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The professionalization of teachers in Brazil: scenarios and challenges in/for Mathematics teacher education

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Abstract: This article seeks to problematize the scenario of basic school teachers' education (BSTE) established in Brazil over the last decades, as well as the shortage of teachers, and to bring to the debate the need to value research, programs, and projects that foster the proposal of public policies for BSTE that promote teacher professionalization. To this end, this article has a reflective and interpretative approach, based on a diachronic movement of research and evidence arising from formative processes. Brazil is experiencing a shortage of teachers and students in teaching degree courses, this situation needs a national pact to reverse the problems plaguing BSTE and teacher professionalization, a pact committed to an emancipatory, inclusive, socially referenced, environmentally responsible and ethical education, and to the construction of a society that combats inequalities and promotes equity and teacher appreciation.

Keywords: Mathematics Teacher Education. Professionalization of Teachers. Professional Identity.

La profesionalización de los profesores en Brasil: escenarios y desafíos en/para la formación de profesores de Matemáticas

Resumen: Este artículo busca problematizar el escenario de la formación de profesores de escuela básica (FPEB) establecido en Brasil durante las últimas décadas, así como la escasez de docentes, y traer al debate la necesidad de valorar investigaciones, programas y proyectos. que fomenten la propuesta de políticas públicas para el FPEB que promuevan la profesionalización docente. Para ello, este artículo tiene un enfoque reflexivo e interpretativo, basado en un movimiento diacrónico de investigaciones y evidencias surgidas de procesos formativos. Brasil vive escasez de docentes y estudiantes en carreras de magisterio, esta situación necesita un pacto nacional para revertir los problemas que afectan al FPEB y la profesionalización docente, un pacto comprometido con una educación emancipadora, inclusiva, socialmente referenciada, ambientalmente responsable y ética, y con la construcción de una sociedad que combata las desigualdades y promueva la equidad y el reconocimiento docente.

Palabras clave: Formación de Profesores de Matemáticas. Profesionalización de los Docentes. Identidad Profesional.

Profissionalização docente no Brasil: cenários e desafios na/para formação de professores de Matemática

Resumo: Neste artigo, busca-se problematizar o cenário de formação de professores para atuar na Educação Básica (FPEB) instituído no Brasil ao longo das últimas décadas, assim como a escassez de professores, e trazer para o debate a necessidade de valorizar investigações, programas e projetos que fomentem a proposição de políticas públicas de FPEB que promovam a profissionalização docente. Para tanto, este artigo tem uma abordagem reflexiva e interpretativa, assente em um movimento diacrônico de pesquisa e de indícios decorrentes de

processos formativos. O Brasil vive um apagão de professores e de alunos nos cursos de licenciatura e, para reverter esse quadro, é preciso estabelecer um pacto nacional no enfrentamento aos problemas que assolam a FPEB e a profissionalização docente. Um pacto comprometido com uma educação emancipatória, inclusiva, socialmente referenciada, ambientalmente responsável, ética, e com a construção de uma sociedade que combata as desigualdades e promova a equidade e a valorização docente.

Palavras-chave: Formação de Professores de Matemática. Profissionalização Docente. Identidade Profissional.

1 Introduction

Discussing teacher professionalization in Brazil is a challenge, both due to the contradictions inherent in teacher education policies and the fact that this education and the teaching career are the stage for intense ideological and political disputes. Although our federative system seeks to decentralize decisions, the legislation suggests a centralization of the Federal Executive regarding policies for basic school teachers' education (BSTE), considering that most approved laws (decrees, ordinances, resolutions) are the initiative of the executive branch without the need to be processed in the National Congress.

The legal guidelines that regulate the BSTE in Brazil since the Lei de Diretrizes e Bases da Educação — LDB 9394/1996 [Education Guidelines and Bases Law] (Articles 61, 62, and 63, which specifically refer to the BSTE) do not consolidate a State policy. In this way, the country continues with specific government actions without guarantees of continuity in future governments, as we have seen in recent years with increasingly severe cuts in education.

Emergency policies, which should be temporary, are sometimes the main intervention strategy of public authorities, as is the case with teaching degree courses in the distance learning (DL) modality. Although the law foresees that teacher education must preferably be in person, there are still many courses in this modality. According to data from Inep, in 2022, 65% of those completing teacher education courses chose to take DL courses, registering a significant increase of 119% compared to 2012.

It is imperative to recognize the need for measures that consolidate teaching professionalization and propose a solid and articulated system to qualify and value educators. Teacher appreciation is directly associated with the professionalization process, which involves remuneration, public perception of teachers' roles, accreditation, collaboration, professional development, school culture, and autonomy, among other aspects.

In recent years, Brazil's teachers, education, and science have been facing challenges that are impacting the country's development. Teachers' downgrading goes beyond low salaries; it involves precarious working conditions (overcrowded classes, lack of teaching resources, inadequate infrastructure, misuse of functions), violence and insecurity, intimidation, political and ideological pressures, and lack of autonomy. Significant cuts in budgets allocated to education, from basic education to public universities, have harmed the quality of teaching and academic research by scrapping the physical structure, working conditions, and professional development. Scientific denialism, with the dissemination of misinformation on topics such as climate change, vaccines, and pandemics, undermines trust in science and the scientific method. Political interventions in research funding bodies and universities have interfered with academic autonomy and promoted the precariousness of research, the "brain drain," compromising fundamental advances in several areas of knowledge. The internal attacks on education and science reflect a complex scenario of downgrading and challenges –but of

resistance and search for solutions, such as those implemented last year[1].

