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ARTICLE

OTHER WAYS TO THINK MATHEMATICS TEACHING: THE USES OF THEORY AND PRACTICE ON TEACHERS TRAINING

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ABSTRACT: This paper develops from discursivities concerning theory and practice that go along with teachers training. Taking Michel Foucault's theorization, Ludwig Wittgenstein's latter thought and studies on contemporary teaching as analytical inspiration, this research describes the meaning ascribed to theory and practice on Mathematics' teachers training courses, analyzing how they have been providing teaching that corroborate dichotomous utterances about these dimensions. The research material was provided by means of semi-structured interviews with Mathematics teachers who teach on Mathematics degree courses in the South of the country. The analytical movement performed exhibits that, as mathematical and educational knowledge are ascribed only in one of these dimensions, ways of teaching that prioritize what lies either on the concrete and the daily or on the abstract and the formal are settled, thus naturalizing and corroborating the dichotomy theory-practice on teachers training.

Keywords: Mathematics Education, Dichotomous utterance, Teachers training, Theory and practice.

OUTRAS FORMAS DE PENSAR AS DOCÊNCIAS EM MATEMÁTICA: OS USOS DE TEORIA E PRÁTICA NA FORMAÇÃO DE PROFESSORES

RESUMO: Este artigo desenvolve-se a partir das discursividades sobre teoria e prática que circulam na formação de professores. A pesquisa, ao tomar como inspiração analítica as teorizações de Michel Foucault, o pensamento tardio de Ludwig Wittgenstein e estudos sobre docência contemporânea, descreve os significados atribuídos à teoria e à prática em cursos de formação de professores de Matemática e analisa de que forma eles têm produzido docências que reforçam enunciados dicotômicos sobre essas dimensões. O material de pesquisa foi produzido a partir de entrevistas semiestruturadas com professores de Matemática que desenvolvem a docência em cursos de Licenciatura em Matemática no sul do país. O movimento analítico realizado mostra que,

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na docência em Matemática, ao significarem-se os conhecimentos matemáticos e pedagógicos somente em uma das dimensões, são construídos modos de ensinar que priorizam o que está na ordem do concreto e do cotidiano ou o que está na ordem da abstração e do formalismo, naturalizando e reforçando, na formação de professores, a dicotomização teoria-prática.

Palavras-chave: Educação Matemática, Enunciado dicotômico, Formação de professores, Teoria e prática.

OTRAS FORMAS DE PENSAR LAS DOCENCIAS EN LAS MATEMÁTICAS: LOS USOS DE TEORÍA Y PRÁCTICA EN LA FORMACIÓN DE PROFESORES

RESUMEN: Este artículo se desarrolla a partir de las discursividades sobre teoría y práctica que se encuentran en la formación de profesores. La investigación, tomando como inspiración analítica las teorizaciones de Michel Foucault, el pensamiento y los estudios posteriores de Ludwig Wittgenstein sobre la enseñanza contemporánea, describe los significados atribuidos a la teoría y la práctica en cursos de formación de profesores de Matemáticas y analiza cómo esos cursos han producido prácticas docentes que refuerzan declaraciones dicotómicas sobre esas dimensiones. El material de investigación se produjo a partir de entrevistas semiestructuradas con profesores de Matemáticas que desarrollan su docencia en cursos de Licenciatura en Matemáticas en el sur del país. El movimiento analítico realizado muestra que, en la docencia en Matemáticas, al significar el conocimiento matemático y pedagógico solo en una de las dimensiones, se construyen formas de docencia que priorizan lo que está en el orden de lo concreto y de lo cotidiano o lo que está en el orden de la abstracción y del formalismo, naturalizando y reforzando, en la formación de profesores, la dicotomía teoría-práctica.

Palabras clave: Educación Matemática, Declaración dicotómica, Formación de professores, Teoría y práctica.

INTRODUCTION

This work investigates how theory and practice are signified and set in motion in Mathematics teaching in teacher training courses. At first, we present the texture of the problematization and then, the meanings of theory and practice that circulate in teacher education, to subsequently show how much it is necessary to pay attention to teaching and training when we take a dimension as a priority or when, to extinguish the theory-practice dichotomy, we reinforce actions that intensify it. At the end of the text, we make some considerations about the analyses, indicating certain points that we consider important in the training of teachers, especially in the area of Mathematics.

