Teachers and research on their own practice: a systematic literature review

Os professores e as pesquisas da própria prática: uma revisão sistemática de literatura

Les enseignants et les recherches sur leur propre pratique: une revue systématique de la littérature

Os professores e as pesquisas da própria prática: uma revisão sistemática de literatura

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Abstract

Knowing the results of research into teachers' own practice can help us understand how their own professional development takes place. To this end, we developed a systematic review of research of own practice, often known as "Self-Study", related to educational processes or teacher development. The research is qualitative-interpretative, having been carried out based on the selection of articles from journals in the field of Mathematics Education, published between 2013 and 2023. We focus on empirical research involving Teachers who Teach Mathematics (TTM) in the context of the final years of Basic Education or in Continuous Professional Development. Regarding the investigative stance adopted in practice, the importance of a reflective stance, communication, cooperation, interactions in the teaching and learning process and the mediating role of the teacher were highlighted. Among the results, it was identified the need for new research related to Continuous Formation was identified to create teacher-researchers "OF their own practices" and investigations related to teacher "noticing", understanding that such research provides insight into this type of situated learning.

Keywords: Research of Own practice, Self-study, Educational process for mathematics teachers, Teacher professional development.

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Resumen

Conocer los resultados de investigaciones sobre la propia práctica, realizadas por los docentes, puede ayudarnos a comprender cómo se lleva a cabo su propio desarrollo profesional. Para ello, desarrollamos una revisión sistemática sobre investigaciones de la propia práctica, a menudo conocidas como "Self-Study", relacionadas con los procesos formativos o el desarrollo docente. La investigación es cualitativa-interpretativa, y se realizó a partir de la selección de artículos de revistas en el área de Educación Matemática, publicados entre 2013 y 2023. Nos centramos en investigaciones empíricas que involucran a los Profesores que Enseñan Matemáticas (PEM) en el contexto de los últimos años de la Educación Básica o en la Formación Continua. En relación con la postura investigativa adoptada en la práctica, se destacó la importancia de la postura reflexiva, la comunicación, la cooperación, las interacciones en el proceso de enseñanza y aprendizaje, y el papel mediador del docente. Entre los resultados, se identificó la necesidad de nuevas investigaciones relacionadas con la formación continua para la creación de profesores-investigadores de sus propias prácticas y de investigaciones relacionadas con el "noticing" del docente, entendiendo que tales investigaciones favorecen la percepción de este tipo de aprendizaje situado.

Palabras clave: Investigación sobre la propia práctica, Self-study, Formación de profesores de matemáticas, Desarrollo profesional docente.

Résumé

Connaître les résultats de recherches sur la propre pratique, réalisées par les enseignants, peut nous aider à comprendre comment se déroule leur développement professionnel. À cet effet, nous avons élaboré une revue systématique des recherches sur la propre pratique, souvent connues sous le nom de « Self-Study », liées aux processus de formation ou au développement des enseignants. La recherche est de nature qualitative-interprétative, réalisée à partir de la sélection d'articles publiés dans des revues dans le domaine de l'Éducation Mathématique, entre 2013 et 2023. Nous nous concentrons sur des recherches empiriques impliquant des enseignants de mathématiques (EM) dans le contexte des dernières années de l'Éducation de Base ou dans la Formation Continue. En ce qui concerne la posture investigatrice adoptée dans la pratique, l'importance de la posture réflexive, de la communication, de la coopération, des interactions dans le processus d'enseignement et d'apprentissage, ainsi que du rôle médiateur de l'enseignant, ont été mises en évidence. Parmi les résultats, il a été identifié le besoin de nouvelles recherches liées à la formation continue afin de constituer des enseignants-chercheurs de leur propre

pratique et des recherches liées à la notion de "noticing" chez l'enseignant, comprenant que ces recherches favorisent la perception de ce type d'apprentissage situé.

Mots-clés : Recherche sur la pratique propre, Self-study, Formation des enseignants en mathématiques, Développement professionnel des enseignants.

Resumo

Conhecer resultados de pesquisas da própria prática, realizadas por professores, pode ajudar a compreender como se dá seu próprio desenvolvimento profissional. Para tal, desenvolveu-se uma revisão sistemática sobre pesquisas da própria da prática, muitas vezes conhecidas como *Self-Study*, relacionadas aos processos formativos ou ao desenvolvimento docente. A pesquisa, qualitativo-interpretativa, foi realizada a partir da seleção de artigos de revistas da área da Educação Matemática, publicados entre 2013 e 2023. Tomou-se como foco pesquisa empírica envolvendo Professores que Ensinam Matemática (PEM) no contexto dos anos finais da Educação Básica ou na Formação Continuada. Em relação à postura investigativa adotada na prática, destacaram-se a importância da postura reflexiva, da comunicação, da cooperação, das interações no processo de ensino e de aprendizagem e do papel mediador do professor. Dentre os resultados, identificou-se a necessidade de novas pesquisas relacionadas às formações continuadas para a constituição de professores-pesquisadores das próprias práticas e de investigações relacionadas ao *noticing* do professor, por entender que tais pesquisas propiciam a percepção desse tipo de aprendizagem situada.

Palavras-chave: Pesquisa da própria da prática, *Self-study*, Formação de professores de matemática, Desenvolvimento profissional docente.

Teachers and research on their own practice: A systematic literature review

Continuing education processes in Brazil have been offered in different ways and for different purposes, and among so many types, Fiorentini et al. (2016, p. 20) highlight:

> [...] research on one's own practice, formative and investigative practices based on university-school partnership/collaboration, lesson study, narrative research on education or professional development processes, and the life stories of teachers who teach mathematics.

In particular, the formative processes (initial or continuing) that consider encouraging research involving teachers' own practices stand out to qualify a reflective professional and promote the development of professional teaching knowledge, which enables the development of mathematics teaching and learning environments under the assumptions of the Common National Curriculum Base (*Base Nacional Comum Curricular* - BNCC) (MEC, 2018).

When reflecting on this approach, we asked some questions leading to the present study. On the one hand, the aim is to identify how research has been conducted on teachers' own practices and, on the other hand, to understand how continuing education processes can influence teachers' professional development in the sense that they can become teacher-researchers of their own practices (Ponte, 2002). The relationships between these perspectives can contribute to a more comprehensive understanding of this type of research to propose future continuing education processes that encourage empirical investigation of mathematics teachers' own practices in order to associate reflective and investigative processes with the emancipatory power of teachers in solving their teaching problems.

