed to solve it as I had written in the plan. And of the possible doubts I had written, only one appeared. So it was more like improvising (discussions about resolutions with the class), wasn't it?! I moved toward what I wanted as an answer, but at that moment, I was like: "And now, what am I going to do?" (Breno, DP, 09/29/2017)

The excerpts denote the need to make decisions in unexpected situations in the two contexts investigated, showing that they are fundamental for the PTs to face such circumstances.

Flávia and Talita revealed **concern with the affective aspects** of the relationship between teacher and student in the classroom.

In the teaching practicum, I didn't have aggressive students, but I had students who didn't respect me much as a teacher. Maybe because I'm so young or maybe because I don't look like an adult. Then they wanted friendship... so I had to get around the situation. (Talita, I, 11/24/2017)

If we don't have an idea that students are different and come from different cultures and backgrounds, we may try to standardize everything and fail to "reach students" (teach them). (Flávia, I, 11/29/2017)

The affective and personal aspects of relationships with students influence PTs' work. In several situations, basic education students identify more with the Pibid scholarship holders than with their teachers. Talita, for example, says that because of her youth, the students did not see her as a teacher and tried to make friends with her. Face such a situation mobilized aspects of her PI related to affectivity and emotions since she had to manage the circumstances to be respected as a teacher and take advantage of this proximity to enhance students' learning. Noting this identification, reflecting on the limits and benefits for the subject's learning can allow the PTs to start their careers with a close look at these emotional aspects in class.

Kelchtermans and Hamilton (2004) argue that emotions "are not simply a matter of personality or idiosyncratic teaching style, but constitute a fundamental aspect of [teaching] work" (p. 789) and go beyond the discussion about nervousness and lack of confidence in the classroom. With this, we infer that **identification between students and scholarship holders**

and prospective teachers can make it possible for the latter **to get to know them better and reflect on emotional aspects of teaching practice,** enabling the use of this knowledge to **reliably identify students' cognitive and relational demands.**

Another aspect considered by the PTs in the discussions and interviews was their concern for student learning.

> Before, I helped my colleagues in the classroom very much. I always gave them answers, or said "do this way, so you get the answer". I wasn't teaching them, right?! I was just passing along the answer. Later, when I started working as a teacher, students came to ask questions, and I thought, "I can't answer because I won't be teaching." This happened at Pibid. During this month that I participated in Pibid, I changed many things that I believed before. I thought teaching was just about coming up and tell the student: "do it like this. That is the answer. It is correct ". You have to make them understand and really teach them. The teacher must be there as a mediator. (Breno, I, 12/05/2017)
> In Pibid, I have experienced the importance of making students understand the entire process. It's no use just "throwing it" on the board, or even when you try to teach, the student must understand the entire process, and from the beginning. (Marcele, I, 12/07/2017)

From the previous excerpts, we infer that the PTs realized **aspects of teaching behaviors** in the teaching process that may favor student learning, such as not giving ready answers and having a plausible explanation that supports what is being taught. Therefore, **reflections triggered by situations experienced in the Pibid and STP** led the PTs to modify their conceptions and rethink, confirming or not aspects of their social function and their political commitment as teachers.

Regarding teaching behaviors, Wagner and Talita also perceived group work as an opportunity to encourage students' proactivity, making them more involved in building their knowledge and facilitating the teacher's work in large classrooms.

> Whenever I worked in a team, it was easier... I think that contributed to me knowing how to approach them with questions. (Wagner, I, 12/01/2017)
> I really like putting them in groups, because they exchange ideas and sometimes one student understands what the other says and not the teacher. (Talita, I, 11/24/2017)

In this conception, teachers and students work together, and learning occurs collaboratively. Like this, **experiencing different teaching methodologies in Pibid and STP** may help students reflect and modify or consolidate their conceptions regarding the effectiveness of some actions in the classroom, knowing their positive and negative points in practice.