In this article, we problematize the BSTE scenario established in Brazil over the last few decades, the shortage of teachers, and some public policies and programs aimed at teacher education. Moreover, we bring to the debate investigations carried out by the Grupo de Estudos e Pesquisa sobre a Formação de Professores que Ensinam Matemática (Gepefopem) [Studies and Research Group on the Education of Teachers who Teach Mathematics] which highlights the need to value programs and projects that promote teacher professionalization.

2 Current scenario of teacher education in Brazil and the shortage of teachers

Over the last twenty-two years, the Resolutions that establish the Diretrizes Curriculares Nacionais (DCN) [National Curriculum Guidelines] for the initial education of basic education teachers, published by the Conselho Nacional de Educação (CNE) [National Education Council] (CNE/CP Resolutions n. 01/2002, n. 02/2002, n. 01/2006, n. 02/2015, n. 02/2019 and n. 04/2024), reflect different views on teacher education, which influence the curriculum and pedagogical projects adopted in higher education institutions, and the disputes present in civil society and the State. The teaching territory has been invaded by different groups, whether linked to education or not.

Since Resolutions CNE/CP n. 01/2002 (Brasil, 2002a) and n. 02/2002 (Brasil, 2002b), we observed advances, tensions, and contradictions within the scope of teacher education policies. We consider as advances the presence of professional practice in initial teacher education to break with the tradition of the *3+1* model so that teaching degree courses take on their own identity; the proposition of practice as a curriculum component from the beginning of the course, apart from *teaching practice* and *supervised practicum*, with the principle of inseparability between theory and practice; the search for an articulation between the mathematical contents that the prospective teacher will teach and appropriate strategies for the learning of basic education students, considering their diversity and age groups.

On the other hand, some tensions have been observed, with a tendency towards a certain degree of generality in teacher education and an emphasis on practice and the concept of competence (with the principle of articulation between education and the market), with epistemological guidelines that made it possible to neglect fundamentals of the educational knowledge in curriculum designs. These aspects strengthened again with CNE Resolution n. 02/2019 (Brasil, 2019), which "Defines the National Curriculum Guidelines for the Initial Education of Basic Education Teachers and establishes the Common National Base for the Initial Education of Basic Education Teachers (BNC-Formação)". This resolution confirms yet another process of downgrading and precariousness of the BSTE, evidenced in the epistemological, curriculum, and professionalization fields.

> In the epistemological field, the teacher is understood as a consumer/implementer of knowledge produced by other educational agents. There is an attempt to standardize the curricula of the education courses for basic education teachers, an emphasis on the pedagogy of competencies, a disruption of the theory-practice unit, and fragmentation of teacher knowledge, by breaking with the perspective of organicity between initial and continuing education. In the professionalization field, the teachers are held individually responsible for their education and professional development. (Cyrino &

[1] For example, the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) [National Council for Scientific and Technological Development] launched the Programa de Repatriação de Talentos – Conhecimento Brasil [Talent Repatriation Program] in April 2024. This program aims to attract Brazilian scientists who are abroad back to the country.

Grando, 2022, p. 1)

CNE Resolution n. 02/2019 (Brasil, 2019) meant a setback to the significant advances achieved with CNE Resolution n. 02/2015 (Brasil, 2015), which had been received by academia as a remarkable achievement in education, as the text includes concepts historically defended by different entities and researchers in the education field. CNE Resolution n. 02/2015 (Brasil, 2015) gave greater organicity for the education of basic education teaching professionals, with National Curriculum Guidelines for initial education at higher education level (teaching degree courses, teaching education courses for graduates, and second teaching degree courses), and continuing education. It indicates the development of an institutional teacher education project by qualification institutions that articulate initial and continuing education involving the university and basic education. We observed in the text aspects related to the valorization of education professionals, considering a conception of education based on an emancipatory and permanent process, with knowledge that meets social diversity, the pedagogical act in its complexity, and the cultural and political implications, with the recognition of the teaching work specificity. The curriculum proposal in this resolution broke with the logic of competencies present in the set of post-LDB/1996 guidelines and brought to the debate topics dear to the teaching profession, such as pedagogical issues, educational management, and themes involving the diversity of subjects, cultures, and knowledge in the school context.

With the approval of the Base Nacional Comum Curricular (BNCC) [National Common Curriculum Base] in 2017, part of the group that was in the Ministério da Educação [Ministry of Education] in the 1990s returned to the government in 2016, within the scope of the MEC and the CNE, with a privatist and little dialogic bias, rescued the concept of competence as a pedagogical-curricular foundation, and dichotomized initial education from continuing education with the publication of CNE Resolution n. 02/2019 (Brasil, 2019). This resolution was published at the end of 2019 with an imposing and authoritarian practice, without any dialogue with university institutions, scientific associations in the educational field, and entities representing teachers.

