OTHER THEMES

Specific Mathematics for Teaching Discourse: the art of governing

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ABSTRACT – Specific Mathematics for Teaching Discourse: the art of governing. The article discusses how the Mathematics discourse specific to teaching has proposed the conduct of mathematics teachers. It is a theoretical essay resulting from a Foucaultian problematization that focused on studies dealing with Mathematical Knowledge for Teaching, the Specialized Knowledge of the Math Teacher and Mathematics for Teaching. This discourse puts into practice different types of power, mobilizing strategies and tactics in order to activate the technology named *Technology of Mathematical Specificity*. The results suggest that the behaviors made available by this discourse move between individual and disciplinary logic to government logic.
Keywords: **Math Education. Discourse. Power. Governmentality.**

RESUMO – Discurso da Matemática Específica para Ensinar: a arte de governar. O artigo discute como o discurso da Matemática específica para ensinar tem proposto a condução da conduta de professores(as) de Matemática. Trata-se de um ensaio teórico decorrente de uma problematização foucaultiana que incidiu sobre estudos que tratam do Conhecimento Matemático para o Ensino, do Conhecimento Especializado do Professor de Matemática e da Matemática para o Ensino. Esse discurso põe em exercício diferentes tipos de poder, mobilizando estratégias e táticas a fim de acionar a tecnologia nomeada *Tecnologia da Especificidade Matemática*. Os resultados sugerem que as condutas disponibilizadas por esse discurso transitam entre a lógica individual e disciplinar à lógica governamental.
Palavras-chave: **Educação Matemática. Discurso. Poder. Governamentalidade.**

Introduction

In the area of Mathematics Education, different speeches have been circulated in order to argue that, to teach Mathematics, a teacher should mobilize specific mathematical knowledge for teaching (Ball; Bass, 2003; Ball; Thames; Phelps, 2008; Barwell, 2013; Carrillo; Climent; Contreras; Muñoz-Catalán, 2013; Davis; Renert, 2014). The term *discourse* is used in accordance with the Foucauldian theorization, which extrapolates the notion of a simple combination of words or phrases referring to a set of practices that designate the things[1] they speak about. Thus, a discourse is not reduced to an act of speech, it not only represents the thing of which one speaks, but constitutes it (Foucault, 2014a; 2016).

We identified the specific Mathematics discourse to teach circulating in studies of the area about different denominations, among which we highlight: Mathematics Knowledge for Teaching (MKT), Mathematics Teacher's Specialized Knowledge (MTSK), and Mathematics for Teaching (MfT), given their widespread dissemination (Hoover; Mosvold; Ball; Lai, 2016).

In a previous study (Grilo; Barbosa; Maknamara, 2020), we suggested that the discourses circulating in these studies can be organized in two groups: i) cognitive-representational discourses, for which the teacher is able to decompress, connect, anticipate, articulate, understand, and prove mathematical ideas in a way associated with the specific demands of teaching. Therefore, he or she chooses activities appropriate to the demands of teaching, is critical of didactic and curricular materials, is efficient, regent of tasks related to teaching, and attentive to inequalities; and, ii) socio-discursive discourses[2], for which the teacher is regulated by the principles of pedagogical practice, flexible, explorer of opportunities, and formulator of mathematical concepts according to the context in which he/she participates. Because it is an integral part of a social practice, it is collectively constituted, therefore, it is evolutive, participative and engaged and its practice results from a collective and unstable repertoire.

This way of organizing them is intended to point out that there are differences between the epistemological affiliations that underlie them theoretically, without disregarding the possibility that they influence each other, regardless of the terminologies adopted. In this sense, we have adopted the notion of specific mathematics to teach in an attempt to capture the variability of CME, CEPM and MpE discourses in a single expression. Therefore, when we use the phrase *specific mathematical discourse to teach* we are referring to a discourse formation that brings together the discourses of WEC, CEPM and MpE. A discursive formation is assured by a set of relationships that is established between instances and objects of discourse, considering their historical conditions, their regularities and dispersions (FoucaulT, 2016).

These discourses have been widely disseminated among mathematical educators in different countries, through research that relies

on items that advocate for themselves the task of reflecting on real situations faced by teachers when teaching Mathematics. By way of example, we cite one of the projects of the group of researchers led by Deborah Loewenberg Ball[3], the Learning Mathematics for Teaching Project (LMT), which provides more than 100 publications[4] that address this issue: measures the group uses to study (Schilling; Blunk; Hill, 2007); what they believe to be the structure of the teacher's mathematical knowledge (Hill; Schilling; Ball, 2004); how teachers learn mathematical knowledge for teaching (Hill; Ball, 2004); of how teachers' knowledge relates to students' mathematical performance (Hill; Rowan; Ball, 2005); of the relationships between teachers' knowledge, curriculum and teaching quality (Charalambous; Hill, 2012), among others.

