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The professional mathematics teacher: fabricating and governing the becoming of the teacher^{*}

O profissional professor de matemática: fabricando e governando o devir do professor

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Abstract: This paper aims at unpacking the becoming of the mathematics teacher as a professional immerse in the Chilean society, by mapping the changes that have taken within his/her fabrication and governing. A Foucault-inspired history of the present is deployed, as analytical strategy, to problematize how the discursive assemblage of social development and school mathematics produces a particular teacher—an autonomous professional that has to engage in continuous training and has to be a good decision-maker, framed within political and economic agenda. Ways of conceiving and understand the mathematics teacher are (re)producing a discursive network that operates as a technology of government for the fabrication of the desired mathematics teacher.

Keywords: becoming, history of the present, mathematics teacher, Foucault

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Resumo: Este artigo tem como objetivo discutir o devir do professor de matemática como um profissional imerso na sociedade chilena, mapeando os câmbios que ocorreram dentro de sua fabricação e governança. Realiza-se uma historização do presente, inspirada no trabalho de Foucault, utilizando-se essa estratégia analítica para problematizar como a montagem discursiva do desenvolvimento social e da matemática escolar produz um professor particular – um profissional autônomo que deve se empenhar em treinamento contínuo e que deve ser um bom tomador de decisões, dentro da agenda política e econômica. Propõe-se que as formas de conceber e compreender o professor de matemática estão (re)produzindo uma rede discursiva que funciona como uma tecnologia de governo para a fabricação do professor de matemática desejado.

Palavras-chave: Devir, historização do presente, professor de matemática, Foucault

Introducción

By navigating within discourses about the mathematics teacher is possible to identify a large number of statements concerning his/her relevance (see, Huang and Shimizu, 2016; MINEDUC, 2012; OECD, 2016a). For example, mathematics teacher's quality has been linked with the development of a better educational system and increasing educational quality (Luschei and Chudgar, 2015; OECD, 2016b); with more and better opportunities for students (UNESCO, 2007); with a fairer society (OECD, 2014); and with the improvement of social conditions (OECD, 2005). At the same time, that these statements are produced and reproduced, it has been asserted that the mathematics teacher does not have the necessary competencies, knowledge, and qualities for becoming an effective and competitive subject. In other words, the mathematics teacher is recognized to be deficient. According to the Chilean assessments, it is stated that initial teacher training does not achieve the required quality standards. In 2011, a newspaper, called "La Tercera", published an article titled "Pedagogy graduates only know 33% of the mathematics of the first four years of schooling". Here is emphasized that Chile obtained the lowest performance amongst 17 countries that participated in the Teacher Education and Development Study in Mathematics (TEDS-M). From this study, it shows that Chilean teachers know, at the most, 23% of the subdomain of geometry, 29% of the subdomain of algebra, 31% of subdomain of the data, and 33% of the subdomain of number (La Tercera, 2011). In 2013, another newspaper called "El Mercurio" published an article titled "Pedagogy graduates' assessment: 60% of teachers don't know the subject they teach", in which it is shown that 55%

of high school mathematics teachers, assessed through *INICIA test*², have an insufficient level of pedagogical and disciplinary knowledge (El Mercurio, 2013). This duality in circulating discourses embodies a narrative of exaltation and degradation, in which truths, knowledge/power relationships, and ways of thinking and understanding are entangled for fabricating and governing the mathematics teacher.

However, such fabrication and government have not a natural and linear development, rather have a multiplicity of continuities and discontinuities. By mapping the becoming of the mathematics teacher as a professional—subjected to market rationality—through different historical trajectories, it is seeking to problematize the conditions that enable to think, understand and conceive the teacher the way we currently do. As discussed elsewhere (Montecino and Valero, 2017; Montecino, 2017), this inquiry refers to the mathematics teacher not in terms of a particular concrete person, but to a discursive formation that is constantly changing. Here, it opens a discussion regarding the desired mathematics teacher that circulates within dominant discourses, who is the expert, the effective or the professional, among others, according to the argumentative network put in use. The desired teacher is not a subject who exist “but fabrications that research calculates and measures to actualize the desired model of the teacher” (Martins, Popkewitz and Yanney, 2015, p. 12). Becoming an unreachable ideal even for those considered good teaches.