At the end of May 2024, CNE/CP Resolution n. 04/2024 (Brasil, 2024) was published after several manifestos, motions, and letters triggered by CNE/CP Resolution n. 02/2019 (Brasil, 2019). That resolution provides, also superficially, for "the Diretrizes Curriculares Nacionais para a Formação Inicial em Nível Superior de Profissionais do Magistério da Educação Escolar Básica [National Curriculum Guidelines for the Initial Education at a Higher Education Level for Basic School Teaching Professionals (teaching degree courses, teaching education courses for non-graduates, and second teaching degree courses)". There was no public hearing to listen to and debate with civil society, only a public consultation in December 2023 and January 2024, when the category is traditionally demobilized (end-of-year parties, holidays, for example). This new resolution seems to be a *patchwork quilt* with various concepts and guidelines that make up both resolutions that preceded it (CNE/CP Resolutions n. 02/2015 and 02/2019), without any connection between foundations and formative principles. For example, the resolution keeps the Cores[2] with workloads similar to that set out in CNE Resolution n. 02/2019, emphasizing *Core II — Learning and Deepening of Specific Contents of Areas of Professional Activity*. Will it be a remake of the 3+1 model? Or is there another conception of what is considered specific content in teacher education?

[2] Core I — Estudos de Formação Geral [General Education Studies] (880 hours); Core II — Aprendizagem e Aprofundamento dos Conteúdos Específicos das áreas de atuação profissional [Learning and Deepening of Specific Content in Areas of Professional Activity] (1,600 horas); Core III — Atividades Acadêmicas de Extensão [Academic Extension Activities] (320 hours); and Core IV — Estágio Curricular Supervisionado [Supervised Practicum] (400 hours).

Despite considering as a principle of the BSTE the articulation between theory and practice "from the mobilization of scientific, pedagogical, aesthetic, and ethical-political knowledge, ensured by the inseparability between teaching, research, and extension and by the insertion of teacher degree students in basic education institutions, privileged space of teaching praxis" (Brasil, 2024a, p. 3), we did not observe any mention of practice as a curriculum component (PCC). Core III refers to 320 hours of academic activities of extension (AAE) to be developed in basic education institutions, linked to curriculum components from the beginning of the course, with guidance, monitoring, and assessment by a higher education institution (HEI) teacher educator. We cannot affirm that there is a relationship between AAE and PCC. In other words, can we say that AAE replaced PCC? The extinction of the 400 hours of PCC seems like a setback, as theory and practice were conceived as a unit, considering action-reflection-transformation. It is a mistake to understand that extension is restricted to schools since, in CNE/CES Resolution n. 07/2018, extension is considered an "interdisciplinary, political, educational, cultural, scientific, technological process that promotes transformative interaction between higher education institutions and other sectors of society, through the production and application of knowledge, in permanent articulation with teaching and research" (Brasil, 2018, p.1-2). There is also no reference to academic-scientific and cultural activities.

Another change observed in CNE/CP Resolution n. 04/2024 (Brasil, 2024a): in teacher education courses (teaching degree and pedagogy) in the DL modality, DL can occupy up to 50% of the course load. The resolution establishes that in this modality, the supervised practicum (SP), extension activities, and at least 880 hours of Core II with specific content from the teaching degrees must all be held in person. Currently, DL students can attend 100% of learning classes and deepen specific content remotely. This change may have been caused by complaints indicating that limited interactions impoverish the exchange of experiences, collaborative learning, and other classroom practice experiences (beyond the SP). In the current scenario of the DL teaching degree, only the SP is entirely face-to-face.

Different from what CNE/CP Resolution n. 02/2015 (Brasil, 2015) recommends, Resolution n. 04/2024 (Brasil, 2024a) does not deal with continuing education nor present an understanding of teacher appreciation. There is no connection between initial and continuing education and teaching work. Finally, we are once again presented with a new resolution with many gaps, contradictions, and tensions.

In the name of *quality of education*, we observe its dismantling and, consequently, in teacher education courses, with curricula that break with a humanist and civic perspective and promote a movement to downgrade the teaching profession. This movement can be observed not only through CNE/CP Resolutions n. 02/2019 (Brasil, 2019) and n. 04/2024 (Brasil, 2024a), but also due to low salaries (absence of a career plan, non-implementation of the national salary floor), precarious working conditions, the lack of public competition, the compromise of the teacher's mental health, the mischaracterization of teachers' role (as they must assume different roles), and the constant attacks on education and science professionals experienced in recent years, among other aspects.

This downgrading movement has contributed to the shortage of teachers in Brazilian basic education, known as the *teaching blackout*, and to the low demand and retention of students in degree courses, called the *teaching degree blackout*. The shortage of teachers in basic education has been getting worse in recent years. Between 1970 and 2000, the shortage of teachers was mainly related to a boost in the number of schools, triggered by Law n. 5692/71, which had the slogan *school for all*. Today, this shortage is directly tied to teachers' downgrading.