To this end, we conducted a systematic literature review, selecting scientific articles published in four Brazilian qualified journals in the area of mathematics education to answer the questions: "What are the indications in the literature on empirical research on one's own practice –or self-study– involving mathematics teachers working in middle or high school? How do approaches to researching one's own practice, also called self-study, provide professional teaching development?"

We begin by characterizing the design of this type of research through different conceptual understandings presented by different researchers. After that, we describe the methodological aspects of our study and then present the literature review results, conclusions, and final considerations.

Research on teaching practices: knowledge involved and practice

Ponte (2002), discussing "research on one's own practice," highlights that the complexity of teaching problems concerning intellectual, political, and people and resource management activities is not easily solved and requires teachers to have problem-solving and research skills that go beyond simple common sense, experience, and professional goodwill.

Throughout teaching work, in the search for appropriate teaching and learning processes, the teacher often carries out a reflective process without the formalization and rigor typical of an investigation. In the education field, from the epistemological perspective of Schön's reflective practice (1983, 1987), we understand that teachers become reflective when they seek to perceive or recognize "knowing-in-action" through observations and reflective processes at different times. This approach is considered reflective research on one's own practice when the teacher establishes specific objectives and adopts rigorous procedures and criteria that ensure the investigative quality of the results and new knowledge, which must be made public and disseminated through scientific articles (Ponte, 2002). Thus, in addition to being a reflective teacher of the practice, he/she becomes a teacher-researcher of his/her own practice.

Cochran-Smith and Lytle (2009), when referring to the relationship between professional knowledge and teaching practice, indicate that being close to teaching degree courses and classrooms provides different types of learning. They conceive three perspectives on the production and learning of knowledge, classifying them as "knowledge FOR practice," "knowledge IN practice," and "knowledge OF practice." The prepositional contraction "IN", the preposition "FOR," and the prepositional contraction "OF" are intentionally highlighted using capital letters, as they refer to specific types of knowledge, as explained below.

Cochran-Smith and Lytle (1999) indicate that "knowledge FOR practice" consists of scientific or practical theories or knowledge taught and learned in formative processes, which teachers will use in the classroom in their practices. "knowledge IN practice" refers to the knowledge teachers develop during their professional career through experiences lived or reflected in their practices. Finally, "knowledge OF practice" addresses what teachers construct when they take their own practice as a field of research, intending to become aware of their different knowledge and wisdom about their own practice and their own teaching developments. According to the authors, such development occurs through theory generated by others and from the perspectives of professional learning, with the more significant objective of producing new knowledge.

Depending on the type of knowledge one wishes to deepen, research with well-defined objectives can be proposed to understand and seek solutions to problems that emerge from contexts related to teaching practice.

Thus, considering these three conceptions of knowledge generated from practice, presented by Cochran-Smith and Lytle (1999), the following can be developed: "Research FOR Practice": refers to studies or planning of future practices, that is, they are linked to the construction of "knowledge FOR practice"; "Research IN Practice": focuses the classroom, the learning of the teacher or students, the curriculum, the materials and methods, among others, that is, the construction of "knowledge IN practice"; and, finally, "Research OF practice": they aim to expand the teacher's knowledge and wisdom, thinking and rethinking their practices, focusing on the teacher and their own practical actions.

Research of Own Practice (ROP)

Among the various types of research conceived as "OF practice," according to Cochran-Smith and Lytle (1999), the type of research of one's own practice stands out, as indicated by Ponte (2002), in which it is understood that the teacher/researcher reflects on his/her own teaching development, both in terms of changing or redefining knowledge, knowings, attitudes, beliefs, and changes in his/her own practice. Specifically, such research is developed through investigative actions in the context of the teacher-researcher's own classroom. One of the advantages of this approach is that the questions emerge from the needs of the teacher, who seeks to reflect on their actions in the real context of the classroom to improve the quality of teaching and learning they promote. The researcher is familiar with the problem, and this can contribute to the data analysis to be carried out.

Due to its characteristics, one advantage of data collection is that, as it involves participant observation in the natural context where the intervention takes place, it is an immediate source of data, which enriches the analysis process due to the proximity of the teacher-researcher to the topic investigated. On the other hand, this aspect may limit interpretations if the research is carried out in isolation, without considering the process of data triangulation between peers.

Cochran-Smith and Lytle (1999) highlight that collaborative work developed in research communities, among researchers, teachers, and academics, generates good results, as in these spaces, reflective discussions and exchanges of knowledge about theories and practices take place, which contribute to problematizing and discussing research on practices, especially in the case of investigations "of their own practices." The authors also highlight the importance

of reflection and collaboration between teachers, which occur in investigative communities, when teacher-researchers aim to meet the criteria for quality investigations: link with practice, authenticity, novelty, methodological quality and dialogical quality, listed by Ponte (2002), based on Zeichner (1998) and Anderson and Herr (1999). Cochran-Smith and Lytle (2009) also indicate that participation in such communities encourages the development of an investigative teaching stance to theorize and understand their practices from broader social, political, and cultural perspectives.

Self-study type research

From Loughran's (2007) perspective, self-study emerged from the work of teachers and teacher educators who intended to combine perceived conflicts in practical work during teacher education that were contrary to the expectations of planned academic research. In this approach, an important term is modeling, which refers to the experience of investigating by exploring the model of own practice, that is, analyzing how what is preached is practiced, making the classroom a place for reflection and investigation to perceive new insights about teaching and learning. It can be carried out in different ways: through specific teaching practices, by exploring the teacher's thinking during teaching, through writing diaries or educational relationships, among others.

Loughran (2007) mentions the belief that learning about teacher education practices developed through self-study evolves over time because teacher educators learn to challenge the traditional view of formative processes as they begin to develop their theories based on personal experience, as the questions and tensions that trigger this type of investigation are often tacit and are at the heart of the dilemmas. Loughran also refers to the value of collaboration and shared research since, for an adequate analysis of issues in one's own practice, taking a distance from the problem is one of the most significant challenges in this approach.

It highlights the aspect of self-confidence related to the teacher-researchers' feeling of vulnerability, which is necessary to genuinely study personal conflicts. These conflicts are affected by the feeling of dissonance (imbalance), which usually provokes the research (Loughran, 2007).

A characteristic of self-study is that, as discoveries emerge, new actions are required, and as the study progresses, the focus also changes because new perspectives and possibilities emerge (Loughran, 2007). This approach enables the perspective of the "I" teacher in research on practice and also favors a change in the focus of research in their students' teaching and learning –both high priorities to understand teachers' knowledge, largely unexplored, as a

necessary source of insights for the improvement of teaching. Furthermore, it enables the communication of the knowledge generated "to inform other educators not only about teaching but also about teaching about teaching and about learning about teaching" (Loughran, 2007, p. 30).