Analytical strategy

By problematizing the becoming of the mathematics teacher, his/her government and fabrication, it is sought to contribute to the studies on the mathematics teacher by positioning the discussion within the social, political, and economic. This problematization is conducted through a Foucault-inspired *historizing of the present* (Foucault, 1991): aiming at “seeing the present through different historical trajectories that make possible the objects of thought and actions” (Pereyra and Franklin, 2014, p. 10). The circulating discourses, truths, and knowledge about the mathematics teacher are thought “within a grid of historical practices that makes the object of research possible to ‘see’ and act on” (Popkewitz, 2013). According to a Foucauldian approach, history is not understood from a linearity—a cause–effect relationship of facts and events—but history should be used as “a means of critical engagement with the present” (Garland, 2014, p. 367).

Consequently, the history of the present is a strategy to make “problematic the stories we are given and those we tell” (Popkewitz and Brennan, 1998, p. 27), in this case, the stories about the mathematics teacher, by considering that “the past is intricately woven in constituting the present” (Popkewitz, 2013, p. 440). This inquiry is focusing on the constitution of institutions for teacher training in Chile; the

² The Ministry of Education of Chile (MINEDUC) states that the *INICIA test* is a diagnostic and formative assessment for graduates (or prospective) teachers. This assessment focuses on pedagogical and disciplinary knowledge, being part of initiatives of MINEDUC for the improvement of initial teacher training (see <https://www.ayudamineduc.cl/ficha/programa-inicia-5>)

establishment of ideas that circulate or have circulated, such as professional training and permanent training; and finally, the establishment of a market for teacher (re)training. In order to trouble the fabrication of the mathematics teacher as a professional, who has to be in a continuous training and becoming a good decision-maker.

The empirical materials analyzed are publications released by Chilean government and Chilean Ministry of Education (MINEDUC) from late 19th century. Materials such as draft laws (e.g. MINEDUC, 2016), national reports (e.g. Longo, 1993; Schiefelbein, 1976), and curricular programs for teacher training (e.g. Mellafe, 1988; MINEDUC, 2012). Also, studies about Chilean teachers (e.g. Cox and Gysling, 1990; Gutiérrez, 2008) and documents that refer to the constitution of institutions for teacher training (e.g. Letelier, 1940; Nuñez, 1883). The focus is not on who wrote these documents, rather on the constitution of a discursive network that shapes what could be said and thought about the mathematics teacher. Therefore, this article is not seeking to make a judgment on the authors or the institutions that produced such documents.

From the technical teacher towards the professional teacher

In the middle of 19th century in Chile, there was an interest in training qualified professionals for favoring the development of commerce and industries, in order to achieve the social progress and economic growth that was aspired. “Progress is understood as a consequence of the development of sciences and a suitable national system of education, ideas that were exposed by Bello³ on several occasions”⁴ (Hernández, 1986, p. 135). Science has been historically understood as a secure means for achieving progress, in this context, it recognized that the real power of subjects resides in the head, and not in their arms (Nuñez, 1883). Configuring a narrative in which social development will no longer depend on people’s raw force, rather on their intellectual force—a qualified professional that leaves the farms for being part of the industries. Creating suitable citizens through education was part of the foundations of diverse countries, during the late 18th century and early 19th century, developing educational system and curriculum for fabricating of citizen (Tröhler, Popkewitz and Labaree, 2011).