According to research by the Semesp Institute[3] released in 2022, the number of teaching degree graduates who are working as teachers has clearly decreased. In 2010, 42.5 thousand teaching graduates were working as teachers, while in 2021, this number was 32.8 thousand. This reflects a worrying trend: even with an significant number of graduates, few are interested in a teaching career. The number of middle school teachers fell from 779 thousand to 753 thousand from 2016 to 2021; in high school, it fell from 520 thousand to 516 thousand in the same period. An alert regarding the *teaching blackout* had already been announced in the report produced by the Câmara de Educação Básica do Conselho Nacional de Educação (CNE) [Basic Education Chamber] in 2007.

Considering that only 29.3% of the teaching degree graduates worked as teachers in 2021, we observed many unqualified teachers teaching classes. For example, in mathematics, in 2021 in Maranhão, only 38.5% of middle school teachers were qualified.

According to the indicator of the adequacy of teacher education (Chart 1) in the technical summary of the basic education 2022 school census (Brasil, 2023a), referent to mathematics, only 65.3% of the middle school classes are served by teachers with adequate education (Group 1), 0.9% of Group 2, 24% of Group 3, 2.1% of Group 4, and 7.7% of Group 5.

Chart 1: Categories of adequacy of teacher education related to the subject they teach

Group	Description
1	Teachers with a higher education teaching degree in the same subject they teach or a research degree in the same subject with a completed pedagogical complementation course.
2	Teachers with a research degree in the corresponding subject but without a teaching degree or pedagogical complementation.
3	Teachers with a teaching degree in an area other than that in which they teach or with a research degree in the subjects of the common curriculum base and pedagogical complementation completed in an area other than that in which they teach.
4	Teachers with other higher education degrees not considered in the previous categories.
5	Teachers without a higher education degree.

Source: Nota Técnica n. 020/2014 (Brasil, 2014, p. 5)

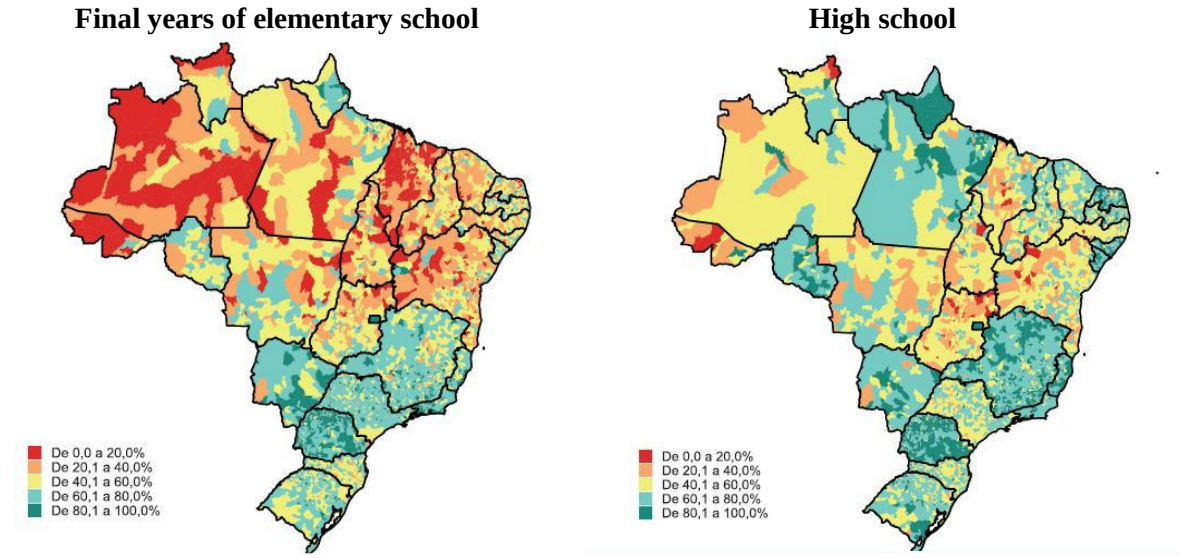
The indicator of adequacy of teacher education in mathematics in high school is slightly better than in middle school. We observed that 79% of the classes are taught by teachers from Group 1, 1.1% from Group 2, 14.5% from Group 3, 2.5% from Group 4 and 2.9% from Group 5.

In the North, Northeast, and part of Central-West, a notably lower percentage of subjects in middle school are taught by teachers with adequate education (Group 1). Regarding high school, the percentage of subjects taught by appropriately qualified teachers (Group 1) per municipality shows no clear patterns in the country's regions. We observed that the five highest percentages are in the states that represent the five large brazilian regions: Amapá (87.4%), Federal District (87.1%), Paraná (83.4%), Espírito Santo (83.2%) and Sergipe (79.6%).

Figure 1 shows the percentage of subjects taught by teachers with adequate education (Group 1) per municipality.

[3] https://www.semesp.org.br/

Figure 1: Percentage of subjects taught by teachers with adequate education (Group 1 of the indicator of the adequacy of teacher education) by municipality – Brazil – 2022 and by the level of education



Source: Censo escolar da Educação Básica 2022: resumo técnico (Brasil, 2023a, pp. 45, 48)

However, the lack of teachers is unrelated to the lack of seats in teaching degree courses. Data from Inep's latest higher education census, released in 2022, shows that the number of entrants into in-person teaching degrees has decreased since 2014. According to Inep sociologist Luiz Carlos Zalaf Caseiro, in an interview with Revista Pesquisa FAPESP (Queiroz, 2023, p. 4), from "2014 to 2019, the idle rate of teaching degrees in public institutions was around 20%, while in 2021 this percentage rose to 33%. [...] Mathematics teaching degrees in public institutions in face-to-face format registered 38% of unfilled vacancies in 2021". In addition to the low demand, we observed a lack of adherence, increasing a *blackout in teaching degrees*. From 2012 to 2021, the accumulated dropout rate from the mathematics course (teaching degree) was 68%, the highest after the physics course (72%).