With this movement, we seek to indicate alternatives for thinking about contemporary teaching and, also, to stress how this teaching (re)produces, in the education of the Mathematics teacher, what still seeks to transform: *the theory-practice dichotomization* or, still, *the privilege of one dimension over the other* in this training.

The empirical material produced consisted of 11 semi-structured interviews with Mathematics teachers[3] who work in Mathematics Degree courses at a Federal Institution in the south of the country. To analyze the materiality resulting from this method, we try to maintain, as Foucault teaches us, an open and attentive posture to the senses and enunciations that come into contact in the scrutiny of the material, looking at what was said in its positivity. (FOUCAULT, 2016). With this, we establish approximations and distances between the meanings of theory and practice made visible in the interviews and the statements that they move so that, in the end, we can analyze what they have produced in teacher education.

With a contemporary lens, from studies of authors who turn their backs on thoughts that are inscribed in the Platonic arc and the doctrine of two worlds[4], we seek to examine some of the processes that are engendered in teaching and in the relationships built in this teaching, understanding that "Looking again at the mechanisms of our educational institutions, questioning the truth of our cultivated discourses, examining everything that makes us what we are, all this opens up possibilities for change". (GORE, 2011, p. 16).

Inspired by Giorgio Agamben (2009), we use the term *contemporary* to refer to a way of being and of reading the world. Using a contemporary lens means being able to look at the present of this time and see it as discontinuous, neutralizing its lights and perceiving its multiple colors and meanings, its shadows, and also the points of darkness. In that sense, the

> [...] contemporary is not only the one who, perceiving the darkness of the present, apprehends the resolute light; it is also the one who, dividing and interpolating time, is capable of transforming it and placing it concerning other times, of reading history in an unprecedented way, of "quoting" it according to a need that is not it comes not at all from his will, but from a demand to which he cannot respond. (AGAMBEN, 2009, p. 72, author's emphasis).

To think about these questions, we took the theories of Michel Foucault, the later thinking of Ludwig Wittgenstein, and studies on contemporary teaching as analytical inspiration. The inscription of this research in these registers allowed us to look more freely at Mathematics teaching and constitute it as an object of our thinking, which enabled us to describe and analyze the productivity of statements about theory and practice in the processes of education in Contemporaneity. When we look at the training of Mathematics teachers and, specifically, at the teaching in Mathematics that is developed in formative contexts, we are attentive to the studies of Mathematics Education and the meanings of theory and practice put into circulation in this area of training.

In the field of Mathematics Education, the concern with the theory-practice dichotomization has been manifested in different ways, whether in research that uses the references used in this text or in investigations that are inscribed in other theorizations. Dario Fiorentini (2003), from another perspective, points out that, although what is said around the theoretical and practical dimensions seems to change direction, what is perceived in the training processes "is the continuity of a predominantly retrograde and centered on the model of a technical rationality that divides theory and practice". (FIORENTINI, 2003, p. 9). Researches like these show that the theory-practice dichotomy has been seen as a problem in the education of the Mathematics teacher.

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[3] Although we are aware of gender studies and the implications of using the term professors to refer to the women and men who participated in this research, we chose not to use the gender in the term to obtain greater fluency in the text.

[4] We refer to the understandings that conceive reality in a dichotomous way – one intelligible and the other sensitive. In this understanding, "everything that concerns facts and deeds in the sensible world would concern practices, while everything that concerns what is truly thought and truly said (about such practices) would concern theory – or, perhaps better: would be the result of the good and correct application of the theory. Here is the correspondence between the dual doctrine and the theory-and-practice binary; [...]". (VEIGA-NETO, 2015, p. 126).

Corroborating the diagnosis made by Fiorentini (2003), Suelen Santos (2015) shows that, in the education of mathematics teachers, teaching is loaded with dichotomous understandings of theory and practice. In the dichotomy,

> [...] theoretical knowledge intends to give support, a "solid base", to what can be observed and done in practice. In the education of Mathematics Teaching, a non-coexisting, discontinuous and causal succession is established: first the theory and then the practice; practice, therefore, is subordinated to theory, since the latter is considered a priori. (SANTOS, 2015, p. 68, emphasis added by the author).

In the historicity of Brazilian educational thought, we can see that in the model of *technical rationality*, which instituted the first courses for teacher training at a higher level, created in Brazil in the 1930s, the teacher was seen as

> [...] a technician, a specialist who rigorously applies, in his daily practice, the rules that derive from scientific and pedagogical knowledge. Therefore, to train this professional, a set of *scientific subjects* and another set of *pedagogical subjects* is necessary, which will provide the basis for their action. (DINIZ-PEREIRA, 1999, p. 111-112, my emphasis).