In this fashion, the quality of the educational system and teachers are being called into question from their poor outcomes. In 1856, the Society of Primary Instruction was founded in Chile. This Society aimed at increasing the number of schools and the improvement of the teaching quality, for ridding people from

³ Andres Bello is considered one of the greatest humanists of Ibero-America. In 1829 was appointed as Chilean Minister of Finance. In 1932, he was a member of the board of education, which propose all plans and programs of study for all Chilean schools. In 1837 he was elected Senator. In 1840, Bello and Egaña were designated for the elaboration of the Civil Code. From 1843 to 1865, he was Rector of the University of Chile, which was founded at the end of 1842, in the search of a modern national state of ordering the society according to reason and science (Gutiérrez and Gutiérrez, 2000)

⁴ All quotations are translated from Spanish to English by the author.

ignorance, as well as lifting them out of poverty (Velásquez, 1873). It is acknowledged that the quality of the educational system and teachers are central to ensuring the training of a qualified subject, a subject that favors social and economic progress.

As countries began to establish national school systems, they found that they needed a larger supply of qualified teachers who had received a professional education. [...] And demands for better qualified elementary school teachers led countries to upgrade the institutions in which they were prepared from secondary to higher education status. (Kilpatrick, 1992, p. 5)

The constitution of a formal training for teachers was considered vital for improving the quality of the educational system. Letelier (1940) asserts that teachers' quality leaves much to be desired, as well as the quality of candidates to be teachers, a problem that comes from the very beginning of Chilean school system. In this light, teachers need to be trained since they are the most effective agents for achieving Chilean aspirations, such as to elevate the moral and social conditions of people, to improve lifestyles, and to increase levels of production (Nuñez, 1883). In the search of improvement of the teacher and of a successful educational system, it was considered that vocational training was not enough for teaching; rather scientific and academic support was needed. Letelier (1940) asserted that it is absurd to believe that inspiration and vocation are enough for being a teacher; who teaches need academic and scientific preparation. Thus, the teacher turns of being a technical worker toward a trained professional.

Before the foundation of institutions aiming at teachers' training; teachers and their educational job were structured on vocational attitudes and not on scientific knowledge, the task of teaching is based in the "called for social service". The ones who had the conditions for teaching became "qualified technicians" that only repeated, over and over, the lesson of a manual. "The manual! It was the beginning and end of teaching practice" (Letelier, 1940, p. 24). The demand of more teachers, either for policies of expansion of the educational system in Chile or the lack of people who could teach (see Velásquez, 1873), led people without the training and enough knowledge to take the positions for teachers (Letelier, 1940). Gutiérrez (2008) asserted that before the foundation of the Pedagogical Institute—in 1889—, mathematics teachers of the high school were lawyers, doctors, engineers, military retirees, and fiscal employees, but few of them had the engagement and the knowledge for teaching. But, at the end of the 19th century, it sought to shift this fact, by demanding a professional mathematics teacher with the knowledge and scientific support for teaching. Regarding the teaching of mathematics, in this period, it was enunciated that mathematics was essential for the development of children's intellect and for disciplining their mental faculties (Nuñez, 1883), which can be reflected in the preface of the book titled 'The Elements of Geometry' "[...]the

learning of science is not only a mean of acquiring useful knowledge but the development of intelligence through the observation and analysis” (Basterrica, 1877, p. 5).

The mathematics teacher as an autonomous professional...

The most enlightened countries in Europe, such as Switzerland, France, Austria and Germany, have acknowledged that a good education needs to have good teachers, and for having them, it is essential to train them in specialized institutions (Letelier, 1940). Over the 18th and 19th century, in diverse countries, new institutions of higher education were established to prepare teachers, which had as the main focus the practical preparation on how to teach (Kilpatrick, 1992). The establishing of a formal teacher education in Chile started in 1842, with the first Normal School, and the first Normal School for women in 1854 (Avalos, 2003; Cox and Gysling, 1990; Nuñez, 1883), both based on the successful experiences of European and North American teachers’ training and on the implementation of their educational systems (Nuñez, 1883)—in the 1760s. In Europe, “[t]he first initiatives by governments for teacher education were undertaken for elementary schools, establishing normal schools or seminaries” (Smid, 2014, p. 579). In particular, the effectiveness of the German model was recognized in Chile— as well as in other countries— (see Nuñez, 1883), which promoted teacher training based on scientific knowledge. Normal Schools were established on the German model.