The LMT is pointed out as one of the pillars of another project entitled Teacher Education and Development Study in Mathematics (TEDS-M). This project, conducted under the aegis of the International Association for the Evaluation of Educational Achievement (IEA), was designed to provide information that could be used in the development of policies and practices for training mathematics teachers (Tatto, 2013). According to Tatto (2013), TEDS-M involved seventeen countries[5] and was the first transnational study developed to provide data on the knowledge that future teachers acquire during initial training, focusing on knowledge of mathematical content and pedagogical knowledge of mathematical content. The measures elaborated and used by these projects are the result of the refinement made by Ball, Thames and Phelps (2008) of Shulman's (1987) proposal to describe the professional knowledge of teachers.

This refinement is the result of an attempt by researchers to develop the notion of Mathematical Knowledge for Teaching (MKT) which aims to emphasize the importance of mathematical knowledge which is specific to teaching, a mathematical knowledge which, according to Hoover, Mosvold, Ball and Lai (2016), is different from the mathematics typically taught at school (although it includes knowing the mathematics taught to students) and the mathematics needed by other professionals who are not teachers. In Ball, Thames and Phelps (2008), Knowledge of Content is subdivided into: Common Knowledge of Content, Specialized Knowledge of Content and Knowledge of Content on the Horizon. Likewise, the Pedagogical Knowledge of the Content, is subdivided in: Knowledge of the Content and Students, Knowledge of the Content and Teaching and Knowledge of the Content and Curriculum.

In this scenario, other discourses appear in dispute, either to propose an emphasis on the Specialized Knowledge of the Content, such that the specialized nature would define all knowledge regarding the teaching of mathematics (Carrillo; Climent; Contreras; Muñoz-Catalán, 2013), or to propose the non-dichotomization between, for example, the knowledge of mathematical content and the pedagogical knowledge of mathematical content (Huillet, 2009; Pournara et al, 2015; Tatto; Burn; Menter; Mutton; Thompson, 2018). There are also discourses that challenge Ball, Thames and Phelps (2008) for considering it extremely fo-

cused on the individual and choose to present mathematical knowledge to teach from a social, collective, emerging perspective (Adler; Hulliet, 2008; Barwell, 2013; Davis; Rennert, 2014).

Even not integrating TEDS-M, countries like Saudi Arabia, South Africa, South Korea, Brazil, among others, did not remain on the sidelines of these discussions. Among these countries, it is possible to identify investigations that use the items proposed by LMT (Haroun; Ng; Abdelfattah; Alsalouli, 2016; Kwon; Thames; Pang, 2012), as well as there are those that adopt a more social perspective for research on mathematical knowledge to teach (Pournara et al., 2015; Davis; Rennert, 2014; Santos; Barbosa, 2016).

Faced with the scope and how these discourses have influenced Mathematics Education, we consider it opportune, inspired by Michel Foucault, to problematize how these discourses have proposed the conduct of mathematics teachers. We understand that the conduct is the practices of control over the subjects' lives, whether they are in the scope of individual or collective life, which aim to establish a possible field of action. In this sense, we have developed a theoretical essay which, according to Meneghetti (2011), requires deep and detailed reflections for the understanding of things. Our reflections focused on studies in which CME, CEPM and MpE discourses circulate and which are widely disseminated in Math Education journals, as described above.

The Power is Shown in Exercise

As we sought to investigate the conduct of mathematics teachers, our gaze was focused on the effects of these discourses on their possible actions. This led us to mobilize the government theme (Foucault, 1989; 1999a; 2008) as a great umbrella, in the sense that it absorbs the *rain* of power exercises that are put into operation by specific Mathematics discourse to teach.

Power shows itself in action when it is exercised, therefore, it is not possessed, it is not won and it is not lost either. If power does not emanate from a center, it is taken "[…] as a productive network that runs through the entire social body much more than a negative instance that has the function of repressing" (Foucault, 1989, p. 8). Thus, power does not apply to an individual or is applied by him, power crosses them in order to direct behavior.

When Michel Foucault set out to investigate the subject of government, he turned to identifying and describing the power technologies aimed at conducting himself and others. From some of his works (Foucault, 1999a; 2008), it is possible to understand that the term technology was used by Michel Foucault "[…] as a system of practices invested with strategic rationality" (Villadsen, 2014, p. 3).

