HISTORY OF SCIENTIFIC AND ACADEMIC PRODUCTION IN MATHEMATICS EDUCATION: REPRESENTATION, INSTITUTION AND POLICY

Filipe Santos Fernandes

Federal University of Minas Gerais (Brazil)
fernandes.fjf @ gmail.com

Abstract

The aim of this paper is to list elements for the construction of an agenda for scientific and academic research in mathematics education in Brazil, under a historical perspective. In face of the urgency and the necessity for the construction of this investigative agenda, we choose to take a position that marks some initial routes, specific to the intentions of this text: the practice of history under a Foucauldian perspective, putting in evidence the production of knowledge, which is not disconnected from the dynamics of power relations; and the possible consequences resulting from the formation and action of individuals with master and doctorate degrees in mathematics education in Brazil. With this text, we expect to attract greater interest, within the field of History of Mathematics Education, for the formation and consolidation of mathematics education as a field of knowledge in the Brazilian scenario.

In which direction are we spinning the wheel of history?

In 1993, in a thematic issue of the journal "*Pro-posições"*, one of the first compilations of Brazilian authors about the emergence of a field of knowledge called mathematics education, Roberto Ribeiro Baldino posed the following question: "In which direction are we spinning the *wheel of history* when we convey this discourse, unarguably implemented, on a global scale, which we call 'mathematics education'?" (Baldino, 1993, p. 43). Far from a strictly moral issue, the question posed an invitation to all researchers at the time, who raised their flags in the name of the establishment and consolidation of mathematics education as an autonomous field of knowledge, recognized by academia, to turn their attention to the dynamics of this scenario - involving political, socio-cultural, scientific, ethical, epistemological, and many other aspects - that enabled the emergence of mathematics education.

Baldino did not issue a simple invitation to discuss the contents or representations which came in to play for the constitution of mathematics education as a field of knowledge. The direction in which he pointed seemed to show the irreducibility of mathematics education into this set of contents and representations, unraveling " the seemingly strong links between words and things" (Foucault, 2008a, p. 55). It is an invitation to look into how mathematics education was carefully invented from a myriad of relations, deeply immersed in a dynamic of power and knowledge.

Today, Baldino's question still resonates with some researchers concerned about the process of constitution of mathematics education and its relationship with scientific work in academia. Proposals are increasingly being articulated, at national and global level, in order to examine scientific and academic research in mathematics education under aspects of historicity – the historical forms, as both agent and effect of processes - and its scientific actuality – the way of being a science, which may coincide or not with epistemological positions inherent to institutional space. Two simple examples of how this issue has been gaining attention of researchers are : first, at national level, the inclusion of the line of research in History of Scientific and Academic Production in Mathematics Education between the first and the second editions of the National Meeting of

Researchers in History of Mathematics Education (*Encontro Nacional de Pesquisa em História da Educação Matemática* - ENAPHEM); and second, at international level, the maintenance by Spanish Society for Investigation in Mathematics Education (*Sociedade Espanhola de Investigação em Educação Matemática* - SEIEM) of a work group called Didactics of Mathematics *(Didáctica de la Matemática)*; which aims to examine, under a epistemological light, the coordination of theories in order to understand mathematics education as a discipline in the scientific-academic universe.

Other actions have been undertaken, especially in the field of Philosophy of Mathematics Education. By posing the question: *what is research in mathematics education in Brazil?*, the Group for Research Phenomenology and Mathematics Education (*Grupo de Pesquisa Phenomenology e Educação Matemática – FEM*) has established a philosophical exercise that seeks to "offer input to think about research in mathematics education in Brazil, mainly at an institutional level, understood as that national forum that congregates all researchers in the country" (Bicudo & Paulo, 2011, p. 255). Note that such a proposal does not dissociate from the philosophical aspects that guide the research in mathematics education, especially in regard to its scientific actuality, and the historical aspects of its constitution, showing mathematics education as process.

Thus, historicity and scientific actuality exist side by side: the paths *of action* by which mathematics education is constituted do not dissociate from a sense of its own, singular time. This is the moment in which an urgent and necessary agenda for research can be established. An agenda concerning the production of a set of tools that assist in the questioning and updating of the issue raised by Baldino; and direct our attention to the question posed by Group for Research Phenomenology and Mathematics Education, albeit through different theoretical and methodological paths, committing to the historical aspects of the constitution of mathematics education in the scientific-academic setting that, with attention and care, refers to mathematics education as fabricated, invented, deeply immersed in a dynamic that does not take knowledge as given, but as manufactured product.

In view of the urgency and the necessity for the construction of this investigative agenda, we choose to take a position that marks some initial routes, specific to the intentions of this text. Given its attention to the inseparability of knowledge production and power relations, such position will find its main theoretical basis in the work of Michel Foucault. As history under *a Foucauldian orientation* would be, in the case of this proposal, "a form of history which can account for the constitution of knowledge, discourses, domains of objects etc., without having to make reference to a subject which is either transcendental in relation to the field of events, or runs in its empty sameness throughout history" (Foucault, 2008b, p. 188). By treading a genealogical path, a history with *Foucauldian orientation* opposes the search for source, and gives rise to a sense of origin that gives prominence to dispersion in place of evolution, and continuity and accident in place of cause-effect relations.