The categorization of the knowledge necessary for future teaching, and the idea of a hierarchy between them, created ways of thinking about teacher education. In this formative model, understandings are engendered that consider theory as being only specific knowledge (in this text, mathematical knowledge) and practice as consisting of pedagogical knowledge and teaching activities. We say this because many of the criticisms registered in Brazilian educational thought refer to these meanings.

> [...] the separation between theory and practice in professional preparation, the priority given to theoretical training to the detriment of practical training, and the conception of practice as a mere space for the application of theoretical knowledge, without an epistemological statute of its own. Another mistake in this model [of technical rationality] is to believe that mastery of the specific area of knowledge to be taught is enough to be a good teacher. (DINIZ-PEREIRA, 1999, p. 112).

Although in Brazil, since the first Law of Directives and Bases of National Education (LDBEN- *Lei de Diretrizes e Bases da Educação Nacional*), of December 1961, and the laws that were established later, different directions in research that deal with theory and practice in teacher training have become evident. This model of technical rationality still seems to occupy a significant place in Mathematics Degree courses in the country. (GATTI; NUNES, 2009).

In a retrospective of Brazilian research on the training of mathematics teachers until 2000, Ana Cristina Ferreira (2003) points out that she has found many works that show deficiencies in the process of initial training of mathematics teachers and suggest perspectives for its improvement. According to the author, the

> [...] research points to reflection, collaborative work, and a more balanced and harmonious relationship between theory and practice – in which both become allies, dialoguing dialectically – as fundamental points for the various changes that are necessary. (FERREIRA, 2003, p. 32).

Although many researches rely on the dialectical perspective to think about theory and practice, we prefer to get out of this two-way relationship. With this, we do not try to "criticize" the meanings already constructed for these terms in Modernity or Contemporaneity, nor do we seek to seek another, supposedly more advanced, meaning for them. "Falling into this temptation would mean remaining in the same field of theorizations under analysis". (SILVA, 2002, p. 11).

Contrary to usual thinking, we try to escape from universals, from absolutes, without falling into relativism. We assume what Alfredo Veiga-Neto (2011) called the "Foucauldian posture",

> [...] which is characterized by the most complete and permanent distrust of truths that are usually taken for granted, calm and natural. A posture that is manifested by the constant attempts to escape any framework that postulates as unproblematic the Enlightenment ideas of a founding subject, a transcendental reason, and a natural and universal man or woman who would inhabit each of us. (VEIGA-NETO, 2011, p. 243).

With this perspective that explains our place of speech, we understand that although some directions taken to investigate theory and practice are inscribed in a cause and effect relationship[5]so that it seems natural to prescribe forms of articulation between these dimensions to overcome such mismatch, we believe it is possible to think of these dimensions from outside the base on which this problem was created, which implies "changing the glasses that we see the world in this or that way". (VEIGA-NETO, 2015, p. 118). Outside the Platonic arc, we propose, then, to think about theory and practice, considering them as two sides of the same coin or as dimensions of the same materiality. What effects will these and other understandings of theory and practice have on teacher education? This is the challenge we take on.

METHODOLOGICAL PATHWAYS

This text is part of doctoral research that investigates how theory and practice are signified and set in motion in Mathematics teaching developed in Mathematics teacher education courses. The empirical material was produced from a research project approved by the Research Ethics Committee of the Universidade do Vale do Rio dos Sinos (UNISINOS), under the number CAAE 76642517.6.0000.5344, opinion nº 2.430.329. In this part of the study, we present the narratives of 11 Mathematics teachers who teach in one of the 5 Mathematics Degree courses offered by a multi-campus Federal Institution in the south of the country.

Research data were produced through semi-structured interviews that were recorded and transcribed with the consent of the participants. The interviews had an average duration of 45 minutes each and sought to capture, in particular, the meanings of theory and practice assumed by teachers and their interlocutions in Mathematics teaching. When using materiality, we were ethically careful not to identify the subjects and, in this text, we used the following in the description of the lines: Professor 1, Professor 2, and so on, with the numbering given in the order in which the interview was carried out.