Relationships between research "OF practice"; research of one own's practice and self-study

The approaches to practices described by Cochran-Smith and Lytle (1999), Ponte (2002), and Loughran (2007) reveal proximities. One is the common objective of improving teaching knowledge based on conflicts experienced in the contexts in which the teacher-researcher works. Another is the need for collaboration in investigative processes, whether through research partners or socializations in investigative communities, so that data can be analyzed and interpreted considering the diversity of different perspectives, which favors broader reflection.

However, when discussing "practical" investigations in a more comprehensive way, Cochran-Smith and Lytle (1999) cite the different types of research that can be developed from analyses of practices adopted in the classroom, which includes formative processes, but is not specifically limited to the analysis of one's own teaching practices and can address results from practices of other researchers. Such research may include analyses of the teaching approaches adopted or the learning of the students or teachers involved, but does not need to address the researcher's own teaching development specifically. This last focus would be one of the other possibilities regarding investigations "OF the practices." Ponte (2002), when considering research "OF one's practices," refers particularly to the need for one's professional teaching development, which can be driven by this approach based on systematized reflections on one's own professional practices. Loughran (2007) presents the self-study approach as a type of research on teacher educators' practice, developed in teacher education contexts, where teacher educators' concerns emerge in their own contexts of action, which, when addressed, contribute to their teaching developments.

Methodological Aspects

Under the interpretative paradigm, this qualitative research is characterized as a systematic literature review with meta-synthesis (Fiorentini & Crecci, 2017; Galvão & Ricarte, 2019).

For the composition of the research corpus, we defined the publications of scientific articles in the following journals as the space for scientific production: *Acta Scientiae* (Qualis A2), *BOLEMA: Boletim de Educação Matemática* (online) (Qualis A1), *Educação Matemática Pesquisa* (online) (Qualis A1) and *Zetetiké*(online) (Qualis A2), covering 10 years (2013 to 2023), totaling 2,546 articles. These journals were chosen because they are important and of recognized merit by the Coordination for the Improvement of Higher Education Personnel (CAPES) in the mathematics education area. The first selection was made according to the classification of Fiorentini et al. (2016) on the field of study of the "teacher who teaches mathematics" (TTM)[3] and their different contexts, presented in Figure 1. By reading the summary, the keywords, and, when necessary, the methodological procedures, we identified and classified 559 out of the 2,546 articles found.

In the second refinement, among the 559 articles selected, we chose 92 that contemplated the research context and referred to theoretical or empirical research on practices, being: eight about initial education (IE); 30 about continuing education; three about initial and continuing education (ICE) and 51 classified as other contexts (O). This first analysis indicates that, among the works (559) related to the field of study of TTMs and its different contexts, only around 16.46% (92) relate to the investigative questions developed on practices. This indicates that, within the scope of the chosen journals, this field of investigation is still relatively small compared to the totality of publications involving research on TTMs.

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[3] TTMs are teachers who teach the initial years of elementary school (holding a pedagogy degree) or teachers who work in middle school, high school, or higher education and may or may not be licenced in mathematics.
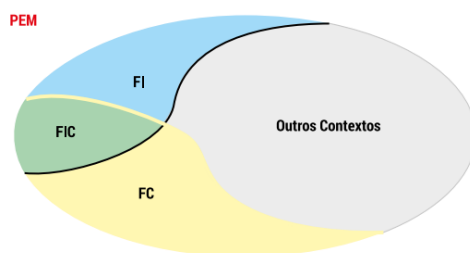
Figure 1.

Teachers who teach mathematics (TTMs) as a field of study and its different contexts: initial education (IE), continuing education (CE); initial and continuing education (ICE); and other contexts and aspects (Fiorentini et al., 2016, p. 26).

In this next stage of refinement, when looking for research characterized by research of one's own practice or the self-study type, combined with the possible focuses of these studies (Figure 2), we noted that the dimension "*TTM's teaching or professional practices*" could be subdivided into two new categories: "Investigating one's own practice" and "Investigating others' practices." In our understanding, this is due to recognizing that these types of research have very different characteristics. When teacher-researchers analyze data collected from their own experience, there is a much greater proximity (or involvement) than when they analyze data from other teachers' experiences. Therefore, we suggest an adaptation, as shown in Figure 3.

As the focus of this paper is TTMs who *research their own practice* or carry out *self-study*, we considered the final selection criteria to be only articles that were empirical investigations of one's practices (i) carried out by teachers working in middle or high school; (ii) in mathematics teacher education courses; (iii) in formative contexts that involved reflections on specific interventions by the researchers themselves –teacher-researchers participating in research groups, or doctoral or master's students. Considering such criteria, we shortlisted only seven articles, representing approximately 7.6% of the total 92 studies involving teacher practices or, more broadly, only 1.3% of the total 559 articles that refer to the field of study of TTMs and their different contexts; or, still, approximately 0.3% among the 2,546 articles consulted. The selected articles were published in *Acta Scientiae* (4), *BOLEMA* (1), and *Educação Matemática Pesquisa* (2). Notably, no article of this nature was identified in the analysis of the 239 published in *Zetetiké*. This is the first indication of the systematic review: we found few published results on empirical research of one's own practice or self-study in formative contexts of TTMs that teach in middle or high school.
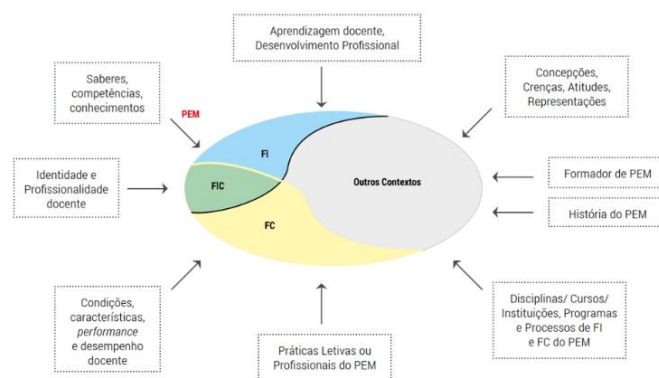
Figure 2.