There is little doubt that at least since the end of the Second World War, education policy and curricular developments have been determined fundamentally by international trends, supranational influences, and demands for global progress. (Tröhler and Lenz, 2015, p. 6)

In 1889, the Pedagogical Institute⁵⁶ is founded (Letelier, 1940), with great German influence (Avalos, 2003; Gutiérrez, 2008). The career of high-school mathematics teacher was created in this Institute. In 1890 the Pedagogical Institute was part of the University of Chile. Gutiérrez (2008) stated that

⁵ The Pedagogical Institute laid the foundations for the development of mathematics in Chile, as an autonomous discipline, beyond of its teaching as ‘useful’ science, which was the goal of mathematics education in the 19th century (Gutiérrez, 2008). Prior to Normal Schools and Pedagogical Institute, Nuñez (1883) stated that the mathematics had been reduced to mechanical techniques to solve problems. Also, Gutiérrez and Gutiérrez (2000) affirmed that the mathematics as ‘useful’ science is constituted as a program of the State for achieving progress, responding to aspirations of who were parts of the enlightened society of Chile, whose beliefs were that science is the only means of growing.

⁶ Mathematics teacher training in the Pedagogical Institute was comprised by: cultural and scientific training, general pedagogical training, mathematical training, and mathematical pedagogical training and practice of teaching (Gutiérrez, 2008).

the Pedagogical Institute was established with the aim of introducing and developing pedagogy in Chile. To provide a high-level training and scientific foundations for who teach were the main concerns for the creation of this Institute. Internationally, “the education of future mathematics teachers became an object of concern[...] Mathematics teacher became a profession one could enter only by following a prescribed programme and by acquiring the necessary diplomas.” (Smid, 2014, p. 579). According to Letelier (1940), the need for constituting the Pedagogical Institute emerged from two main causes, causes that are also valid for the establishment of Normal Schools: (a) teaching was an exclusive responsibility of the Church, something that has changed in last years⁷; (b) a specific training for becoming teacher was not necessary because teaching was reduced to the mechanical labor of giving and receiving lessons, something that was sought to. At the beginning, German teachers were hired in Normal Schools and in the Pedagogical Institute, for example, *Poenisch* and *Tafelmacher*⁸ (see Gutiérrez and Gutiérrez, 2014). They helped in the drawing of mathematics teacher training programs and in the teaching of mathematics in diverse levels. Letelier (1940) asserted, “we have to resort to German teachers if we want to give to prospective teachers the best pedagogical education” (46–47).

The educated mathematics teacher became an autonomous agent for teaching; someone “who does not only has the ability to make independent pedagogical decisions and judgments, but who also displays personal and moral commitment” (Sitomaniemi-San, 2015, p. 54); someone who is able to fostering his/her field (Poblete, 1964). In other words, a teacher equipped with tools, knowledge, and methods that enable him/her to manage diverse aspects of the teaching and learning of mathematics, beyond only repeating what is said in a text or manual. This movement made possible to leave behind the teaching of the mathematics as a mere application. Given that the teacher was ought to teach mathematics not as a set of propositions and rules that responded to certain human activities, such as, the trade or the industry, but as a system of ideas and valid and useful knowledge for everyday life (Gutiérrez and Gutiérrez, 2014).

...that has to be in continuous training...