The teachers interviewed were 6 males and 5 females. All teachers have varied experiences in teaching Mathematics, both in LM courses, in Basic Education (in the High School stage), or even in other undergraduate courses in Higher Education. As for teaching time, 7 teachers have less than 5 years; 2 teachers are from 5 to 10 years, and 2 professors have more than 15 years of teaching experience. Furthermore, all the teachers interviewed have degrees in the area of Mathematics and have postgraduate training in Mathematics, Education, or even in the area of Engineering, as shown in Box 1.

Box 1- Academic education of the interviewed teachers

	Mathematics area	Education Area	Engineering Area
Master's degree	10	1	-
Doctorate degree	4	2	2

[5] We understand, supported by Veiga-Neto (2004, p. 2), that "the causality that is easy to perceive in the world of Nature - in which a cause follows an effect, in which an action implies a reaction in the opposite direction and in the same intensity - has little to do with the world of culture, economy, education".

Source: Prepared by the authors from the research material (2019).

As for the strategies of description and analysis of the speeches generated from the interviews, we used different operations: we read and reread, we highlight recurrences, we mark singularities, we build categories, we organize and reorganize groups of meaning, we make connections. As Foucault teaches us, we kept our gaze focused on what was said, "[...] simply as a *dictum*, in its simple positivity" (VEIGA-NETO, 2011, p. 97, author's emphasis).

The teachers' speeches were also taken as narratives that, as conceptual-methodological tools and allowed us to approach the concepts, experiences, and practices of the subjects who speak (ANDRADE, 2014). This is because we understand that when narrating something about our teaching, we also reconstruct some of the meanings that we assume in our teaching constitution processes and in our ways of being a teacher.

We inscribe this research in studies on contemporary teaching and the theories of Michel Foucault and the thinking of Ludwig Wittgenstein, in its late phase, as we understand that both authors deconstruct the dichotomy using different ways, but using language. The inscription in these theorizations also allowed us to place Mathematics teaching as an object in our thinking, which made it possible for us to stress the productivity of the statements and discourses on theory and practice made visible in the teachers' speeches.

We use the expression enunciated, in this text, with the meaning proposed by Veiga-Neto (2011):

> [...] a very special kind of discursive act: it separates itself from local contexts and everyday trivial meanings to constitute a more or less autonomous and rare field of meaning that must then be accepted and sanctioned in a discursive network, according to order - either in terms of its truth content, or in terms of the person who practiced the enunciation, or in terms of an institution that welcomes it. (VEIGA-NETO, 2011, p. 94-95).

With this conceptual understanding, we look at the discourses on theory and practice, conveyed in the teachers' narratives, as a set of statements that cross and produce effects in teaching, which can legitimize, interdict, and manufacture truths that are operated in the context of the education of teachers. Such discursivities reveal the discourses, which work as a "[...] set of statements that are supported by the same training system" (FOUCAULT, 2016, p. 131) and for which it is possible to "[...] define a set of conditions of existence" (FOUCAULT, 2016, p. 143). Interpellated by these meanings, we consider that the teacher is also constituted by inserting and valuing so-called true speeches, which empowers him as a teaching individual subjected to himself and the other, through language.

With the choices of these conceptual and methodological tools, we seek, in this text, to describe the meanings of theory and practice in teaching Mathematics teachers and analyze how, from them, ways of being a teacher are signaled, in contemporary times.

THE MEANINGS OF THEORY AND PRACTICE IN MATHEMATICS EDUCATION

> The meaning of a word is its use in the language. And the meaning of a name is often explained by pointing to its bearer. (WITTGENSTEIN, 2014, p. 38).

Thinking about thought requires the recognition that the force that moves and institutes it is language. We use Ludwig Wittgenstein's later thinking to understand what words are made and what their uses in language are meanings. In this way, language constitutes thought, forming not only what we think, but what we do, creating realities and instituting meanings.

To account for this way of understanding thought and language, we start from the understanding that we move in certain games, and in them we construct meanings, validate and refute ways of thinking and explaining, specifically, theory and practice. With Wittgenstein, we call

language games "the totality formed by language and the activities intertwined" (WITTGEINSTEIN, 2014, p. 19) and we use this concept to approach the understanding that what we mean, while teachers, as theory and practice, are ways of thinking within a given language game, which make sense in this game, since their uses are established in it.