However, it must be stated that the choice of a Foucauldian orientation is just one of the paths chosen from the range of interests that this text mobilizes. Other possibilities are not excluded: other historical and historiographical ways, other conceptions of mathematics education and their modes of expression as scientific research over time; other initial contours that define and drive the research agenda. In short, what is expected is an augment of interest in the History of Mathematics Education regarding the formation and consolidation of knowledge in the Brazilian scientific-academic setting.

What history of the academic and scientific production in Mathematics Education?

Issues about the historical aspects that surround mathematics education have been increasingly grounded in a shared disquietude of the community regarding their own history. Among the various

concepts and trends, works are emerging, which focus their interest in the historiographical approach to the establishment and consolidation of ideas, practices and discourses that underlie these conceptions and consolidations.

Thus there is a mutual influence of least two major schools of thought in these studies. On the one hand, the field of History provides us with theoretical and methodological tools to guide, inevitably so, the work of researchers who deal with historiographical issues in mathematics education. On the other hand, mathematics education contributes to the sensitive views of mathematics educators to historical processes that probably would not be mobilized or invented by those trained in History or by researchers of History of Education. This permeation, however, does not mean thinking the History of Mathematics Education as an amalgamation between History and Mathematics Education, nor does it lead us to think that it is an area of History of Education concerned with Mathematics.

Therefore, the research in the field of History of Mathematics Education deals with historical processes of a concept of mathematics education legitimized by a community of mathematics educators which bring into play a historiography concerned with production, organization, availability and analysis of historical sources, in order to conduct historiographical research, as well as their own way of thinking about history and its production. In the specific position the present text is based, practicing the History of Mathematics Education entails the elaboration of understandings about how this mathematics education *knowledge* is constituted.

Thus, some issues arise: in what ways can a Foucauldian orientation enrich the investigations on the history of mathematics education? How did the work of Michel Foucault pose questions which help question the constitution of mathematics education? What is Foucault's contribution to the reflection upon the history of the academic and scientific production about mathematics education in Brazil?

By targeting such concerns, initially we hope to examine Foucault's view of *knowledge*. By opposing the Aristotelian tradition of knowledge as *natural* – thus, placing it in the realm of instinct, *a priori,* and, by approaching Nietzschean questions, Foucault (2002) views knowledge as an *invention*. Knowledge is therefore not natural but counternatural: knowledge as an invention, has no origin, it does not exist prior to the subject, nor is the revelation of something that is already in existence; knowledge "is simply the outcome of the interplay, confrontation, connection, struggle, and the compromise between the instincts. Something produced is when instincts meet, fight one another, and finally, at the end of their battles reach a compromise. That something is knowledge" (Foucault, 2002, p. 16).

Knowledge is rupture, as invention always creates something new, and "something with a small beginning, low, petty, shameful" (Foucault, 2002, p. 15), with its own space and place. And, because it is the result of struggles, battles, of malice and greed, that knowledge is about domination. Therefore, under a Foucauldian perspective, knowledge cannot be thought outside the dimension of power[1]. Foucault's hypothesis is that there is no knowledge without power, and the opposite is also true: the constitution of knowledge is embedded and inextricably marked by in

[1] *Power* cannot be understood, here, according to a legal-repressive perspective. Power, for Foucault, is the need for fulfillment of desire, not a consequence of desire, but its potential realization. By putting the power next to desire, the author proposes that power be understood as "a multiplicity of correlations of forces immanent to the domain where they are exerted, and constitutive of their organization; the game that, through ceaseless struggles and confrontations transforms, strengthens, reverses; the support that such correlations of force find in each other, forming chains or systems or, conversely, the gaps and contradictions which isolate them from each other. Finally, the strategies in which they originate and whose general outline or institutional crystallization is embodied in state apparatus, in the formulation of law, in social hegemonies (Foucault, 1999b, p. 89). Thus, power cannot be thought of as the institution, the State, or the law: it is everywhere; not because encompasses everything, but because it emanates from everything.

power relations; knowledge determines power relations; and power to be exercised, must engender knowledge.

"The historian should not fear pettiness because it was amidst pettiness, from small thing to small thing that, ultimately, the great things were formed. To the solemnity of origin, it is necessary to oppose, in good historical method, the meticulous and unspeakable smallness of these fabrications, these inventions" (Foucault, 2002, p. 16).

According to the excerpt above, the author's concern seems to be founding a history that brings into play the rules from which emerge certain forms of subjectivity, certain object domains, certain types of knowledge; which seek "find the differences, display the forces at play in every minor thing, drive interests out of their caves" (Luiz, 2010, p. 12); which calls into question the "meta-historical development of ideal meanings and indefinite teleologies" (Foucault, 1979, p. 19), approaching what is petty, small, deviant or trite.
Thus, a history of knowledge under a Foucauldian perspective derives from a ludic production of knowledge, resulting from the interplay, and "arising from an activity of simulation, fiction, representation, construction of masks, which give a face, a countenance, a presence, an appearance to the world and its beings" (Albuquerque Jr., 2004, p. 87). The purposes that guide this research agenda, in particular, are intended to rebuild the masks assigned to mathematics education, giving it a presence among the forms that are being created in time and space, in the most meticulous and petty dimensions of scientific and academic dynamics. Such a construction requires "minutious knowledge; a large number of accumulated materials, [which] require patience" (Foucault, 1979, p. 19).