The data reinforces the urgent need for public policies valuing teaching professionalization, offering better education, working conditions, and adequate incentives. Without these efforts, the quality of education in Brazil could continue to deteriorate, negatively impacting the country's social and economic development.

3 Public Policies and Teacher Education Programs

To mitigate some of the problems associated with the education and shortage of teachers we reported before, Brazil implemented some public policies and programs aimed at initial and continuing teacher education, such as the Programa Institucional de Bolsa de Iniciação à Docência (PIBID) [Institutional Teaching Initiation Scholarship Program], Residência Pedagógica [Pedagogical Residency], Programa de Apoio à Formação Superior e Licenciaturas Interculturais Indígenas (ProLind) [Support Program for Higher Education and Intercultural Indigenous Teaching Degrees], Programa Nacional de Formação de Professores da Educação Básica (Parfor) [National Basic Education Teacher Education Program], Universidade Aberta do Brasil (UAB) [Open University of Brazil], Programa Nacional de Alfabetização na Idade Certa (PNAIC) [National Literacy Program at the Right Age], Pró-Letramento [Pro-Literacy], Cursos de Formação Continuada em Rede (Plataforma Freire) [Continuing Education Courses], and postgraduate programs in teaching and education, among others.

However, the effectiveness of these initiatives depends on efficient implementation, adequate funding, and continued support from various spheres of the government. For those

policies and programs to be characterized as State policy, they must be permanent, not dependent on mere vacancies announced in temporary notices.

For example, Pibid and the Pedagogical Residency Program are programs that encourage the guided and supervised initiation into teaching by allowing students in teaching degree courses to be inserted into the daily life of public basic education schools so that they can participate in methodological experiences and develop teaching practices in those schools. Those programs are promoted by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Capes [Coordination for the Improvement of Higher Education Personnel] and have been constituted as spaces for struggle and resistance to maintain initial teacher education. The new Pibid Notice n. 10/2024 was launched at the end of May 2024, expanding the offer of scholarships (80,040 scholarships) and directing some seats to subprojects that serve literacy teachers, field education, quilombola education, Indigenous education, bilingual education for people with hearing impairments, and special education (Pibid Equidade). In this notice, the program resumes some aspects of its original format, such as including students from all semesters of teaching degree courses (incorporating the Pedagogical Residency Program).

However, Section 13 of the final provisions of that notice states that "Capes may cancel the granting of the funding referred to in this notice during the execution of the project, in the duly justified cases of the occurrence of unforeseeable circumstances or reasons of greater force, without harm to other applicable measures, except for acquired rights" (Brasil 2024b, p. 11).

Programs such as the Pibid must seek to guarantee continuity and universal access for students and teachers of teaching degrees. This access can be promoted through scholarship support, covering graduates and professors passionate about academic research and those who need to prepare to face and combat social inequalities present as micro-universes in each classroom. It is also essential to provide opportunities to create proposals aligned with the interests and needs of states and municipalities.

When we defend the existence of public policies for teacher education, we refer to permanent and comprehensive actions by public authorities, which consider the accumulated discussions/investigations in order to combine the reading technical capacity of formative processes with the possibilities of intervention policies, taking them as parts of the same process. Developing intervention strategies by the State requires a meticulous process involving formulation, planning, management/execution, and evaluation of proposed actions. The lines of collective actions must consider social rights declared and guaranteed by law.

Since 2023, Bill n. 3824/2023, proposed by Senator Flávio Arns, which establishes a "Política Nacional de Indução à Docência na Educação Básica" [National Policy for Induction into Teaching in Basic Education], has been pending in the Chamber of Deputies. Art. 5 of that bill foresees federated entities may adopt measures such as:

- I – the development of public campaigns, especially in colleges and universities, to promote and disseminate, among undergraduates, the characteristics and financial and intellectual benefits of the teaching career, minimum salary, and professional development perspectives, among others;
- II – the structuring of spaces for reception, integration, and coexistence of undergraduates with basic education teachers in schools, including moments of experience with students;
- III – the establishment of mentoring programs involving experienced teachers from basic education schools and undergraduates;