“Something that cannot be improvised in education is the teacher” (Letelier, 1940, p. 21). Around 1960, almost all countries had a lack of teachers (Grube, 2015), even more, of quality teachers. It is

⁷ “The French Revolution ended the dominance of the churches in educational affairs. Later, states accepted responsibility for what we call now secondary education (particularly in France and Prussia). Mathematics became an important part of that education. As a consequence, the education of future mathematics teachers became an object of concern for those states, which started to issue decrees and laws to ensure the quality of the mathematics teachers at the new, state-regulated schools for secondary education.” (Smid, 2014, p. 579)

⁸ Both of them taught, based on German pedagogy, mathematics and “new” teaching methods in the Pedagogical Institute, and they supervised teaching practices. Also, they published ‘The Elements of Mathematics’, composed of 6 volumes dedicated to the studying of mathematics in Chile (Gutiérrez, 2008).

acknowledged a direct relation between teachers' quality and the level of educational system quality (Letelier, 1940). Diverse social changes and new requirements have revealed that initial training is not enough for ensuring a quality teacher. Teachers who needed training based on scientific knowledge, now need to be immersed in a continuous training process. The autonomous teacher has to become a lifelong learner: a subject that never stops learning, a subject that is embedded in a continuous training process, in which he/she will be always in a process of becoming. The Chilean reforms, of 1964 and 1970, introduced conceptually and institutionally the notion of continuous training, which considered an initial and continual education (Avalos, 2003). Schiefelbein (1976) stated that teacher as professional must develop continuous learning, leaving out the idea that he/she is a technical and operational performer. Also, PIIE (1984) enunciates that continuous training help teachers in modifying and improving their practices, as well as to perceive themselves as professionals of education. At the end of the 20th century, along with the establishment of the ideas of continuous training, Chile began working in the strengthening of the teaching profession as part of the educational reform. For example, in the initiatives '900 schools' program' (see Gutman, 1994; MINEDUC, 2001), implemented by MINEDUC in 1990, one of the lines of action were teacher's professional development.

As years progress, it has been established the demand—and need—of more and better mathematics teachers; new schools are being opened and more children are accessing to education. Also, social changes have demanded a subject with new knowledge and skills. In order to supply such demands, other institutions⁹ started to be responsible for mathematics teachers' training, according to the model of the Pedagogical Institute. The model of Pedagogical Institute, also, was a model exported to certain Latin American countries, for example, Venezuela in 1936 (Gutiérrez, 2008).

...and becoming a good decision-maker

Due to the social demands and changes, the teacher needs to invest in upgrades—retraining programs in order to favor his/her professional development. In other words, to invest in self-capitalization and human capital to avoid becoming *obsolete* (see Montecino, 2018). Teacher (re)training programs are configured as a product—consumer good—, which are offered by diverse agencies to be consumed by teachers. There is a close relationship between professional development and teachers retraining with the financial sector; either by inversions and debts of teachers (e.g. currently, a master's degree in mathematics education in Chile is around 8.000 dollars), and of other social agents (e.g. in 1996 the Chilean government

⁹ In 1925 the Pontifical Catholic University started with this labor with the creation of the faculty of philosophy and education science. Later, the University of Concepción, the Catholic University of Valparaíso, the Austral University, the University of North, and the University of Santiago started with the mathematics teachers' training.

released 25 million of dollars for initial teacher education). It is established that citizens should be educated, despite of the state subsidies for poorer students (Jofré, 1988)¹⁰. Over the years, diverse programs have been configured for (re)training teachers, constituting a market traced by programs developed and managed by governmental and private agencies—such as CPEIP¹¹, universities, and specialist entities.

The most important Chilean challenges of the 20th century were both the expansion of coverage in education¹² and its quality. A measurement for facing these challenges was privatization¹³ of the educational system—during the military regime (1973 to 1990)—, since Chilean State did not have the necessary resources for reaching the expansion of educational system (Bruner and Cox, 1993). During this regime, teachers lose their condition of public employees. Moreover, teacher' salaries were determined by their own employer (public or private), which were reduced by 50%. Shaping market logic of who—schools and universities—has more money is who can hire better teachers. With the privatization of the educational system, the teacher has the free choice of selecting where to study his/her initial and continuous training, as well as where to work and in what to invest. Both the teacher and teacher (re)training are reformulated as a consumer good or a merchandise.