I had never thought about analyzing my own class, analyzing positive and negative aspects. I never had that line of thinking, it came during my undergraduate studies. My formation will help me be a much more focused teacher, with greater interest and desire to do the best for my students... So, for my education, I think it helps me become a more critical, more dedicated teacher. (Gabriel, I, 11/29/2017)

When we write the final teaching practicum report, we give a "general" idea of everything we did. But we have to think about what we could have done, what we shouldn't have done, and things that will interfere with our practice. For example, if I had explained something in one way and then realized that it wasn't the best way for that room, and I realized that it wasn't such a good thing for any room, maybe it would be something I wouldn't do anymore. Think about failures so that in the next opportunities, I can avoid them. (Flávia, I, 11/29/2017)

From what the PTs stated, we infer that reflecting on their practice in preparing the STP reports made them realize the importance of reflection regarding actions in the classroom, teaching strategies, students' doubts, records on the board, and other aspects of a teacher's daily life. This critical reflection (Muir & Beswick, 2007) is relevant for the teacher to develop self-critical work and, based on it, (re)constitute their practice.

The excerpts presented above allow us to identify that the PTs consider that critical teachers who reflect on their practice develop more effective work within what they believe to be the teacher's professional and political commitment. Therefore, besides mobilizing aspects of professional and political commitment, **preparing reports on activities carried out** may encourage PTs' autonomy and self-knowledge, fundamental aspects of their PI.

Motivation with work is one of the aspects of self-knowledge presented by Kelchtermans (2009) and one of the signs that PTs are excited about choosing their profession. In the mathematics teaching degree, wannabe teachers often give up right at the beginning when faced with mathematics subjects in higher education.

I never had any doubts (about being a teacher). But I didn't know how much I would enjoy being there teaching the students. Normally, the difficulties of college make us doubt it (about being a teacher or not). Just like many people in the 2nd year who are finding it difficult, and say, "I think I'm going to stop; I don't think that's it." This doubt is caused by the difficulty of graduation, not by enjoying being a teacher. (Renata, I, 11/30/2017)

After saying this, Renata was questioned whether contact with the classroom before the STP contributed to a positive reaction to these graduation difficulties.

I think that perhaps the person would already be assured that it is what they want. That they don't see themselves in anything else. A person who has never had contact (with the classroom), working with someone who has already had it, for example, someone who knows how it works, it is very important... It's difficult to deduce this, but I think that if I had had contact before, perhaps it would have given me more strength, as long

as I had enjoyed it in the same way as I enjoyed the teaching practicum. (Renata, I, 11/30/2017)

Based on Renata's statements, we infer that **contact with the classroom** confirms, or not, the choice of the profession, as the PTs deal with the reality of what they will do in their professional practice.

> Having contact with students in their first years of graduation sometimes reinforces the idea of seeing whether you really want to be a teacher. I have friends who began a mathematics teaching degree and then changed to a research degree because when they entered Pibid or PSS[5], they saw that it was not what they wanted. (Nelson, I, 12/08/2017)
>
> I wanted to be an independent teacher at a pre-university course, which was my focus. And now, I decided to work with children. Before, I had no doubts about my profession, but during the teaching practicum, my opinion took a different path. (Gabriel, I, 11/29/2017)

For them, contact with the classroom Pibid offered, in Nelson's case, and in the STP, strengthened their choice of profession. Having not participated in the Pibid, Gabriel could outline his choices during the STP. These formative programs serve as motivation so that the PTs do not give up when confronted with difficulties during the undergraduate course.

Pibid and the supervised teaching practice actions and the movement to constitute prospective teachers' professional identity

In Table 1, we associate Pibid and STP actions with the movement for the constitution of the investigated PTs' PI. The fragmentation of the PI domains in the table above is only for analysis, but in the complexity of the PI, they are entangled and inseparable. The actions in Pibid or the STP can encourage PTs in different ways and mobilize different domains of their teaching PI.

Table 1.

Pibid or STP actions that promoted the prospective mathematics teachers' PI

Actions within the Pibid or STP	Mobilization of the domains of teachers' PI
Experiencing their first experiences as a teacher.	Modifies and expands the repertoire of *knowledge of the profession.*

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[5] Nelson refers to the Simplified Selection Process (Processo Seletivo Simplificado - PSS) in Paraná, which selects teachers to teach in public schools in the state, replacing the lack of public candidates.