- IV – the involvement of undergraduates in research and extension activities in basic education schools;
- V – the inclusion of undergraduates in school transformation efforts;
- VI – the improvement of selection examination and recruitment, and selection and allocation programs for new teachers;
- VII – the establishment of spaces and efforts to promote mental health in basic education schools, with the involvement of
- undergraduates whenever possible;
- VIII – the improvement of cooperation and communication strategies between teachers and between teachers and the management of basic education schools;
- IX – the offering of scholarships to high-performing entrants in the Exame Nacional do Ensino Médio (ENEM) [National Secondary Education Examination] and other entrance exams when candidates opt for pedagogy and teaching degree courses, especially in areas where there is a shortage of teachers in the country, measured through official research and studies;
- X - the offering of scholarships to pedagogy and teaching degree undergraduates to develop activities to support pedagogical work, practica, reinforcement classes, or monitoring;
- XI – the offering of scholarships and other incentives for undergraduate students to participate in activities in basic education schools located in rural areas, remote regions, or with specific educational challenges;
- XII – by means of a declaration or certificate, acceptance of the activities referred to in items IX, X and XI of Art. 5 as eligible for scoring during the title phase of public selection exams for the nomination of effective teachers in public basic education schools. (Brasil, 2023b, pp. 2-3)

We consider that scholarship offers for graduates could be aimed at all teaching degree students and not just those who have high performance in ENEM, especially in areas with a shortage of teachers in the country, which would allow them to develop work support for pedagogical activities, practica, and research, among other things. The scholarship can be a vital support so that they can adhere and dedicate themselves to their studies, besides developing activities at school from the first year of their education, so that they can get to know and learn to be teachers, taking co-responsibility for their education (intentionally and with shared objectives) the HEI professional and the school tutor teacher.

The proposal of that law draft aims to attract more people to a teaching career by implementing various stimulus measures, ranging from campaigns and the construction of reception spaces to creating a scholarship program. These measures are relevant, as they address both essential cultural aspects, which include satisfaction and social recognition of the profession, and elements related to remuneration and working conditions. Thus, we seek to prioritize several initiatives that ensure students choose and remain in the teaching career.

Another ongoing proposal refers to the beginning of teaching. Diretoria de Formação de Professores da Educação Básica (DEB) of Capes [Basic Education Teacher Education Board] is discussing the proposal for a teacher residency program so that the resident teacher (graduate or beginning teacher) can be accompanied and guided by a supervising teacher (from the public basic education network) and a supervising professor (from the HEI), through the composition of residence centers. In addition to this monitoring, the resident teacher would participate in continuing education. Beginning teachers require special attention because they often face tensions and new experiences, besides having to constantly adapt to new work contexts (Barreto

& Cyrino, 2024; Huberman, 1995; Marcelo, 2022; Veenman, 1984).

It is crucial to implement public policies that strengthen teaching professionalization in Brazil, aiming to face current challenges in the education area, including measures to improve remuneration, enhance the teaching career, offer quality initial and continuing education, guarantee better working conditions, and offer psychosocial support to teachers. Furthermore, promoting partnerships with schools, investing in technology and innovation, and adopting inclusion policies is essential.

In this context, there is a need to reflect on the role of mathematics teachers, teacher educators, or researchers in the development of educational policies and programs that aim to improve teacher education. How can we contribute to influencing decisions and actions in this regard? We must work together to find solutions that stimulate debate about the impact of our research and mathematics teacher education programs on developing effective policies for teacher professionalization. Below, we present some reflections on investigations by Gepefopem that point to promising paths for future research.

4 What do our investigations have to offer to BSTE public policies?

The mathematics educators' community develops research that can provide a solid basis for the formulation and implementation of public teacher education policies. By integrating this research into educational policies, it is possible to develop formative programs that are effective, relevant, and capable of meeting current challenges in mathematics education.

In this section, we share reflections from Gepefopem's investigations into collaborative and reflective formative processes, which go beyond the traditional approach focused only on technical aspects, with themes and management pre-established by the teacher educator. We articulate our vision on teacher education, the movement towards establishing their professional identity (PI), and the characteristics of these formative processes, highlighting objectives, structure, dynamics, and the role of the educator. We also explore videos and multimedia cases, professional noticing, and the integration between initial and continuing education.

Becoming a teacher means assuming new perspectives about oneself and others (teachers and students) as knowledge producers and (co)responsible for their learning. Motivation for work, perceptions regarding their tasks and the role of mathematics and mathematics education, the perspective of the future as teachers, and their responsibilities are fundamental to the movement to establish teaching PI (Cyrino, 2016a, 2017, 2018, 2021). We use the expression *PI constitution movement* because we understand that the PI, just like identity, is "continuously formed and transformed in relation to how we are represented or challenged in the cultural systems around us. [...] The fully unified, complete, secure, and coherent identity is a fantasy" (Hall, 2015, pp. 11-12).

Therefore, deconstructing current formative models is crucial for a shift towards other formative possibilities that problematize school, education, and the constitution of future generations, valuing different forms of life, cultures, traditions, and ways of learning and producing knowledge. This move is not easy to implement, as it goes beyond the dichotomy between theoretical knowledge and professional practice, which has been the dominant theme in discussions about teacher education for decades.

We challenge ourselves to think about the education of teachers who teach mathematics (TTM) from an in(ter)disciplinary perspective, which means breaking the boundaries of subjects and knowing/knowledge understood as components of a curriculum and breaking standards of conduct. However, this rupture leads us to think about identifying aspects of these

frontiers of teaching knowing/knowledge long disregarded in the TTMs' formative processes and articulating them with different domains of the teaching profession. Therefore, it is not simply a question of destroying these boundaries but understanding and articulating them with one's future profession.