For Castro (2016, p. 412), "[…] studying practices as techniques or technology consists in placing them in a field defined by the relationship between means (tactics) and ends (strategy). Therefore, to describe

a technology consists in situating it in terms of strategies and tactics. Strategy is the means used to make work or to maintain a technology of power, it aims at the routine training that shapes individuals from previously planned objectives and tactics is what puts the strategy into operation. According to Maknamara and Paraíso (2013, p. 49), "[…] while strategy is meticulously architected [...], tactics are opportunistically activated". Foucault (2014b) illustrates these concepts considering the military scope for which strategy can be understood as a way to conduct war and tactics would be the existence of the army as a principle to maintain the absence of war in society.

The use of the word government should not be confused with the use that is currently given to the word as government of a state; bodies, population are governed. The population is a political character that appears in the 18th century (Foucault, 2008), as a new collective subject, "[…] a new body: multiple body, body with countless heads, if not infinite, at least necessarily numerable" (Foucault, 1999a, p. 292).

In the present study, we consider the set of mathematics teachers as the population for which the mathematics discourse specific to teaching structures a possible field of actions. This discourse has provided information that subsidizes both public educational policies, whether at the level of basic schooling (Hill, 2007) or teacher training (Hill; Ball, 2004), and the pedagogical relationships that occur in the classroom (Charalambous; Hill, 2012). Given their breadth, both in terms of what they subsidize or may subsidize and in terms of territorial scope, they put into operation government practices that aim to structure the possible field of action for all Mathematics teachers, moving from individual and disciplinary logic to government logic.

In trying to make explicit the transition from individualizing power practices to massifying practices, Michel Foucault coined the concept of *gouvernementalité* which, according to Fimyar (2009), translates the effort to create governable subjects through control techniques, normalization and molding of people's behaviors. For Veiga-Neto (2002), the word governance would be the most appropriate translation for gouvernementalité. Thus, governance is government practices that have their object in the population and that intend to structure the possible field of actions of themselves and others (Foucault, 2008).

In taking the concept of governance, Michel Foucault does not disregard that these powers continue to act on individual bodies with the pretension of conducting conduct. Thus, in order to unveil how the Mathematics discourse specific to teaching has proposed the conduct of mathematics teachers, we analyze different types of power put into operation by this discourse. To do so, we rely on the genealogy on the subject of government carried out by Michel Foucault, who denies the possibility of a center of power, generally represented by the State in classic theories on government, and turns to show how power is diluted, crossing the whole social structure, in the defense that "[…] power is everywhere; not because it encompasses everything, but because it comes from everywhere" (Foucault, 1999b, p. 89).

The Exercise of Power: from disciplinary to governmental logic

In investigating the theme of government, Foucault (1989; 1999a; 2008) identified and named different types of power, of which we highlight: sovereign power, pastoral power, disciplinary power and bio power. These powers were identified in different historical times, but still today they can coexist by acting mutually on bodies and populations.

We will begin our digression into the sovereign power that is based on the existence of the figure of a sovereign and his subjects. According to Foucault (1999a), the sovereign, in order to defend his territory or himself, holds the right over the life and death of his subjects. This allows us to ask, for example, why the study developed by Shulman (1987), which intended to revolutionize the way the professor's knowledge had been researched until then, was not enough to account for the knowledge required of the mathematics professor? How sovereign is the Mathematics that leads Ball, Thames and Phelps (2008) to establish specific domains in the conceptual map of teachers' knowledge elaborated by Lee Shulman, even recognizing the importance of his ideas on content knowledge and pedagogical knowledge of content in teaching? The authors themselves outline a possible answer to these questions:

> Our hypothesis is that teachers' opportunities to learn mathematics for teaching could be better adjusted if we could identify these types [of knowledge] more clearly. If the mathematical knowledge needed for teaching is indeed multidimensional, then professional education could be organized to help teachers learn the range of knowledge and skills they need in focused ways. If, however, the mathematical knowledge needed for teaching is basically the same as general mathematical ability, then it would be unnecessary to discriminate against professional learning opportunities. Based on our analysis of the mathematical demands of teaching, we assume that Shulman's knowledge of content could be subdivided into CCK [common knowledge of content] and specialized knowledge of content and his pedagogical knowledge of content could be divided into knowledge of content and students and knowledge of content and teaching (Ball; Thames; Phelps, 2008, p. 399).