TTM as a field of study - initial education (IE), continuing education (CE); initial and continuing education (ICE); and other contexts and aspects - and their possible study focuses (Fiorentini et al., 2016, p. 27).
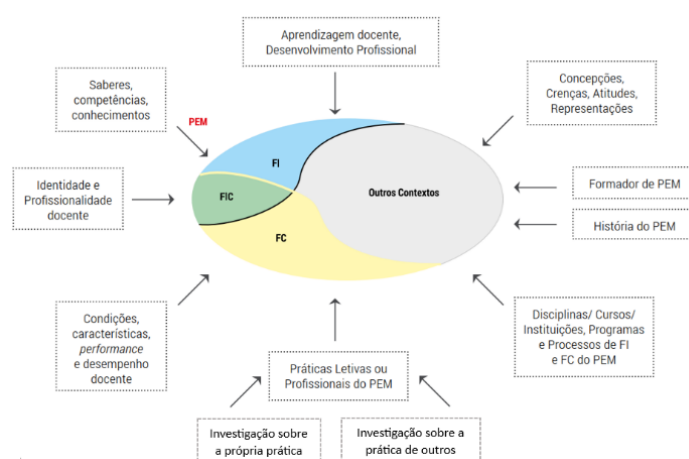

Figure 3.

TTMs as a field of study - initial education (IE), continuing education (CE); initial and continuing education (ICE); and other contexts and aspects –and their possible study focuses, with adaptation (Authors, adapted from Fiorentini et al., 2016, p. 27).

Below, in the presentation and discussion of the results, the articles are identified by the number written in the first column of Table 1. Furthermore, excerpts from the articles are in italics to differentiate them from direct quotes used in the results discussions.

After delimitating the corpus for our study, we read the selected articles in full to identify relevant aspects that would help us answer the initial questions proposed in the research.

Table 1.

Coding and description of the articles selected to compose the corpus *of the research*

(Authors, 2024)

No	Type	Description of the articles
1	CE*	Cox, D., D'Ambrosio, B. S., Keiser, J., & Naresh, N. (2014, August). Repositioning ourselves: acknowledging contradiction. *Bolema*, *28*(49), 990-1011, Aug. 2014.
2	CE*	Hummes, V. B., Moll, V. F., & Breda, A. (2019, Jan/Feb). Uso combinado del estudio de clases y la idoneidad didáctica para el desarrollo de la reflexión sobre la propia práctica en la formación de profesores de Matemáticas [Combined use of lesson studies and didactic suitability for the development of reflection on own practice in the education of mathematics teachers] *Acta Scientiae*. *21*(1), 64-82.
3	O**	Trevisan, A. L., & Buriasco, R. L. C. (2016). Avaliação e currículo: o caso da trigonometria [Assessment and curriculum: the case of trigonometry] *Educ. Matem. Pesq.*, *18*(2), 551-549.
4	O**	Rutz, K. P., Marinho, J. C. B., & Silva, F. F. (2018, May/June). O trabalho pedagógico com situações-problema nos Anos Iniciais do Ensino Fundamental em uma perspectiva construtivista [Pedagogical work with problem situations in the initial years of elementary school from a constructivist perspective] *Acta Scientiae*, *20*(3), 359-376.
5	O**	Veronez, M. R. D., & Castro, E. M. V. (2018, May/June). Intervenções do professor em atividades de modelagem matemática [Teacher interventions in mathematical modeling activities] *Acta Scientiae, 20*(3), 431-450.
6	O**	Vicentin, F. R., Passos, M. M., & Arruda, S. M. (2022, September/October). Ação docente e ação discente em aulas de matemática fundamentadas na exploração de objetos de aprendizagem na lousa digital: caracterizações e conexões [Teaching and student action in mathematics classes based on the exploration of learning objects on the digital board: characterizations and connections] *Acta Scientiae*, *24*(5), 328-352.
7	O**	Brandelero, D. S., & Estevam, E. J. G. (2023). "Reflexões Compartilhadas em uma investigação sobre a própria prática: trajetória de aprendizagem de uma professora envolvendo ensino exploratório de estatística" [Shared reflections in an investigation of one's own practice: A teacher's learning trajectory involving exploratory statistics teaching] *Educ. Matem. Pesq.*, *25*(1), 479-507.

Note: *CE: Continuing Education; **O: Others

Results and discussions on literature indicators

In the first part, the analyses aim to answer the first research question: "What are the indications from the literature on empirical research of one's own practice involving mathematics teachers who work in middle and high school?"

The summaries of articles related to the question "What is the field of study and its different contexts? Where was it held? What are the objectives?" are presented in Appendix 11.

The first aspect indicates that only two studies of one's own practice were carried out in the context of continuing teacher education – in this case, Articles (1) and (2), with the others being carried out through didactic interventions by the teacher-researchers in classrooms and were classified as per Fiorentini et al. (2016) as "Others."

In the continuing education field, Article (1), written by researchers from the University of Miami, USA, focuses on a formative process for basic school teachers. Article (2), prepared by researchers from the University of Barcelona (UB), Spain, presents a formative process aimed at teachers who were completing a professional master's degree in mathematics teaching in Brazil. The analysis of the objectives of the two studies indicated significant differences.

In Article (1), the authors aimed to discuss their teaching learning, resulting from a conflicting context perceived during the formative course, in which their actions in discursive and reflective mediations were misaligned with the proposed theoretical aspects. According to the authors, this process was possible due to the "awareness of *discrepancies between our beliefs and practices* as teacher educators and educational researchers" (p. 991, emphasis added). In the reflective meetings of the community of practice, the authors realized that, during the CE, they indicated to the participating teachers that they should consider the students' perceptions during discursive classroom interactions. They suggested that teachers should value "students' voices to improve mathematics teaching" (p. 990) to help them construct their own knowledge, enabling "agency" and respecting each student's "identity."

However, as teacher educators, they chose to categorize the reflections of the participating teachers using only qualitative research tools. Reflecting on this practice, they realized that their own teaching approach, as teacher educators, silenced the voices of the participating teachers, denying them the "agency" and "identity" they defended in theory. In this sense, they were taking a teaching stance that conflicted with the constructivist approach proposed in the formative process teachers should adopt in their classrooms. Thus, when collectively reflecting on the proposed formative process, they could perceive that the investigative approach resulted in a "living contradiction, since this stance conflicted with our belief that students deserve agency and identity" (Article 1, p. 990). This conflict generated the self-study presented in Article (1) and confirms one of the main characteristics highlighted by Loughran (2007) when he indicates that this type of research emerges as an attempt to combine conflicting aspects of teacher education work, in opposition to the expectations of academic research.

It was also possible to identify that this type of research is connected to the conflicts experienced by teachers-researchers who participate in communities of practice. When the

research results in Article (1) were collectively planned and analyzed by the members of the group in which they participated, it was possible to perceive that the socialization of different critical views on their own experiences allowed the realization of essential and unexpected aspects of the lived contexts of their own practices. This aspect confirms what Loughran (2007) indicates. Unlike what the name self-study suggests, this type of research is generally not carried out individually; it is developed collectively within an investigative community. The importance of the participation of teacher-researchers in communities of practice (Cochran-Smith & Lytle, 1999; Lave & Wenger, 1991) is also highlighted, where experiences are exchanged, and collaborative reflections occur, which drives the deepening of theoretical and practical reflections when considering the plurality of perceptions of the actors involved. This critical, reflective, collaborative work is fundamental to professional teaching development.