Thus, "a language game that is fully satisfactory in a given situation may not be so in another, because when new elements arise, situations change, and the uses that worked at the time may no longer be satisfactory in a new situation". (CONDÉ, 2004, p. 89). This Wittgensteinian perspective indicates that the meanings of words do not carry an invariable universal essence, but fluctuate as a product of the use we make of them in the language games in which we move. Thus, thinking about the meanings of theory and practice in mathematics teaching implies thinking about the uses that these words assume in the ordinary language of teachers. We have understood that language

> [...] is like a collection of different tools. [...] Many of the tools are related to each other in form and use, and the tools can be roughly divided into groups according to their relationships; but the boundaries between these groups will often be more or less arbitrary and there are various types of intersecting relationships. (WITTGENSTEIN, 2010, p. 47-48).

The arguments presented by Wittgenstein indicate that it is within a form of life[6] (with its grammar and language games) that we construct the rationality that determines what we accept and what we reject as true. "In other words, from grammar and language games, there is the possibility of establishing criteria of rationality that can be understood and even accepted by different forms of life." (CONDÉ, 2004, p. 30).

By taking this theorization as a toolbox, we assume the constitutive function of language, since, if it expresses something, "it does not do so insofar as it imitates and reduplicates things, but insofar as it manifests and translates the fundamental will of those who speak". (FOUCAULT, 1990, p. 306). Thus, we understand that it is through language that we interact with the world (CONDÉ, 2004); that we give meaning to the materiality of the world and even to the meanings we attribute to the theoretical and practical dimensions in teaching developed in teacher education.

To help us understand and systematize the meanings attributed to theory and practice, through the research material, we use the concept of *ostensive definition*, explored by Wittgenstein (2010; 2014), which allowed us to allocate in the grammar of language used by teachers and the uses assumed by these dimensions.

The *ostensible definition* of a word can be seen as the most familiar meaning (taught to us, in our initial insertions in the language and as part of a culture). It is often a table and "establishes a link between a word and 'a a thing', and the purpose of this link may be that the mechanism of which our language is a part must work in a certain way". (WITTGENSTEIN, 2010, p. 143, author's emphasis). The *ostensive definition* "explains the use – the meaning – of the word, if it is already clear what role the word has to play in language", (WITTGENSTEIN, 2014, p. 31), which implies that the word only makes sense in the context in which it is used, or rather, in the language game in which it is imbricated.

This understanding allowed us to organize, from the material produced in the interviews, families of meanings for theory and practice, considering the related use of these terms in Mathematics education. With this, we try to think about the role played by these dimensions in language games set in motion by Mathematics teachers, especially by those who constitute school mathematics and mathematics teaching in teacher education. In the analysis exercise we carried out, we tried to pay attention to the grammar of the words of *theory and practice*, that is, the rules

[6] We use this concept from Wittgenstein's understanding: "What must be accepted, the given – one could say – are forms of life". (WITTGENSTEIN, 2014, p. 292).

according to which they are used in this or that way (or, according to Wittgenstein (2010), the conditions necessary for the understanding of their sense).

In this movement, we identified that the expression theory was used in a more restricted way than the practical expression, meaning, in general, *systematized knowledge*. Looking to build a family of meanings[7] for the term *theory* from the research material, we highlight this term being used as pedagogical or mathematical content and, in this case, as the axiomatic structure of Mathematics, with its definitions, theorems, and properties. The excerpts presented below illustrate the use of the term theory in teaching Mathematics, but they also show meanings for *practice*.

Box 2- Meanings of Theory in Mathematics Education

I ***bring theory all the time to the students*** *because they are always learning some content,* ***I am always giving some content to them****.* (Teacher 10, interview).
[...] I see that the course here has much more ***theoretical subjects*** *in the* ***sense of pedagogical*** *[...].* (Teacher 2, interview).
[...] I think we have a series of ***curricular components that are theoretical****, that are* ***the basis of our Science, and they are theoretical****. We cannot forget that we are* ***studying a theory****, [...]* ***the theory*** *is, necessarily, at the moment,* ***presenting the basic foundations of some curricular component*** *in which I am; then, the definitions, the theorems that follow from those definitions [...].* (Teacher 1, interview).

Source: Prepared by the authors from the research material (2019).

In the continuity of our analyses, we identified that the expression *practice* was used by teachers more widely, although the use of this term has usually referred to *the action of doing something*. In the idea of action, we identified two families of meanings for the practical dimension: one related to the exercise of teaching, that is, *practice as a future teaching activity*, and another related to the *dialogue of school mathematics in the order of life;* in this case, the practice is seen by the *logic of the application*.