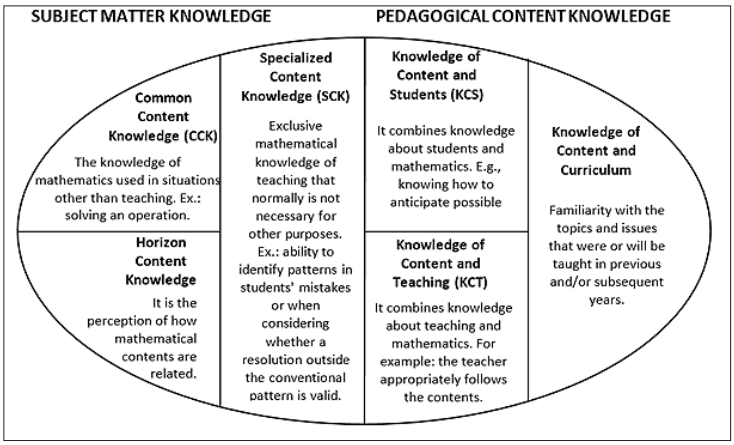
Thus, this Mathematics that is specific to teaching would have a prominent place, exercising a sovereign power that crosses its subjects, the teachers of Mathematics. Therefore, the territory to be governed is that which involves teaching practices, whether in initial or continuing education courses or the pedagogical practices established in the school spaces. The subjects' sacrifice is identified in the sense of *making die* a teaching practice based on a Mathematics that is not specific to teaching, allowing *letting live* a teaching practice that is aware of such specificities.

The sovereign power exercised by mathematics, as a body of scientific knowledge that needs to be scrutinized before being moved for

teaching purposes, runs through all those who deal with it. Thus, as Foucault (1989) suggests to us, we look at this power not as located in a center; but, as a network, from its ramifications when crossing this multiple body that are the teachers of Mathematics.

The categorization proposed by Ball, Thames and Phelps (2008) (Figure 1) shows that Mathematical Knowledge for Teaching requires, among other domains, a Specialized Knowledge of Content that is different from the general mathematical ability that would be expressed by a Common Knowledge of Content.

Figure 1 – Domains of Mathematical Knowledge for Teaching

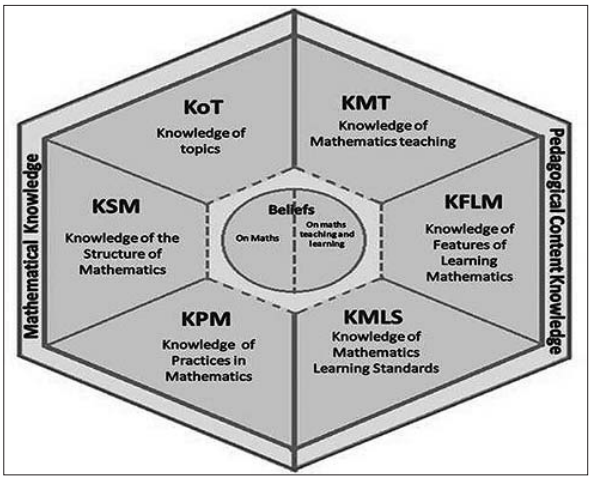


Source: Adapted from Ball; Thames; Phelps (2008).

These domains are described in most of the studies where cognitive-representational discourses circulate on the specific mathematical knowledge to teach (Barwell, 2013). For Ball, Thames and Phelps (2008), Mathematical Knowledge for Teaching is multidimensional and once the types of knowledge required to teach are identified, teacher training courses could be organized to help teachers learn the range of knowledge and skills they need to teach.

Other studies propose that teachers' knowledge is specialized (Carrillo; Climent; Contreras; Muñoz-Catalán, 2013; Moriel Junior; Wielewski; 2017) and configure the notion of Specialized Knowledge of Mathematics Teachers. As can be seen in Figure 2, CEPM also organizes itself into domains and sub-domains that would focus on demands related to the teaching of Mathematics in particular. Thus, in these discourses it is not enough to recognize that to teach Mathematics the teacher needs to have a Specialized Knowledge of the Content: it is necessary to conduct it in such a way that it moves between one type of knowledge and another.

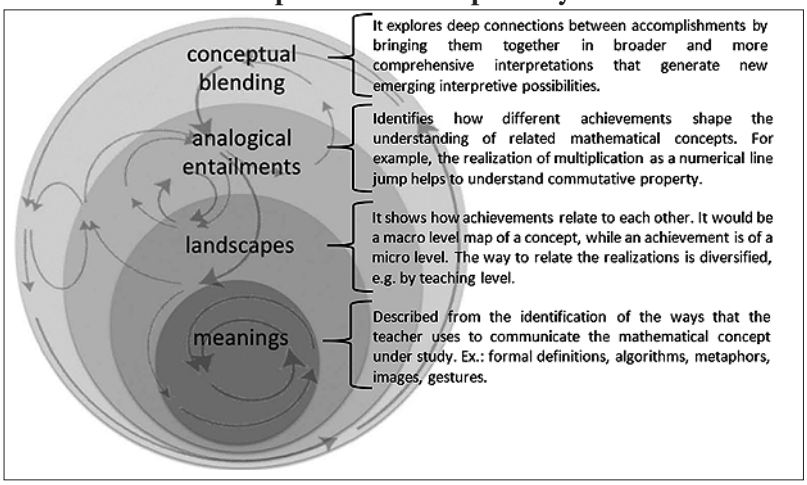
Figure 2 – Domains of the Specialized Knowledge of Mathematics Teachers



Source: Carrillo; Climent; Contreras; Ribeiro (2017).