Unlike Article (1), in Article (2), the objective did not emerge from a conflicting aspect perceived during the implementation of the proposed teacher education process. Instead, it arose from previous group reflections dedicated to research on teacher education to favor the "development of reflection on the teachers' own practice" (p. 65). The authors aimed to perceive potential in two distinct approaches: in this case, "lesson studies" (Hart et al., 2011) and "didactic suitability criteria" and their decomposition into components and indicators, proposed within the scope of the onto-semiotic approach to mathematical cognition and instruction (Godino et al., 2007), which could complement each other in the proposed teaching and learning processes.

The analysis of the research objectives carried out in the contexts of continuing teacher education presented in Articles (1) and (2) allowed us to see that research can emerge in different ways: during the formative processes or their planning. However, both align with the definition of research on practice presented by Lytle and Cochran-Smith (1990): "intentional and systematic research that teachers conduct about their school and classroom" (p. 86), which arises from questions that reflect the concern of teachers who seek to attribute meaning to their experiences, adopting a learning attitude relative to their own practice. In both studies, the teacher-researchers systematically reflected on their practices. They assumed a different teaching stance, which corroborates Lytle and Cochran-Smith's (1990) adoption of "inquiry as stance" in permanent questioning in the context of their practices.

We found that of the seven selected articles, the specific term "self-study" appeared only in Article (1), published in a Brazilian journal but of North American origin, in which the authors present its definitions and particular aspects. The other authors of the articles, of

Brazilian or Spanish origin, did not adopt the terminology. This fact is justified in the case of articles (3) to (7) because they do not address research carried out in teacher education contexts.

In the qualitative analysis, we also noticed that some articles lacked emphasis on the research objectives related to the own teaching developments, which can be identified in the research questions presented. This fact does not occur in Article (1), as the authors evidence the focus of the article on the research question, "How effective were we in supporting teachers to become better listeners and to understand the importance of listening to students as an important component of their practice?" (p. 994), which leaves no doubt about the aspects "of the own practice" investigated. In this case, it was also possible to see that the results presented in Article (1) are consistent with the objective initially established.

In Article (2), the authors state that they generally aim to "investigate the development of reflection on practice in teacher education" (p. 65) but do not present specific questions about their own learning about teaching. In this case, they present as results reflections about their practices as teacher educators, and it is clear that the objectives of the investigations "in practice" and "of practice" combine or overlap. The authors focused on presenting results indicative of the methodology adopted. Still, they did not explicitly highlight how the self-reflective process helped them in relation to their own teaching development as teacher educators. We understand that, due to the nature of this paper, it also refers to the types of research on one's own practice, or self-study, and that it would be important to highlight in the guiding questions of the studies, in the objectives and results, how the research enabled them to expand or deepen their own professional teaching knowledge.

Articles (1) and (2) refer to different teaching learning based on their reflections on different proposed objectives. Interestingly, both papers have a common objective related to teacher educators' learning regarding their own experienced practices, with a view to planning future formative actions, which involved reflection on the reflection on action (Schön, 1983). In Article (1), learning occurs through reflections on the impact of teaching on the participants' skills and allows awareness of discrepancies between their beliefs and practices as teacher educators and educational researchers, which need to be reviewed in future actions. In Article (2), the teacher educators evaluate their own experiences to ensure that the methodological planning proposed in the formative process would be adequate, aiming to encourage the development of reflection on the participating teachers' practices. Through the investigation, they concluded that the initial expectations were met, which indicates that the path they chose was viable for achieving the general objectives of the research they were carrying out.

In the field of study of didactic interventions (Classified as "Others"), we found that of the five articles numbered from (3) through (7), the interventions involved teacher-researchers and basic education students, four of which were carried out in the context of elementary education (EE) and two in high school (HS). Specifically: Article (3): 2nd grade of HS; Article (4): 5th grade of EE; Article (5): 8th grade of EE; Article (6): 6th grade of EE and 3rd grade of HS; Article (7): 8th grade of EE. Only one of the interventions, presented in Article (4), took place in a private school in the state of Rio Grande do Sul, Brazil, and the others were developed in public schools in the state of Paraná, Brazil, which indicates that all research of this nature published in the chosen journals comes from South Brazil.

The "Other" fields of study, grouped in our study in the category "scope of didactic interventions," explicitly refer to: (i) Article (3): "researching one's own practice"; (ii) Article (4): "participant research"; (iii) Article (7): "researching one's own practice." In Articles (5) and (6), the characterization of the type of research was not explicitly identified. In Article (5), the authors present the expression "teacher intervention" in the keywords and throughout the text, and Article (6) uses "teaching action and student action." Although they all research one's own practice, only one explicitly mentions this type of qualitative research. In some cases, such as in Article (6), this may have occurred because they also considered aspects related to student action, which would characterize the research as being specific to one's own practice. Furthermore, in Article (7), the authors characterize it as "research of one's own practice," which, according to Cochran-Smith and Lytle (2009), could have three different meanings, that is, it could be research "FOR the practice", "IN the practice," or "OF the practice." According to our understanding, as it is more focused on analyzing investigations related to the practices themselves, it would correspond to a "research OF practice," according to Cochran-Smith and Lytle (2009) or considering Ponte's (2002) theoretical framework. [verificar o original, se está correto]

Different objectives (or focuses) in the selected research were also noted. In Article (3), the authors aim, through self-reflection, to perceive changes in mathematical learning related to the curriculum, resulting from an intervention that involved intentional modifications in the assessment instrument used. Article (4) focused on understanding how the pedagogical work carried out in the classroom was organized, which was planned based on problem situations. Article (5) addressed the teacher's interventions in class when guiding the development of mathematical modeling activities for their students. Article (6) investigated the influences of the use of digital technology resources –learning objects (LO) and digital whiteboards (DW)– aiming to characterize teaching and student actions to contribute to producing mathematical

knowledge in the classroom. Finally, in Article (7), the authors seek to identify learning evidenced in a teacher-researcher's reflections on her own practice in basic education when she uses the exploratory teaching approach to teach basic concepts of statistics. This variety of objectives indicates the potential of this research strategy that involves "practical" research, which is directly linked to the numerous possibilities of professional teaching learning related to teaching practices, which corroborates Stein et al.'s (2008) remarks when they highlight the importance of teachers preparing themselves to deal with the complexity of this exploration in the classroom. This fact is also indicated by Ponte (2002), who highlights the importance of investigating one's own practice in order to promote professional teaching development.