The statements presented below show the meanings found for the practical dimension in Mathematics and also highlight meanings for the theoretical dimension, in particular, linked to mathematical knowledge.

Box 3 – Meanings of Practice in Mathematics Education

I understand that ***I am bringing practice when I manage to work applications of Mathematics****, I* ***see the practice there****, in this* ***application logic****. I understand that* ***I am bringing practice*** *when I* ***can effectively link the content****, as heavy as it may be,* ***to a little piece of the curricular component from Basic Education****, and I understand [also] when* ***I encourage them to do teaching practices within my classroom, put them a little in the position of a teacher****: "now you are going to help us solve this, how can you explain this to me? How can we understand this?" That is* ***when I make the student put himself in the place of the classroom teacher****. For me, these three moments are moments of practice.* (Teacher 1, interview).
But ***the practice can even be creating instruments, even pedagogical games****, or something like that... They* ***are already practicing, in a way, the planning of the lesson****. So, practice can be something along those lines.* (Teacher 11, interview).
The ***internship is the moment*** *when the student will carry out* ***the practice*** *[...].* (Teacher 4, interview).
A prática *é aquilo que a gente consegue, daqui a pouco, aplicar em uma determinada situação, até mesmo do dia a dia.* (Professor 7, entrevista). ***Practice*** *is what we can soon apply in a given situation, even every day.* (Teacher 7, interview).

[7] We are using the expression *family of meanings* to group the understandings that seemed to move the same rules of education.

Source: Prepared by the authors from the research material (2019).

The analysis of the research material has shown us that, in the education of a Mathematics teacher, the *theory* is mostly understood as a set of hierarchical and structured knowledge. *Practice*, in addition to being part of the logic of the application, assumes the meanings of teaching action. In this case, the activities that place the student in the position of teacher – also known as *practice* in the teachers' speech – rehearse the future teaching, either through dialogues between the mathematics content of Higher Education and the mathematics content of Basic Education or for the organization of activities that place the student in the position of teacher. The excerpts in Box 3 show the power of the use of *practice* expression when linked to the professional practice of the Mathematics teacher. In this meaning, when rehearsing teaching, the *practice* in Mathematics is placed back in the dimension of doing and directed towards activities that will, in the future, be the teacher's tasks.

Box 4 - The practice in Mathematics enhanced in the teaching action: the mathematics of HE and the mathematics of BE

It ***[the practice] appears whenever possible****. I try to force the bar with them so that we leave this accommodation here and* ***try to provoke a classroom situation****. For example,* ***I'm working with real numbers,*** *in Analysis... So, let's force it here and* ***try to see how this happens in your classroom: how would you deal with this problem there?*** (Teacher 1, interview).
For example, in Elementary Mathematics 1, I am working on the beginning of the demonstrations: Sets, Natural Numbers, Integer Numbers. So, of course, I present the part of the axiomatic construction of Mathematics, but at the same time, I say: ***"We are now seeing Integers. When we deal with this at the end of Elementary School, how can we do the construction with the students, without using the axiomatic form of Mathematics itself?"*** *So, I try, in every class, to make* ***this connection between pure mathematics and his performance in the classroom.*** (Teacher 9, interview).
[...] if we don't give the space, ***if we don't explain it to the student, he will think that the practice is just going there and teaching****. We have to tell the student that* ***practice is also to design activities, analyze textbooks, prepare a game, make a lesson plan, present a lesson plan.*** *[...] the student has to understand that the practice is not just teaching [...].* (Teacher 8, interview).

Source: Prepared by the authors from the research material (2019).

The different uses of the term *practice* in Mathematics teacher education, both for the meanings that are inscribed in the order of teaching and for the meanings inscribed in the logic of the application of mathematical content, do not seem to make it clear what is meant when the practical dimension in Mathematics is discussed, which has implications for the understanding of these dimensions by Degree students and Mathematics teachers. Our understanding is that the meanings of practice that are inscribed in the logic of teaching action constitute a practice dimension, but of teaching, and not of mathematical knowledge. In this way, we see how knowledge of mathematics and pedagogical knowledge are nuanced and intersect in the constitution of teaching in mathematics. However, it is necessary to be clear that both have theoretical and practical dimensions.