Even supported by distinct epistemological perspectives, in a similar way, the social discourses of mathematics specific to teaching also turn to the modes of displacement, no longer of the teacher as an individual body, but of the population of teachers. The interest lies in observing as teachers, while a body with countless heads moves between the emphases (Figure 3) that would constitute the ways to communicate a given mathematical concept.

Figure 3 – Visual metaphor to describe the relationships between emphases of concept study



Source: Adapted from Davis; Renert (2014, p. 57).

Backed by the theory of complexity, Davis and Revert g (2014) understand that the emphases (achievements, panoramas, linkages, and combinations) would be more focused on the real mathematical content of teaching. Still according to the authors, these emphases do not occur in a linear manner or as stages; they would be co-implicated, emerging and evolving, which would require participative, collective and ongoing commitments from teachers.

The strategy used to exercise sovereign power is to make a Mathematics that is specific to teaching live in order to let a Mathematics that is not specific to teaching die, in the defense that there is a mathematical knowledge that is specific to the teaching of Mathematics. Together with this strategy, the tactic of differentiation is activated, which intends to strip away categories of professional knowledge proposed by Shulman (1987) in order to make explicit the difference between Mathematics to be made available to the teacher and Mathematics required by other professionals. Both discourses, cognitive-representational and socio-discursive, operate in the sense of *making die* pedagogical practices based on a Mathematics that is not specific to teaching, in order to *let live* practices that are established through a specific Mathematics to teach.

We observe, however, that other forms of power are put into operation by these discourses moving from the expression of an individualizing and disciplinary power to the massifying logic that makes teachers live by their rules. The disciplinary power turns to control multiplicity, to organize it in such a way as to use it to the maximum; "[...] it defines how one can have dominion over the body of others, not simply so that they do what one wants, but so that they operate as one wants" (Foucault, 2014b, p. 135). The disciplinary power "[...] takes individuals both as objects and as instruments of their exercise" (Foucault, 2014b, p. 167).

In search of this training of the bodies, the disciplinary power resorts to discipline. The discipline is revealed in "[...] methods that allow for the thorough control of the body's operations, that carry out the constant subjection of its forces and impose on them a relationship of docility-utility" (Foucault, 2014b, p. 135). The discipline acts on the bodies; it is subtle, and its success owes to the use of simple instruments: the hierarchical gaze and the normalizing sanction, in addition to the examination that results from the combination of the former. Let us return our gaze on the exam.

The exam "[...] is a normalizing control, a vigilance that allows qualifying, classifying and punishing. It establishes a visibility over individuals through which they are differentiated and sanctioned" (Foucault, 2014b, p. 181). The examination reverses the logic of the visibility of power, making it increasingly invisible as it is more insidious; it provides a documentary field of records of a series of individual traits that make it possible to classify, categorize and set standards that become homogenizing.

By turning to cognitive-representational discourses, we identify the use of the exam as an instrument for the exercise of disciplinary

power. Projects such as the Learning Mathematics for Teaching Project (LMT) and the Teacher Education and Development Study in Mathematics (TEDS-M) (Tatoo, 2013) use the exam technique through the elaboration/application/refinement of instruments that are applied on a large scale to teachers and students with a view to thorough control of their bodies. These instruments are used to examine the structure of the mathematical knowledge of the teacher (Ní Ríordáin; Paolucci; O' Dwyer, 2017); how these teachers learn this knowledge for teaching purposes (Mosvold; Fauskanger, 2013); how they can relate them to the mathematical performance of students (Delaney, 2012; Tchoshanov, 2011); refining the evaluation instruments (Phelps; Kelcy; Jones; Liu, 2016), among other purposes.

To exemplify how the use of the exam, as an instrument of disciplinary power, is put into practice by cognitive-representational discourses, we present below the summary of the article by Kwon, Thames and Pang (2012).