In general, within the scope of the analysis of all the selected articles, we perceived that the way they were prepared did not always translate or value aspects related to professional teaching development and the learning of the teachers-researchers themselves, which should emerge from the reflective investigation of their own practice.

It is possible to verify that Articles (1), (3), (5), and (7) explain the characteristics of the reflective investigation of the own practice or self-study in their objectives, according to the fragments:

> [...] assessment of the impact of one's own teaching on the participants' skills (Article (1), p. 991);
> [...] thinking about our own professional development practice (Article (1), p. 1000);
> Present a self-reflection on the curriculum that was "created" in this context (Article (3), p. 553);
> Investigate what is revealed by the teacher's interventions (Article (5), p. 433);
> Investigate learnings that are evident in the reflections of a teacher-researcher (Article (7), p. 484).

However, this does not occur in Articles (2), (4), and (6), as their objectives imply the characteristics of the research on one's own practice as per the following fragments:

> It discusses how the combined use of lesson study and suitability criteria makes it possible to overcome the limitations and expand the advantages of both methodologies (Article (2), p. 64);
> Understand how pedagogical work is organized in a classroom (Article (4), p. 359);
> Characterize teaching and student actions (Article (6), p. 333).

About indicators related to teacher development

Next, the analyses aimed to answer the question: "How can research into one's own practice provide teachers' professional development?"

Regarding the analysis of the questions: "Which main authors were cited/used? What is the research approach and methods used?", all research was characterized by the qualitative approach. As the selected articles dealt with empirical research and involved interventions in classrooms (criteria established for selection), we found that at least one of the authors was a teacher-researcher. These conditions were established for the selected research to be considered as one's own practice, according to Ponte's understanding (2002), or self-study type (Loughran, 2007).

Many researchers cited in the selected articles are linked to methodologies that prioritize the search for professional development (PD) or the improvement of teaching, for example: (i) Article (1) uses the lesson study methodology (Fernandez & Yoshida, 2004; Yoshida, 1999) and the thinker-doers strategy (Hart et al., 2004) and cites others, such as Lave and Wenger (1991), highlighting the importance of being part of a community of practice (CoP) for teacher development; (ii) in Article (2) the authors adopt action research (Elliott, 1993), reflective practice (Schön, 1983), and lesson studies (Hart et al., 2011) as trends in teacher education that propose teacher research and reflection on teacher practice as a fundamental strategy for PD; (iii) in Article (3) the authors consider the perspective of assessment as a research practice and as a learning opportunity based on Trevisan (2013) and mention Ponte (2002) when highlighting the relevance of research related to own practices and their contribution to teachers' professional development; (iv) Article (4) uses problem situations to promote research-based teaching, according to Azevedo (2004). The authors assume learning through cooperation from a Piagetian constructivist perspective, characterized by Camargo and Becker (2012), and present the different pedagogical models according to Becker (1994). They highlight that the data were analyzed using content analysis techniques (Bardin, 2011); (v) Article (5) considers the teacher a guide during the process of developing mathematical modeling activities, according to Dias (2005), Malheiros (2008), Veronez (2013), and Vertuan (2013). The analysis process was guided by content analysis (Bardin, 2011); (vi) in Article (6), the authors work with learning environments using digital technologies (DT) following Souto and Borba (2016). Class preparation was inspired by Silva (2015). For data analysis, they use content analysis, as conceived by Moraes (1999); finally, (vii) in Article (7), the authors refer to Ponte (2002) when they highlight that teaching requires constant investigation into the

teacher's practice to enable continuous evaluation and reformulation, with reflection and cooperative work being fundamental for professional development. They cite Chapman and Heater (2010) in the context of planned investigations into their own practice, highlighting reflection, collaboration, and communication as important aspects to promote their learning; they also bring Cochran-Smith and Lytle (1999), when proposing an intentional investigation of their own classrooms, supported by the research community in which they are inserted and affirm that this proposal aligns with the idea of professional development (Estevam & Cyrino, 2016). They use the exploratory teaching approach in statistics, adopt the perspectives of Canavarro (2011), Estevam et al. (2015, 2021), and Cyrino and Oliveira (2016), and present Stein et al. (2008) to refer to teaching practices to orchestrate productive mathematical discussions. They consider Dewey (1938) for addressing interactive experience and reflection as important elements for learning and Rodgers (2002) for the importance of collaborative reflection. They highlight that the research has a qualitative approach of an interpretative nature of the data (Creswell, 2010), which constitutes an investigation of one own's practice which, according to Cochran-Smith and Lytle (1999), is characterized as a *systematic study*, organized in terms of forms of recording inside and outside the classroom, and *intentional*, as it is an activity thought out and planned by the teacher him/herself. They indicate the relevance of considering professional identity (De Paula & Cyrino, 2021) and the emotional dimension of teaching (Freire et al., 2014) in investigations and formative actions similar to the one presented.

One aspect identified in the reading and analysis of the articles is that most of them highlight the importance of reflective processes in investigations of one's own practices for improvement. The following excerpts illustrate this perception:

> [...] Our work was shifting from a mere analysis of hard data to introspection and *deep reflection on the complexities of our practices*. (Article (1), p. 1003, our emphasis)
> [...] investigate the *development of reflection on practice in the* education of mathematics teachers through the design and implementation of a formative device that combines the use of CE and ICE as *methodological tools* to organize the teacher's reflections so that synergy is produced between both methodologies. [....]. (Article (2), p. 65, our emphasis)
> As this is research on one's own professional practice, *the reflective component played a decisive role in all stages of the work*. (Article (3), p. 558, our emphasis)
> And this commitment stance *moves the teacher to reflect on his/her practice*." (Article (4), p. 363, our emphasis)
> [...] the experience allowed the teacher to think and give meaning to *the importance of individual and collective reflection* to raise awareness about emerging events in practice, implications, and the possible need for changes. (Article (7), p. 504, our emphasis)

These conceptions and perceptions of the authors confirm what several researchers highlight the importance of reflection on practice seen as a potentializer of best practices, such as Dewey (1983), when citing "reflective thinking," Schön (1983, 1987), when prosing his theory on "reflective professionals," or Zeichner (1993), when addressing "reflective teaching" (Oliveira & Serrazina, 2002).