Identifying and understanding those aspects and their interconnections can help us guide organic teacher education programs capable of exploring different dimensions of professional practice, overcoming the ineffectiveness of curriculum universalization, and promoting the movement to establish teaching PI.

When discussing the movement to establish the PI of the TTMs, we seek to combine other domains required by TTM that go beyond the knowledge/knowing inherent to the TTMs' profession, which has been widely discussed in the literature. We argue that the movement to establish the TTMs' PI occurs taking into account a set of beliefs/conceptions of the prospective teacher, interconnected with their self-knowledge, their emotions, and knowledge of their profession, associated with autonomy (vulnerability and sense of agency) and political commitment (Cyrino, 2016a, 2017, 2018, 2021). We consider that domains such as beliefs/conceptions, self-knowledge, specific knowledge of the mathematics teacher, autonomy (vulnerability and sense of agency), political commitment, and emotions are interconnected and interrelated and can inhabit these boundaries and, therefore, be considered in the formative processes.

In in(ter)disciplinary formative processes, prospective teachers and teachers who teach mathematics (TTM) in basic education can be invited to participate in study groups as formative spaces. The objective of these groups may be to discuss knowledge of TTMs' professional practice so that they can develop and mobilize this knowledge in the search for a conceptual and contextual understanding of teaching and learning processes and establish connections between professional practice and the theoretical approaches present in initial teacher education programs (Gallagher, 2019; Rich & Hannafin, 2009).

The coordination between the HEIs — responsible for the BSTE — and basic education schools can promote an enriching dialogue between TTMs, prospective teachers (mathematics and pedagogy teaching degree students), educators, researchers, and other professionals who work in these spaces. The effort to build a professional knowledge base aligned with the TTMs' teaching experience requires a constant process of reflection based on the construction, deconstruction, and reconstruction of the teaching experience.

When establishing these study groups, prospective and beginning teachers[4] are generally more focused on theoretical aspects, while TTMs focus more on practice, promoting an environment of dialogue that allows these different approaches to be confronted, resulting in an enriching knowledge exchange for both parties. However, the richness of this proposal goes beyond this simple confrontation. Prospective and beginning teachers must experience the change in perspective of more experienced teachers, as it contributes significantly to their professional development. Likewise, TTMs also benefit from observing the construction of professionalism in prospective and beginning teachers, thus expanding their own professional identity and reinforcing the importance of collaborative work in teacher education.

Those groups can constitute a space for learning, research, and practice, where experiential knowledge is shared, explained, formalized, thought about, and theorized, developing professional teaching knowledge. The transition from a study group to a professional community, from the perspective of a Comunidade de Prática - CoP [community

[4] The first years of professional practice (Barreto & Cyrino, 2023; Thomas et al., 2019)

of practice] (Wenger, 1998), represents the final challenge to overcome.

To this end, the structure and dynamics of these study groups, or professional communities, must prioritize the engagement and autonomy of their participants to negotiate, decide and take (co)responsibility for the content to be worked on. Participants are considered protagonists of their own learning, actively acting during the formative process, explaining and sharing their stories, anxieties, difficulties, fears, hits, successes, and failures. They take new roles in these formative processes, reifying their role as teachers and the elements of their pedagogical practice that are usually discussed separately, such as content, task, student production, lesson plan, class management, and classroom interactions. In this way, they can develop their self-knowledge (Kelchtermans, 2009) and an inquiring attitude regarding the teaching and learning processes, recognize the complexity of the profession as a means for individual and collective development, and recognize knowledge as a form of solidarity.

By encouraging collaboration and collective reflection, recognizing the fundamental role of the teacher in their own education, the interactions promoted in study groups and collaborative communities can enable the problematization of teachers' knowledge so that their beliefs and practices are made explicit, justified, and questioned in order to meet their needs and concerns.

TTMs and prospective teachers can mobilize aspects of their political commitment by explaining their role in the education of students, in the constitution of future generations, and in the transformation of society, considering the influence of external political contexts on classroom practice, power relations, and the interests of the school community (Cyrino, 2017). They can reflect on the political and social consequences of their work so that they recognize the role of mathematics as a field of knowledge for understanding and transforming the world, for quality of life, for dignity, and diversity so that their students reach higher levels of empowerment and commitment (Hargreaves, 1995). Teaching is inherently political, even when one seeks to maintain a neutral stance (maintenance of the current condition) regarding any subject.

In this context, the educator, by assuming a sensitive, attentive, and questioning attitude, should: stimulate the emergence of promising ideas and situations for reflection; provide space and time for participants to talk, narrate experiences, listen, and be heard; value and respect the individualities, vulnerabilities, and emotions of the participants as a condition that opens space for reflection and discussions so that they feel welcomed in their professional needs; and promote negotiation of meanings and strengthen the participants' sense of agency so that they can deal with the vulnerabilities of the profession.

When working with the self-knowledge of TTMs and prospective teachers in the formative context, the educator has the opportunity to explore: the self-image of pre-service and in-service teachers so that they can reflect on who they are, or could be, as teachers; self-esteem in the search to understand how well they perform their work as teachers; the recognition of their tasks and how they perceive what constitutes their professional program, their duties and tasks so that they can perform an adequate job; their motivation for work, highlighting and questioning themselves about the reasons why they chose to be teachers, stay in this profession or even give up this profession to seek other careers; and future perspectives, which reveals their expectations regarding their future at work (Kelchtermans, 2009).