> This article examines the challenges in adapting the measures of mathematical knowledge for teaching (MKT) developed in the United States for use in Korea. After an initial analysis of the candidates' questions regarding the 'adjustment' of the items to the Korean context-if the items were known, authentic, and realistic, [...] – we adapted and administered an instrument developed by the Learning Mathematics for Teaching project with 93 Korean teachers and conducted follow-up interviews with nine teachers. Based on the analysis of this data, we conducted a second round of review and then administered the revised test to 101 Korean teachers. The results showed that small modifications that were made to increase the adjustment often increased the teachers' performance on the items, as expected, but the impact of the changes was sometimes difficult to interpret. For several items, the modifications introduced unexpected validity problems. The article discusses the dynamics that arise when making changes to MKT items - in particular, the strain of modifying items to increase adjustment to specific educational contexts while maintaining validity (Kwon; Thames; Pang, 2012).

From what has been explained in this study, we see how the exam is used for body control when it takes teachers as an object of study (when responding to items) and, at the same time, as an instrument of power exercise (when providing information that allows the adjustment of such items). In the logic of the exam, teachers are increasingly visible as the disciplinary power is more insidious by providing records on specific mathematics to teach. These records are first of all individual, but they allow classifying, categorizing, and setting norms that become homogenizing.

Socio-discursive discourses are contrary to the way the exam is used by cognitive-representational discourses as observed in the study of Davis and Renert:

> The emphasis of contemporary research on identifying and measuring what each teacher can articulate explicitly is, in our view, simply inadequate - both as tools to assess what teachers really know and as means to support the development of the M4T's vibrant body of knowledge (Davis; Renert, 2014, p. 116).

However, this does not mean that they do not exercise disciplinary power by using the exam as an instrument of teacher control. What these discourses propose is the use of

> [...] more refined analyses than large-scale evaluations, largely because many of the most important aspects of teachers' knowledge are simply not available for explicit and immediate evaluation. They are tacit and can only emerge through participation in collective explorations, such as concept studies.
> That said, we engage in some pragmatic strategies to increase our population base. For example, the University of Calgary's teacher training program has been restructured so that all teacher candidates - at the elementary and secondary levels - declare a specialization. For those who choose a specialization in mathematics, one of the main components of their two-year (four-semester) experience is the study of the concept. In addition, the Faculty of Education offers a two-year master of education class [...] and a four-year post-graduate certificate that emphasizes the study of the concept.
> These efforts, of course, focus on individuals. Another strategy is to focus on collective levels, such as schools and school districts. A project of this kind is just beginning, involving most teachers who deal with mathematics at a primary and secondary school in Calgary. Again organized around the study of the concept, this five-year project is analyzing the possible impact on school culture (Davis; Renert, 2014, p. 124).

The intention to have even more refined analyses about the variability of accomplishments of a certain concept by teachers' points to the use of the Concept Study as an instrument of control that would allow the thorough examination of what teachers effectively do or can come to do when teaching Mathematics classes. Once again, teachers are given full visibility as an object and instrument of disciplinary power. Teachers are taken as an object when it is intended to record the different forms they use to communicate a mathematical concept and, consequently, they are also instruments of power, for it is they who provide the data for these records.

As we have observed, the disciplinary power comes into play triggered by the strategy that aims to *identify what and how teachers teach Mathematics*. Two tactics are activated in order to achieve this strategy. One of them, associated with the cognitive-representational discourses, is the evaluation tactic that, through the exam, performs a scrutiny of the pedagogical practices established in the school spaces in order

to qualify and classify both teachers and students. Through the *tactic of evaluation*, one can see that the government of men no longer gives itself through obedience, but through the manifestation of what it is (Foucault, 1997). Socio-discursive discourses activate the *tactic of collaboration* in which teachers are invited to participate in collaborative groups so that *their souls may be explore*, so that they reveal the ways in which they carry out a certain mathematical concept and are conducted between different emphases, in order to broaden their repertoire on the concept under study.

The participation of teachers in collective exploration activities, such as the Study of the Concept or the standardized testing of individual measures with homogenizing purposes, trigger other forms of expression of power: pastoral power and biopower. Michel Foucault discusses pastoral power by referring to the figure of the shepherd of sheep in the Judeo-Christian tradition. For the author, "[...] the power of the shepherd is essentially exercised over a multiplicity in movement" (Foucault, 2008, p. 168). Thus this exercise of power does not occur over a specific place, but over a flock, the teachers, more specifically, over the flock in its displacement, in the movement that makes it go from one point to another. That is, pastoral power is put into practice by these discourses when they lead teachers between one type of knowledge and another, in the case of cognitive-representational discourses; or between one emphasis and another, when they deal with socio-discursive discourses.

Although the mathematical discourse specific to teaching predicts the participation of teachers in groups, what is expected is that in the end each of them will achieve their individual salvation. In other words, it is hoped to offer each of them different ways of dealing with mathematics for teaching purposes, either by moving between one type of knowledge and another or between one emphasis and another. That is why it is so important to integrate the group, so that each one allows the other to know what he knows, directing them, leading them to each other.