With that, we have understood that not discriminating the uses of the term *practice* in the education of the Mathematics teacher reinforces disconnected and dichotomous understandings that potentiate one or another dimension. As a way of minimizing these effects, we understand that recognizing different uses for the same word and differentiating them (where dichotomous discursivity still naturalizes theory and practice in different and opposing spaces, times, and materialities) is a qualifying bet to help in the understanding of one's teaching in Mathematics and what is at stake when using this or that dimension in teacher education.

From this, it also seemed interesting to show how the meanings produced for the theoretical and practical dimensions reinforce, in the education of the Mathematics teacher, ways of teaching that dichotomize theory-practice or, even, that privilege one dimension over the other in this education. That's what we discuss in the next section.

IN THE TEACHING STRUCTURES: THE POTENTIZATION OF THE THEORY-PRACTICE DICHOTOMIC STATEMENT

To reinforce our argument that the meanings of theory and practice move and productive ways of teaching that potentiate or not the theory-practice dichotomization, we were inspired by Michel Foucault's classes on January 5th and 12th, 1983, transcribed in the book *The government of oneself and others: course at the Collège de France* (1982-1983). We start from Oliveira's Thesis (2015) to understand teaching as a matrix of experience, considering that it has history and is inscribed in the axes of the education of teaching knowledge (knowledge), the normativity of teaching behaviors (power), and the constitution of ways of being a teacher (ethics), explored by Foucault (2010).

Understanding teaching as a matrix of experience is to understand it as an experience constituted in history and based on the axes of knowledge, powers, and ethics, which makes us look at the historicity of teaching, its life in history - here, in the plotted history in teaching mathematics.

> To think of teaching as a matrix of experience, we need to understand that it is the result of historical and social fabrication, arising from practices of pedagogy and psychology, among other areas, in which, corroborating Rose (2011), the "personal experiences of education" they are understood, entangled and through which the human being comes to understand himself and to relate to himself as a teacher. (OLIVEIRA, 2015, p. 20).

With this understanding, we understand that the teacher is also constituted by inserting and valuing the discourses on theory and practice taken as truths. These discourses are understood as a set of statements that are constructed from the same training system (FOUCAULT, 2016). From this perspective, we see the discourses on theory and practice produced and put into operation in teacher education as unnatural since they function as normalizers of ways of being a teacher, legitimizing and activating ways of thinking, acting, and understanding teaching.

In interviews with Mathematics teachers, and also considering our experience in teaching and training, it is common to hear dichotomous statements about theory and practice, such as: "this only works in theory; in practice, it is different", or "I teach theory, not practice", or "theory is necessary to have the practice", or even, "we need to relate theory and practice". Such expressions, often colloquial, reinforce the dissociation between theory and practice and place each of these dimensions in different places. The excerpts in Box 4 illustrate this.

Box 5 – The prescriptiveness of the theory-practice dichotomous statement

I think that one is ***always articulating theory and practice*** *(in the classroom sense), a little less, a little more.* (Teacher 6, interview).
[...] the subjects of undergraduate courses, in particular, must be thought of in a way that ***relations between theory and practice can be established****. [...] Thinking about teacher education (as is the case of a degree), in my view, the* ***theory is only important when transformed into practice****.* (Teacher 5, interview).

Source: Prepared by the authors from the research material (2019).

The discursivity built around the theoretical and practical dimensions, the character of veracity in which dichotomous enunciations circulate in teacher education, and the apparent incompleteness of each dimension seems to make teachers increasingly seek, in one or another

dimension, the solution to the problem that was built about them in the educational field. To end the dichotomy, this movement in teacher education has been reinforced.

What we have noticed is that the status attributed to the expressions articulate and relate, when talking about theory and practice in teacher education, seems to indicate, in the area of training, the most appropriate way of dealing with such concepts, since it would be making the connection between what is understood to be separate. We do not agree that such a priori separation is necessary and important. Our lenses always take theory and practice as indivisible, which makes us not need to relate or articulate these dimensions. We need to understand the two dimensions as inseparable, to understand that knowledge is inseparably constituted of theory and practice. This understanding, in teacher education, will allow us to think about both mathematical and pedagogical knowledge more consistently, in addition to allowing us to justify the choices we make in our teaching.