Such autonomous professional teacher, that is embedded in a continuous training, needs to become a (good) decision-maker. Teachers have the right and responsibility of their professional retraining (Ministerio de Educación Pública, 1992), as professionals, they must be capable of managing their professional development in the best way. The effectiveness and competitiveness of teachers are in function of their capacity of making good decisions, entangling personal interests with collective and social interests with the aim of getting the most benefit. Mathematic teachers, as decision-makers, have less to do with mathematics and its teaching, but more to do about the production of ways of distinction and differentiation, due to competence logic.

¹⁰ Gerardo Jofré, Ministry of Finance between 1985-1989. *Education subsidies system: The Chilean experience*—El sistema de subvenciones en educación: la experiencia chilena—, written by Jofré, is a testimony of how Chile integrated the ideas of Milton Friedman, with a component of Catholic conservatism (Schneider, 1997).

¹¹ This center certifies “courses or programs that are imparted in public or private institutions —nationals or internationals— with the aim of ensuring the quality and relevance for the professional development of teacher” (MINEDUC, 2016, p. 4)

¹² In Chile there were configured diverse policies for setting compulsory education, in 1965 is set compulsory education for primary education (eight years of minimum schooling), but, in 1920 four years of minimum schooling were established, and in 1926 schooling was increased from four to six years. In 2003 compulsory education is set for high school (twelve years of minimum schooling). And in 2013 compulsory education is set for kindergarten education.

¹³ For example, in 1982 MINEDUC enabled the establishment of private institutions of higher education, such as universities and institutes.

Fabricating and governing of the mathematics teacher

The teacher “brings progress to society through the social administration of the child” (Popkewitz, 1998, p. 2) and the fabrication of qualified subjects. Contemporary societies depend on the knowledge and skills of their population—human capital (Brunner and Elacqua, 2003)—for achieving social well-being and growth. All social phenomena are regarded “as resulting from the economic calculations and investment decisions of individual actors” (Shaviro, 2011, p. 76)

The becoming of the mathematics teacher, as professional, is framed under the idea of cost-benefit; the market is delineating forces, dispositions, and discourses, where the teacher is shaped and thought. In this fashion, he/she must be able to calculate the risks of all his/her investments and decisions. It would seem that teachers have control over their lives and over their professional development, however, social interests, demands and changes shape the becoming of the teacher, conducting his/her conduct and constituting ways of thinking and understanding about him/her. In this context, he/she has new levels of ‘freedom’: the consumerism. The professional teacher becomes a *homo economicus*. “Homo economicus is an entrepreneur, an entrepreneur of himself [...], being for himself his own capital, being for himself his own producer, being for himself the source of earnings” (Foucault, 2010, p. 226).

In this vein, the professional mathematics teacher is fabricated as an ‘entrepreneur’, who is self-regulated and self-control for becoming a productive and competent subject, a trained, autonomous, continuous learner, and decision-maker teacher that pursues his/her own interest. The teacher as ‘entrepreneur’ does not offer his/her workforce by a salary; rather his/her capitalize a capital. In other words, a set of other elements of their work, practices, and education. “Salary or wages become the revenue that is earned on an initial investment, an investment in one’s skills or abilities.” (Read, 2009, p. 28).

Conclusion

The discursive assemblage of Chilean social development and school mathematics have promoted to a desired teacher, an autonomous professional that has to be in continuous training and has to be a good decision-maker. The teacher is characterized and fabricated within a narrative of exaltation and degradation, by framing the teacher in a political and economic agenda, where his/her conduct is conducted. He/she must become a self-regulated subject, an entrepreneur of him/herself (a homo economics), who pursues his/her own interest and who can entangle personal interests with collective and social interests. The autonomy and self-government are operating in function of the maximization human capital, where the cost-benefit becomes the cornerstone of all possible decision that the teacher should take. But, is the fabrication of this kind of mathematics teacher what society desires?

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