Providing reflections on the self-knowledge of TTM and prospective teachers and the practices of other teachers in the formative context represents an action that can be carried out based on the analysis of classroom situations, which may come from the experiences of other teachers and/or their own experiences. For example, working with multimedia cases as a

formative resource has the potential for the analysis of other teachers' practice — and their own (Cyrino, 2016b; Estevam, Cyrino, & Oliveira, 2021; Fraga & Cyrino, 2019; Jesus, Cyrino, & Oliveira, 2020; Rodrigues & Cyrino, 2017; Rodrigues, Cyrino, & Oliveira, 2019).

Using videos in formative contexts can be powerful for teachers. It allows them to share their knowledge and perspectives on teaching, stimulating discussion and confrontation of ideas. With the possibility of access to the same practice by different viewers simultaneously and repeatedly, videos allow for the expansion of debate and enrichment of pre-service teachers' perceptions (Dreher & Kuntze, 2015; Groth & Xu, 2011; Grant & Kline, 2010). The exploration of multimedia cases has been recognized as "a privileged context for developing the *noticing* ability of the teacher for its unique potential to capture the richness of the classroom, covering a wide range of details of the situation, presented contextually and holistically" (Estevam, Cyrino, & Oliveira, 2021, p. 170).

Teachers' professional noticing has been increasingly recognized as a key element of this professional learning (Dindyal, Schack, Choy, & Sherin, 2021). The concept of noticing is used to specify the teacher's abilities to recognize and interpret events in the classroom and develop strategies to deal with them consciously (Jacobs, Lamb, & Philipp, 2010; Van Es & Sherin, 2002). Through noticing, we can make decisions based on professional knowledge, both in the classroom –by identifying and understanding students' strategies and difficulties — and in planning — by anticipating class challenges (Rodrigues, Cyrino, & Oliveira, 2018).

Cyrino (2024) discusses professional noticing mobilized by prospective mathematics teachers in non-disciplinary formative processes designed and organized to overcome the lack of connection between prospective teachers' practice in their future profession and the strictly theoretical approach to the knowledge they have in their education. TTMs of basic education participated in some of these formative processes, and the prospective teachers could recognize, interpret, reflect, and discuss what can be done when working with mathematical tasks in their future professional practice. The actions carried out were based on the understanding of praxis as an expression of the articulation between theory and practice, in tune with the reality of basic education schools and the future professional performance of prospective teachers.

Organizing in(ter)disciplinary formative processes requires constructing a dynamic, innovative institutional teacher education project that takes people into account (educators, teachers, prospective teachers, and other educational agents), incorporates elements such as inclusion, values the diversity at the basic school and university, promotes secular values and social responsibility, and gives attention to the aspirations and needs of children, young people, adults, and older people.

These challenges must be faced in (re)constructing public policies that value teachers' work and invest in their education. We must learn from our country's sociocultural diversity, find a way to overcome the ineffectiveness of curriculum universalization in the formative process, and build a virtuous cycle that can promote organicity between initial and continuing education. These actions require a holistic and integrated approach that weighs teachers' necessities at all stages of their careers. Public teacher education policies must be flexible and accessible to create a continuous and collaborative learning environment that fosters the movement to establish the PI and strengthen the teaching profession.

To this end, we must have programs that align the initial education curriculum with a continuing education that contemplates the importance of TTMs' working conditions. These programs should be part of the official workload of TTM's professional activities and be recognized in their career plan, acknowledging their professional development and valuing the teaching profession. Policies that make TTMs feel welcomed in their professional needs, such

as valuing a continuing education that meets TTMs' desires, can make the teaching career more attractive and help retain experienced professionals.

5 Considerations

To reverse the problems reported in this article, we must establish a national pact to face the problems plaguing teaching professionalization and Brazilian education. Such a pact must include an BSTE committed to an emancipatory, inclusive, socially referenced, environmentally responsible, ethical education to help build a society where everyone has the same opportunities.

A national pact to face the challenges of Brazilian education must cover the articulation between initial and continuing teacher education, the valuing of teaching work, care for the mental health of education professionals, inclusion and respect for teachers' and students' equity, as well as the ethical commitment to the education of future generations, the involvement of society and the school community, investment in teacher education and school conditions, the efficient use of resources, support for research, and dissemination of good practices, among other relevant points.

In this way, a comprehensive and multifaceted national pact can contribute to teacher appreciation and development, the promotion of inclusion and equity, environmental and ethical responsibility, community participation, and efficient resource management in education. By considering and prioritizing these aspects, an educational system that offers equal opportunities for all will be possible, forming conscious citizens engaged in building a more egalitarian and fair society.

We emphasize the need for research, programs, and projects that support teacher education in founding and constructing this national pact. By providing evidence-based data and insights, developing innovative programs, fostering collaboration, and sharing knowledge, these efforts can help design effective and sustainable public policies that promote teacher professionalization, which, in turn, will help ensure quality, inclusive, and equitable education.

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