The analysis carried out on materiality also shows that the dichotomous discursivity that builds and moves meanings for theory and practice also mobilizes teaching in Mathematics that either prioritize operations usually characterized as only of the order of abstraction and formalism, or operations that are signified almost exclusively in the order of the concrete, such as *mathematical realism*, already explored by Duarte (2009). This is because the use of theory and practice in this or that way in teacher education has implications and produces effects on teaching. By using theory and practice in certain ways and with certain meanings, ways of being a teacher are signaled and validated, which can help both in the dichotomization of these dimensions and in a more inseparable understanding of them, as can be seen in Box 5.

Box 6 - Ways of being a teacher

[...] sometimes, teachers cannot work theory and practice together, ***they work theory and then practice****. [...] they only show where it is used* ***at the end of the course****. I think differently.* (Teacher 5, interview).
I think we have to have a preview of technical knowledge, ***how to solve, how to do things, and then show the student that it can be useful for him*** *effectively,* ***that you can apply it in that situation, for example*** *[...]*. (Teacher 8, interview).

Source: Prepared by the authors from the research material (2019).

We have noticed that teachers tend to base their teaching actions (how they choose what they teach, how they understand what they teach, how they teach, among others) based on what they understand to be theory and practice. Thus, meaning mathematical (or pedagogical) knowledge only in the theoretical dimension and considering the practical dimension as not an integral part of (or supporting) this knowledge can manufacture and naturalize ways of teaching that prioritize what is in the order of abstraction and formalism. At the same time, meaning mathematical (or pedagogical) knowledge only in the practical dimension can imprint, in training, ways of teaching that strengthen what is in the concrete and everyday order, which tends to prioritize knowledge that is easily contextualized. in the student's immediate reality and, when not, weaken them in their most usual interlocutions.

Considering this diagnosis and going against the dichotomization, we bet on the understanding that theory and practice constitute knowledge inseparably. This allows us to make differentiated choices, choices that can build other meanings for teaching and deny a dichotomous worldview.

TO CONTINUE THINKING...

In the comprehension exercise carried out in this text, we have understood that, although the prescriptiveness of *relating theory-practice* appears as recurrent in teacher education, it is necessary not to give power to the supposed relationship between theory and practice, since, with the idea of a relationship, it already implies a certain distance, a certain dichotomy, which does not

contribute to other ways of qualifying and understanding these dimensions in teaching. Supported by Veiga-Neto, we understand that,

> [...] insofar as we do not recognize, for both - theory and practice -, the ontological status that those who shelter under the Platonic arc confer on them, and insofar as we understand them as merged into one another, we do not it makes sense to speak of "practice in itself", neither of "pure theory" nor of "relationships between theory and practice". (VEIGA-NETO, 2015, p. 132-133).

With this, we argue that teaching may not dichotomize theory and practice, if we understand these dimensions as inseparable, coexisting in the same materiality, as parts of the same process or as sides of the same coin (and, therefore, we chose to use in this text the term *dimensions*). This idea finds support in Veiga-Neto when he says that "[...] there is no practice – or, at least, a practice that makes sense, that is perceived as such – without a theory within which it, the practice, make sense" (VEIGA-NETO, 2011, p. 20).

In this non-dichotomous perspective, we presuppose the non-hierarchization of theory and practice and the move away from a universal and essentialist perspective of these dimensions, which tends to position and value the meanings that are privileged in culture; the sensible and the world of ideas and, therefore, the dichotomy.

This means thinking that, in teacher education, when dealing with mathematics (and also other sciences), even if we still do not know how to signify part of knowledge in some materiality, it is possible to do so, whether in more complex contexts or even in contexts not yet explored (this argument helps us, for example, to deconstruct the dichotomous idea that not all mathematics is practical and to think that mathematical knowledge is composed of theory and practice, as well as pedagogical knowledge). Thus, even if the usual meanings attributed to the theoretical and practical dimensions are allocated more in the order of thought when we refer to theory, or more in the order of action when dealing with practice, these two dimensions constitute, inseparably, the materiality of the world; especially, in this text, the different knowledge that integrates mathematics teaching and training. With this understanding, which produces more balanced truth effects for each dimension, we think it is possible to think about teacher education in other ways and experience other teachings that do not carry dichotomous understandings inherited from the pedagogical tradition.

Finally, by breaking with the theory-practice dichotomy, Mathematics Education may see other formative processes potentiated, and a new understanding of mathematical knowledge may be experienced. Learning and teaching different mathematics, based on the theory-practice inseparability, will be, for a long time, a great challenge.

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The authors declare that there is no conflict of interest with this article.

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