Experiencing situations of vulnerability and operating their sense of agency.	Experiences in dealing with situations of *vulnerability* and operating with *a sense of agency*.
Experiencing teaching methodologies different from directive teaching.	Modifies or consolidates *conceptions* regarding the profession.
Reflecting and discussing teaching behaviors in the teaching process.	Manifests aspects of *political and professional commitment* and *conceptions about the teaching profession*.
Getting to know basic education students and identifying their cognitive and relational demands.	Concerns the *affective* and *emotional* aspects inherent to the teacher and student relationship.
Reflecting on their teaching practice by preparing reports on the activities carried out.	*Autonomy, self-knowledge, professional, and political commitment.*

Some actions carried out by PTs in the STP are closely related to what they developed in the Pibid. This program was created as an additional formative space, and it becomes even more relevant because it was established at the beginning of the degree, allowing PTs to experience their future work environment even before the STP, scheduled for the second half of the course. Gabriel and Renata did not participate in the Pibid and were only encouraged to reflect on aspects of teaching professionalization during the STP.

Experiencing their first experiences as a teacher allowed PTs to modify and expand their repertoire of knowledge of the profession, which gave them access to understandings that, sometimes, when discussed in initial education, are very distant from school reality. This experience requires special attention to their future professional practice, an observation that is not merely skimming but watching intentionally to provide the PTs with learning that will support their future practices (Teixeira & Cyrino, 2015). It also requires stopping to think, look, listen, think, and feel; suspending, even if temporarily, some of their certainties and desires; suspending the automatism of action; cultivating encounter, attention, and care for the learning

of others (students and teachers). This can be a fruitful space for connecting theory and practice (Leite & Passos, 2020), university and school.

This knowledge of the profession can also be constructed or mobilized as PTs may **experience situations of vulnerability and operate their sense of agency**. We are not talking here about the vulnerability that paralyzes and weakens; instead, we are talking about the one that causes PTs to stop for a few moments and operate their sense of agency so that it can justify their decision-making mediated and legitimized by their peers, as discussed in Oliveira and Cyrino (2011) and Oliveira and Cyrino (2022).

The Pibid and the STP helped the investigated PTs deal with vulnerabilities that often cannot be predicted. For example, when a PT did not access the responsible teacher's lesson plan in advance or when he was confronted with a student's unexpected question. Some vulnerabilities can be predicted and mitigated in the Pibid and the STP, such as the first above, which can be overcome with adjustments in management and communication between those involved in the projects. Others cannot always be anticipated, like the second example. Therefore, PTs must be given tools to deal with similar situations in the future; that is, they should experience those situations while still in initial education and have support from their peers to reflect and come up with possible solutions. The search for mediated agency can potentially foster autonomy and, consequently, the movement to constitute their PI so that they can prepare for their future professional activity.

When operating with a sense of agency, PTs often make decisions based on their conceptions of the profession. In interactions with peers, this agency can be mediated through discussions and reflections that can reveal aspects of their professional, moral, and political commitment. Such aspects are also revealed when PTs plan and **experience teaching methodologies different from directive teaching** as a teacher, reflecting and justifying their methodological choices with a focus on the effectiveness of the work to be carried out and the commitment to their profession.

For such experiences to be possible, during initial education, PTs must study and discuss methodological strategies different from directive teaching and go through situations

that give them the confidence to do something that, often, is opposite to what they experienced in the condition of basic education students.

The **reflections and discussions held on teachers' behaviors in the teaching process** and the possibilities of actions to be developed with students in the Pibid and the STP are useful for PTs to express their conceptions and modify them according to their experiences in the classroom. Discussing teachers' professional, moral, and political conceptions and commitments is essential for initial education, and the activities developed in the Pibid and the STP can serve as a channel for opening this debate. These discussions may foster the movement for the constitution of the TTMs' PI and lead to less vulnerable future actions regarding its social functions and responsibilities towards students, schools, the community, and future generations.

The responsibility for student learning highlights the creation of an emotional bond inherent to the teaching profession. According to Kelchtermans and Hamilton (2004), emotions are "[...] a central part of teaching and becoming a teacher, as the work requires high commitment and personal involvement" (p. 798). The Pibid and the STP can lead PTs to **get to know basic education** students. In many cases, some closeness in the relationships can help them identify **students' cognitive and relational demands** and awaken greater sensitivity to affective and emotional aspects that permeate the profession.