Regarding pastoral power, the strategy used is confession, so that the teachers, when participating in formation groups, confess what they know and how they teach a certain concept. Linked to this strategy is the tactic of movement in which teachers are led to move between one knowledge and another or between one emphasis and another of a concept, depending on the epistemological affiliations to which the discourses are submitted, in order to achieve the promised goal: to learn a specific mathematics for teaching.

It is with the emergence of the population, as a new social body, that the bio power comes into action. Bio power, different from sovereign power and disciplinary power (but not separate from them), is not exercised over one body, but over a multiple body, the population, through regulations that seek the government of life (Foucault, 1989).

When we consider the specific mathematics discourse to teach, we see this kind of power in action when they subsidize, regardless

of their epistemological affiliations, public policies, and programs to train mathematics teachers, for example. To illustrate how this power is shown in exercise in cognitive-representational discourses, below are some extracts from studies that suggest how they seek to regulate the government of teachers' lives.

> This discovery provides support for policy initiatives aimed at improving students' mathematical achievement by improving teachers' mathematical knowledge (Hill; Rowan; Ball, 2005).
>
> Curricular implementations in mathematics are unlikely to provide the expected benefits to students if written guidance to teachers is interpreted and promulgated differently than policy makers and curriculum planners intend (Foster; Inglis, 2017).
>
> The implications include limiting the minimum requirement to a four-year university degree and requiring teachers to teach various levels of education over a period of time (NG, 2011).

Its regulations aim to determine from minimum requirements to be a Mathematics teacher to expected proficiency levels of these teachers. It is intended to control the entire population of mathematics teachers, including determining that they must follow the guidelines developed by others, or they will be blamed for the poor performance of their students. They believe that by regulating minimum requirements and quality measures it is possible to improve students' performance in Mathematics.

On the other hand, social discourses ponder the difficulty of grasping the complex, emerging, adaptive and evolutionary nature of mathematics for teaching. However, they argue that

> [...] the [scientific] community has an obligation to work together to explore, test and create new possibilities [...] [for] much could be achieved if the teaching of mathematics and teacher training included emphasis similar to concept studies (Davis; Renert, 2014, p. 120).

Recognizing the difficulty in governing teachers through policies based on large-scale evaluation results, social discourse proposes that this government be based on monitoring the relationship between, for example, students' performance in standardized evaluations and their interest in pursuing careers that require mathematical knowledge.

> [...] Alberta province, Canada, has comparatively good performance in national and international math achievement tests. Even so, enrollment in math-related university programs has been in steady decline for decades. [...] As important as personal achievement is, if the impacts of education are not being registered at the social and cultural levels, we question its effectiveness (Davis; Renert, 2014, p. 120).

In addition, they stress that it is important to note that there is a strong relationship between initial and continuing teacher training (Santos; Barbosa, 2016; Davis; Renert, 2014) and argue for projects that combine the articulation of these trainings in the context of partner schools in which the Concept Study can be developed (Davis; Renert, 2014).

The bio power is exercised having as strategy to constitute educational public policies and teacher training programs. Two tactics are used, respecting the epistemological affiliations of their discourses: the tactic of generalization triggered by cognitive-representational discourses and the tactic of evolution triggered by socio-discursive discourses. The generalization tactic, by means of regulations (laws, guidelines, resolutions, training programs), establishes general criteria to be adopted for the conduct of teachers. They establish through levels of mathematical proficiency homogenizing norms. On the other hand, the evolutionary tactic dispenses with the use of general criteria and is mobilized when it proposes articulation between the initial and continuous training of teachers because it believes that this would achieve mutual evolution, an improvement in the population, in performance, to the point of constituting a group of teachers with a cohesive professional profile and consistent with the specific demands related to the teaching of Mathematics.

We observe that the discourse of Mathematics specific to teaching puts into practice different types of power that move between individual and disciplinary logic (by mobilizing strategies and tactics affectionate to sovereign and disciplinary powers) to governmental logic (by mobilizing strategies and tactics affectionate to pastoral power and bio power). These powers in exercise aim to lead the conduct of mathematics teachers in the sense of: making a specific mathematics for teaching live; identifying what and how teachers teach mathematics; confessing their knowledge and teaching practices; and constituting public policies and teacher training programs.

Effects of Power or What Teaching Conducts?

We showed in the previous section that the conduct of mathematics teachers is only achieved after passing through powers affectionate to sovereignty and discipline, using "[...] more tactics than laws" (Foucault, 1989, p. 166). When we turn our gaze to the types of power put into operation by these discourses we identify and describe strategies and tactics that constitute a power technology that has been addressed to mathematics teachers, which we name Technology of Mathematics Specificity.