We could see that the authors of Articles (1) and (7) highlight changes in their teaching identities as one of the purposes of the investigative processes of their own practices. As an example, in Article (1), one of the objectives of the self-study consisted of "examining practice and documenting changes in our identities as teachers and researchers" (p.1008). In this case, the authors refer to the changes they perceived in their professional teaching identities when researching their own practices. Cyrino (2017) cites the professional identity (PI) of teachers who teach mathematics (TTMs) as a movement that "occurs in view of a set of beliefs and conceptions interconnected with self-knowledge and knowledge about their profession, associated with autonomy (vulnerability and sense of agency) and political commitment" (p. 704). Paula and Cyrino (2020) indicate that "discussing the singularities of TTMs' formative processes is closely associated with the movements of being, seeing oneself, and being recognized as a teacher who teaches mathematics" (p. 4).

Another aspect that stood out in the analysis was that four articles (2, 4, 5, and 7), (approximately 57%, among the seven selected) referred to the importance of communication, cooperation, dialogues, or interactions in the teaching and learning process and the role of the teacher as a mediator, as observed in the following fragments:

> Regarding classroom interaction, participants *emphasize that the interaction between teacher and student should be more dialogical than masterful*". (Article (2), p. 78, our emphasis)
> [...] *cooperation in the classroom, through interactions between students* is configured as a space for *the construction and reconstruction of diverse knowledge*, enhancing learning." (Article (4), p. 372, our emphasis)
> [...] *the importance of the teacher providing moments for discussions* during the activity and thereby encouraging the overcoming of certain difficulties reflect on the role of mathematics in society, awaken motivation in critical phases, and also enrich research on the problem under study. In these discussions, *the teacher must manage discussions so that students' opinions are equally valued*, and all the results considered." (Article (5), p. 433, our emphasis)

Only in Article (1) was the use of narrative verified as a strategy for recording reflections on one's own practices, which was also adopted as a method for disseminating results. We initially conjectured that this strategy could appear more frequently, pondering that it is a type

of research that refers to the teaching learning of the teacher-researcher involved in the investigative process. This understanding is supported by Marçal et al. (2009), who indicate the methodological perspective of adopting narratives as a fundamental instrument in research on one's own practice, highlighting that narrative trails –built from one's own experiences, readings, and interactive sharing of knowledge with colleagues, carried out in research groups, elaborated through systematic and daily observations– enable broad transformations in teaching and learning processes.

Regarding the question: "What are the main results?" (see Appendix 2), we found that five articles (2, 4, 5, 6, and 7) referred to the conclusions of their own teaching learning, on theoretical and methodological aspects, and did not highlight how they emerged from contradictions perceived in their own practices. In Articles (1) and (3), we found that the results related to the own learning emerged from perceived contradictions and led to thinking about necessary changes for teaching improvement.

Only in Article (1) did the authors refer to the changes self-study provoked in their identities as teachers and researchers. These changes in theoretical or didactic perspectives or stances connect with the process of "modeling" practices, as presented by Loughran (2007), when teachers seek to practice what they preach, investigating, exploring, and testing teaching and learning environments through their own models of practices. It is worth noting that the teacher, through modeling their practices, when pursuing the purpose of their professional desire to influence their students' learning positively, is able to perceive interesting insights into their difficulties and dilemmas and, according to Loughran (2007), "the interaction between teaching and learning becomes more accessible and valuable as this purpose of self-study (modeling) creates ongoing experiences that provide opportunities for teachers and students to experience meaningful learning for themselves" (p. 13)

The analysis of Articles (1) and (2), developed in formative contexts, allowed us to perceive that the teachers-researchers intended to propose innovative methodological approaches in their education to deepen teachers' knowledge. This aspect corroborates what Loughran (2007) indicates about teacher educators: they are professionals who continually adapt, adjust, and change their practices in response to the needs and concerns of their context,

which is evident in the results of their research. However, the way they emerged sets them apart. In Article (1), a self-study emerged from a conflict perceived during the formative process, i.e., in the performance of the teacher educators in the classroom. In Article (2), the research emerged from the need for the analysis "OF one's own practices" based on a previously planned model. This is an indication that studies "OF one's own practices" *are approaches that enable professional development*, both for teachers (or teacher educators) who work directly with their students in the classroom and for teacher educators who must continually improve their formative proposals in the face of the challenges that arise.

In general, the analysis of all the selected articles indicates that the research either arose from predefined objectives, when the teachers-researchers sought to "model" new practices, experimenting with new theoretical or methodological approaches, or emerged as "new aspects" to be considered, amid qualitative research carried out on the practices themselves, as indicated in the fragment: "This research addresses an aspect of the social life of a small educational community in constant interaction, *aiming to understand the school journey to contribute to the improvement of teacher planning*" (Article (4), p. 363, our emphasis). In all of them, there was an increase in theoretical and practical knowledge, which certainly favored the professional development of the teaching staff of the teachers-researchers involved.

In the context of research developed in formative processes, the results revealed that the teacher educators had professional learning on the practices of the teachers-researchers involved. This fact corroborates the statement by Bullough and Gitlin (2001) that this type of research, when developed in formative processes, enables the evolution of teaching learning, in the sense that teachers learn to propose new practical approaches based on their own personal experiences.

As indications for future research, we found that (i) Articles (1) and (2) refer to the replanning of the formative proposal, and in Article (1), the authors question: "What does it mean to engage in professional development with teachers without assuming an evaluative stance? How can we approach our work with teachers without a preconceived notion of what should be learned or taught?" (p.1009), and Article (2) states:

> [...] aiming to develop the reflective competence and the 'meta' dimension of mathematics didactic knowledge of mathematics teachers (Pino-Fan, Assis, & Castro,

2015), we are designing and implementing formative devices that combine the use of the CE with the ICE methodology as a tool to organize reflection on their practice (p. 80);

(ii) Articles (3) and (7) refer to the redesign of practices, and in Article (3), the authors propose:

Rethinking assessment practices and the tasks proposed to students both in class and in assessment situations, [...] in an attempt to break with a school culture of teaching mathematics that prioritizes fulfilling the program [...] towards a culture of learning mathematics with understanding (p. 568);

And in Article (7), they signal:

[...] the relevance of considering professional identity (De Paula & Cyrino, 2021) and the emotional dimension of teaching (Freire et al., 2014) in investigations and formative actions similar to the one presented. Other complementary studies that implement the intelligent action/experimentation stage in different contexts can complement and advance the ideas and discussions presented here on the implementation and appropriation of exploratory statistics teaching practices by basic education teachers (p.507);

And (iii) in Article (6), the authors suggest new research to refine results, indicating:

we emphasise that further research must approach the categorization of students' actions in traditional mathematics classes and with the use of games to highlight possible similarities and differences between the four types of planning presented here (column 1 of Table 5) and that left gaps in column 3 (first two lines). (p. 349)

Articles (4) and (5) do not suggest future research.