It is undeniable that the initial education period is full of positive and negative emotions, which will generally be far from those experienced by the (prospective) teacher in the classroom, in direct contact with students. For initial education courses, the Pibid and the STP are fertile spaces for proposing discussions on the affective and emotional aspects, which are sometimes neglected. By enabling prospective teachers to understand their complexity, these spaces may allow for reflection on "emotional, moral, and political issues," fostering "a commitment to action and transformation that involves different agents, such as the school, the university, and prospective teachers." (Rodrigues & Cyrino, 2023, p. 18).

Understanding the complexity of the emotional domain of the TTMs' PI constitution movement is fundamental for us to think about public and formative policies that contribute to an education in which teachers can experience the profession and not just survive it, exercising

it to enhance teaching and learning processes and contribute to the creation of a fair and supportive society, not falling ill or giving up when faced with adverse situations.

Another emotionally charged aspect is the confirmation of adherence to the profession, which can be based on experiences at the Pibid and STP. Such spaces can make PTs feel they belong to a social group and identify with this professional activity (Caporale & Nacarato, 2018). This confidence in choosing a profession reveals traits of PTs' professional self-knowledge, especially concerning self-image, motivation for work, and future perspectives (Kelchtermans, 2009).

Preparing reports on activities carried out in the Pibid and STP can promote self-knowledge, reflections on emotions, and moral and political commitment (Rodrigues & Cyrino, 2023) and the culture of writing in initial education, which is still considered a gap in many courses (Leite & Passos, 2020). Writing reflectively about experienced situations shows potential for self-knowledge, the domain of the TTMS' PI, which, if discussed and problematized in the formative processes, may contribute to enhancing the future teaching practice of undergraduates. Considering the discussions and problematizations of this knowledge in initial education is an added value for the formation of a teacher who aims, in his practice, to collaborate in breaking existing structures of inequality, injustice, and oppression (Kelchtermans & Deketelaere, 2016).

Furthermore, the preparation of reports can favor PTs' exercise of autonomy and professional and political commitments, domains of the TTMs' PI that, when problematized in initial education, can contribute to the formation of a teacher aware of their social function and the tools available in their work to fulfill it.

Based on what has been said, the Pibid and STP constitute fertile grounds for the discussion in mathematics teaching degree courses of domains that constitute the TTMs' PI, conceiving the (prospective) teacher as a complex and singular being.

Final considerations

The actions developed at the Pibid and STP – living first experiences as teachers; experiencing situations of vulnerability and operating with a sense of agency; experiencing teaching methodologies different from directive teaching; reflecting on teaching behaviors in the teaching process; getting to know basic education students and identifying their cognitive and relational demands; and preparing reports on the activities carried out– make these spaces suitable places for the movement of establishing the PTs' PI.

Such actions can also be considered based on initial education proposals that take into account the connection between theory and practice; studies and discussions on different methodological teaching strategies; problematizations of teachers' social roles and their responsibilities towards students, parents, schools, and future generations; emotional aspects of the teaching profession; spaces for reflection on professional self-knowledge; and commitment to management that seeks to overcome gaps still present at this formation stage (Leite & Passos, 2020).

Therefore, in teaching degree courses, we must think about and organize spaces that allow for actions and discussions that consider PTs in constant formation and constitution of their PI, taking into account their complexity, temporality, experience, and dynamism. To this end, the formative process should be less fragmented, watertight, and focused on disciplinary content. Thus, we seek, as a mathematics education community, to allow PTs to understand that their future performance will not only be technical but endowed with complexities and specificities that also take into account the emotional aspects inherent to the profession (Kelchtermans & Deketelaere, 2016; Rodrigues & Cyrino, 2023).

As a limitation of this study, we highlight the temporal aspect, and we suggest that future work focuses on investigating the TTMs' PI in other contexts, highlighting the relevance of their experiences and reflections for the exercise of the profession at the beginning of teaching.

Our study reinforces the need to think about and value public policies, such as the Pibid and initial education courses for mathematics teachers that foster –not only in the STP– alternative education to those centered on disciplinary knowledge, seeking to expand spaces in which prospective teachers can be and feel before all the complexity of the movement to constitute their PI.

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