This technology wants to account for a set of practices, equipped with a strategic rationality that has as its object the teaching of Mathematics, which allows us to show how power and knowledge are articulated to constitute governable Mathematics teachers. The Technology of Mathematical Specificity is driven by discourses that suggest the ex-

istence of a Mathematics that is specific to teaching and, therefore, differs from the Mathematics required by other professionals.

These discourses disclose required behaviors to Mathematics teachers guided by the understanding that to teach it one must know a specific Mathematics, which would be achieved in the interweaving of different strategies and tactics. Initially, the teacher is led to the recognition of the sovereignty of Mathematics in relation to other fields of knowledge, in view of the need to make available to the population of teacher's specific domains of knowledge. Another way to lead teachers is to expose them to examination, materialized in standardized evaluations, producing as an effect an accountability on the performance of themselves and others, because when a country, a state or a school does not reach the desired educational indexes, the responsibility falls on all teachers.

It is also expected that teachers will keep moving, that is, that they will master the different knowledge required to teach Mathematics and that they will know how to move between them as they are required in the task of teaching. In addition, teachers are expected to integrate groups so that they can be collectively led to maintain a specific Mathematics for teaching. Finally, teachers are condemned to live under public policies and/or training courses that aim to subsidize minimum requirements to be a Mathematics teacher.

In this sense, we infer that the teaching behaviors desired by the specific Mathematics discourse to teach go through the constitution of a *subject teacher* (Grilo; Barbosa; Maknamara, 2020, p. 3). A subject equipped with capabilities that would meet specific demands related to the teaching of Mathematics, which go through the recognition of the existence of different types of knowledge or conceptual emphases and which can be acquired through: differentiation of Mathematics in relation to other areas; evaluation and collaboration of what is known; movement in search of learning new knowledge, generalization and evolution of teaching practices.

Final Considerations

To achieve the objective proposed in this essay, we analyze how power is put into operation by the discourse of mathematics specific to teaching. Our analysis has shown that these discourses put into practice different types of power. In presenting sovereign power, we discuss how mathematics needs to be scrutinized before it is moved for teaching purposes. In dealing with disciplinary power we show how the exam is used as an instrument that scrutinizes the life of each teacher by providing thorough control of their bodies. Moving from individual and disciplinary logic to government logic, we saw that pastoral power is shown when discourses intend to lead teachers collectively between different types of knowledge or between different emphases of a mathematical concept and, when analyzing bio power, we saw that the lead-

ership of teachers is established through regulations that fall upon the entire category of mathematical teachers.

These powers in action, often in a mutual way, mobilize different strategies that are triggered by different tactics all at the service of a power technology that we have named as Mathematical Specificity Technology. It was through the analysis of this technology that we were able to show the expected behaviors for Mathematics teachers made available by the specific Mathematics discourse to teach.

The government aimed at Mathematics teachers aims to lead them to the understanding that there would be a specific Mathematics for teaching and that to achieve it the teacher would need to make a Mathematics that is specific for teaching and let a Mathematics that is not specific for teaching die. In addition, these teachers would be subjected to a thorough examination of their practices to provide information that would be able to improve the pathways to be followed in order to improve/evolve Mathematics specific to teaching and subsidize general regulations on teacher training.

Other studies are needed to reflect on the multiple forms of resistance operationalized by the power relations that are mobilized by the specific Mathematics discourse to teach. To this end, it is necessary to question the conditions of the existence of these relations, to direct one's gaze toward the order of strategy and the struggle against the forms of subjection of the subject to himself and to others that reject, among other things, the scientific inquisition that seeks to determine who we are.

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Notes

1 For Foucault (2014a) these *things* are men in their relations with everything around them: resources, customs, ways of acting or thinking, misfortunes like hunger, epidemics, death, etc.

2 From a Foucaultian perspective the two groups are of a discursive order. The register of the word *discursive* aims to demarcate that, when operating from this perspective, there is a recognition that there is not a single a priori mathematics to be taught, but that it emerges from the discursive interactions of a social practice.

3 This researcher was awarded in 2017 by the International Commission on Mathematical Instruction (ICMI) with the Felix Klein medal, the highest award in academic recognition in the Mathematical Education community, in recognition of her leadership and contribution to improving the practice of teaching mathematics and teacher training, with emphasis on the development of the theory of mathematical knowledge for teaching (CME) (Source: <https://deborahloewenbergball.com/>).

4 The list with the publications can be found at: <http://www.umich.edu/~lmtweb/research.html>.

5 Botswana, Canada (four provinces), Chile, Chinese Taipei, Georgia, Germany, Malaysia, Norway, Oman, Philippines, Poland, Russian Federation, Singapore, Spain, Switzerland, Thailand and USA.

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