Conclusions and final considerations

The systematic literature review carried out in our study took articles published in the Brazilian journals *Acta Scientiae*, *BOLEMA*, *Educação Matemática Pesquisa* and *Zetetiké* during the last ten years (between 2013 and 2023). We selected seven articles, which represent approximately 7.6% of the total 92 studies involving teachers' practices or, more broadly, 1.3% of the total 559 articles connected to the field of research on TTMs and their different contexts or approximately 0.3% of the total 2,546 consulted articles. These numbers reveal that the research approach "OF own practice" developed within the scope of continuing education or in contexts of middle or high school has still been little explored and disseminated in these contexts, within the scope of the journals consulted.

A possible explanation for the low number of articles in this sample may be that teachers who reflect on their practices do so spontaneously and not systematically. In order to establish

themselves as teachers-researchers in the contexts that involve their practices, they need to adopt an investigative stance (Cochran-Smith & Lytle, 1999) that includes the use of a research methodology with clear prior objectives and that has the judicious and systematic rigor that this investigative strategy requires (Ponte, 2002). Teachers who reflect on their actions in the classroom context often find it difficult to disseminate the knowledge they have acquired through their own practices, either due to a lack of professional opportunities that allow them to conduct appropriate scientific analyses to ensure quality in their dissemination, or due to a lack of more in-depth or specialized theoretical knowledge on the subjects of the practices they investigate. These issues make them consider only their perspectives and teaching knowledge applied in their daily lives (Ponte, 2002, 2004). In both cases, limitations prevent the systematization of their own constructed knowledge, which makes it difficult to disseminate their results in specialized journals. Another possible explanation for the small number of studies on research "ON one's own practice" developed within the scope of continuing education or in contexts of middle or high school may be because professional teaching knowledge linked to practice has little prestige within scientific communities, where scientific knowledge is privileged. This indication reiterates what Loughran (2004) states when he emphasizes that the validity of research carried out by teachers encounters resistance in the academic environment. The chosen journals, highly regarded from a scientific point of view by CAPES (Qualis A), prioritize the dissemination of knowledge of an academic nature, which limits the space for the socialization of articles related to new professional knowledge, as indicated by the research results. It is worth noting that, in professional master's or doctorate degrees, due to their characteristics and purposes, one of the focuses of research should be the perception of one's own teaching professional development to understand, through self-reflection, how research into one's own practices contributed to changes in their own teaching and learning processes. We understand that they should explore how teacher-researchers perceive their evolution in professional teaching knowledge as they advance their research. As a counterpoint, in the case of academic master's or doctorate degrees, as the main objective is to qualify future researchers, research on one's own practice, despite being an alternative, is

generally not considered a focus, perhaps due to the distance from this type of research that focuses theoretical aspects to the detriment of practical ones.

When seeking to answer the questions "What does the literature indicate about empirical research on 'research on one's own practices' involving mathematics teachers, who work in middle or high school?", "In what way can 'research of one's own practices' provide professional development as a teacher?" the comparative analyses indicated that the majority of the articles did not highlight teacher learning as emerging from perceptions of contradictions regarding one's own practice and did not explicitly bring to the discussion the difficulties perceived by teachers-researchers and their impact on the final results, such as teacher learning driven by one's own practices and changes perceived in one's own teaching identities as a result of the investigative processes on such practices (Loughran, 2007). Most papers highlighted the importance of a reflective stance and communication of cooperation, dialogues, or interactions in the teaching and learning process and the teacher as a mediator in action developed in practice (Cochran-Smith & Lytle, 1999). In all selected research, teachers-researchers were committed to their own teaching development or the professional learning identified from their own practices (Lytle & Cochran-Smith, 1990; Ponte, 2002). The analyses point to the investigation of one's own practice as a promising methodology, as it provides the continuity of professional teaching learning (Gonçalves et al., 2022; Opfer & Pedder, 2011; Webster-Wright, 2009) and promotes professional teaching development by considering the perspective of teaching learning based on theoretical and practical teaching knowledge, arising from the own teaching experience linked to the problems faced throughout their teaching practices (Gonçalves et al., 2022; Gonçalves et al., 2024; Lima & Nacarato, 2009; Ponte, 2004). Furthermore, we saw that promoting formative processes to provide teaching development associated with the investigation of "one's own practice" or self-study through reflections on reflection on action requires this process to be combined with experimentation of one's own teaching practice in the classroom context, where specific teaching demands are made explicit, which can favor the development of critical thinking and autonomy in solving one's own problems, challenging teachers to assume the role of researchers in research "OF their own practices." Collaboration and shared investigations through participation in investigative communities are also

fundamental to broaden the perceptions of the researcher who conducts the research of their own practice.

We concluded that by adopting the investigative stance "On one's own practices" in the classroom, or self-study, in formative contexts, the teacher or teacher educator can enhance their professional knowledge linked to theoretical and practical teaching knowledge, enabling and stimulating their own professional teaching development.

This review does not exhaust the subject, but it makes it possible to identify the need for future planning and implementation of initial or continuing teacher education so that the education of future teachers-researchers of their own practice is facilitated and encouraged, with a view to teachers' professional development in the mathematics education field and collaboration with new knowledge linked to the professional teaching community.

Furthermore, considering the current need for teaching activities in mathematics teaching that enables the development of students' competencies and skills, as provided for in the BNCC (MEC, 2018), it is worth highlighting that the indicators of this research can contribute to planning future continuing education for mathematics teachers, especially regarding the preparation of research projects, their objectives, achievements, and analyses, both at the postgraduate level and in specific courses. By providing professional learning environments for teachers that favor professional teacher development and contemplate the objectives of current Brazilian public policies that prioritize the adoption of formative process models that promote the integration between theory and practice, the development of such projects could favor the occurrence of effective changes in beliefs and practices in the context of teaching activity.

By expanding theoretical and practical knowledge through reflection carried out in research into their own practices, mathematics teachers, when facing the numerous problems that emerge in the contexts of their own classes, become more autonomous and capable of finding appropriate theoretical-practical solutions, which certainly qualifies their teaching methods and enables improvements in students' learning processes.

As indications for future studies, we envision that one aspect that can be explored in research "OF one's own practices" relates to the knowledge teachers develop during their own

experience in the classroom, known in the literature as *noticing* (Stahnke et al., 2016). Such knowledge is related to perception, interpretation, and decision-making, and is developed as practical teaching knowledge of the teacher, constructed in the natural environment of his/her classroom, as a result of his/her own situated learning. Important in the process of professional teaching development, this aspect was not covered in the consulted articles.

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