Pointing out elements for a research agenda: the possible consequences of the formation and action of individuals with advanced mathematics education degrees in Brazil

Despite not having the outlines of contemporary scientific knowledge - that is, knowledge that has a consensus regarding, for example, schools of thought, research approaches, methods, processes, legitimacy, quality, and result validation criteria, mathematics education is a field of knowledge deeply widespread[2] as discourse[3]. In this dynamic it would be fitting to go back to Foucault's questioning: how is this knowledge about mathematics education invented? What forces and knowledge are articulated in a monstrous way in order to allow its emergency in the scientific-academic universe? How does mathematics education determine and is determined by the relations of power and creation of knowledge? What mechanisms are at play? Or, going back to the question by Baldino (1993, p. 43), "In which direction are we spinning the wheel of history when we convey this discourse, unarguably implemented, on a global scale, which we call 'mathematics education'?"

It is, therefore, a perspective that seeks to understand how these procedures for generating and managing the modes of existence in mathematics education; permission or oppression procedures,

[2] Notably, mathematics education, in most universities, has a consolidated position described by factors such as the number of theses presented, which address key issues concerning mathematics education; the number of research projects funded by public authorities, and the different communities, companies and researcher associations; the existence of specific research institutes; the volume of publications in research journals in various fields; and the considerable number of national and international conferences.

[3] For Luiz (2010, p. 2), *discourse* "is knowledge as matter, i.e., the physical manifestation of knowledge: writing, speaking." Note also that to claim that mathematics education is knowledge is not equivalent to saying that it is scientific knowledge (according epistemologies guided by analytical truth) or a discipline (an autonomous field of research that keeps certain characteristics). An interesting position could be taken here: mathematics education as a social practice. In this sense, we indicate Miguel, Garnica, Igliori & D'Ambrosio (2004).

which authorize and legitimize some discourses, while oppressing and silencing others. Observe how carefully, step by step, mathematics education is forming and being formed in the midst of an *economy* of discourse, knowledge and truth.

So, to investigate this mathematics education knowledge in a historical Foucauldian perspective is not to ask for an origin, for causal and teleological relations, but for a network that connects events and establishes the foundation in which buildings of power and knowledge are supported and navigate. It is a matter of wondering about how, in a given historical moment, a discourse legitimized by the scientific and academic field becomes widespread; and understanding forms of appropriation and expropriation in the social sphere. Thus, this questioning then is related to the understanding of the training tools and accumulation of knowledge, observation methods, registration techniques, investigative and research procedures, the monitoring apparatus that will determine the legitimate forms. It is through these subtle mechanisms that power and knowledge will be constituted, organized and put into circulation. In the specific case of mathematics education, one can explore the limits and modifications of these mechanisms through the dynamics of graduate programs; the circulation of books, journals, editors and publishers; documents such as public notices for tenured teaching positions, departmental minutes, library processes and records; educational and social policies; as well as many other ways through which this discourse, this materiality of knowledge, will be widespread, diluted to the point its effect is assimilated.

Therefore, viewing mathematics education as knowledge determines certain ways of operating historiographically; determines certain issues, certain methodological mobilizations, certain approaches. This proposal is predicated on the premise that focus of a history of mathematics education knowledge can be articulated in order to find the "petty" elements, those generally ignored by traditional historiographical operations. Such articulation is linked to the delimitation and relations between: 1) a domain of objects, those which mathematics education can talk about , the things that mathematics education seeks to clarify in a movement of words – mathematics, the mathematical object, education, etc.; 2) the subjective positions, the spaces that the subjects can occupy in order to talk about such objects – the mathematics teacher, the mathematics education researcher, the department responsible for the discussion of mathematics education, the societies, etc.; 3) the field of production and subordination of the statements in which such concepts emerge, are defined , applied and are transformed – research, scientific meetings etc.; 4) the possibilities for the use of discourse – the university, the school, life.

Some information however, is relevant to guide the first steps in this path. Mathematics education as a research area has been emerging in Brazil, more prominently, since the 1980s[4], with several institutional landmarks, such as the creation of the first Brazilian graduate programs in the area – in 1984, the graduate program in mathematics education of *Universidade Estadual Paulista*, in Rio Claro, state of São Paulo, and in 1994, the graduate program in mathematics education of *Pontifícia Universidade Católica*, in São Paulo (SP), along with the foundation of the Brazilian Society of Mathematics Education (*Sociedade Brasileira de Educação Matemática* - SBEM), in 1988; and the launching of the first dedicated scientific journals – *Boletim de Educação Matemática*, in 1985, and *Zetetikè*, in 1993.[5]

[4] Fiorentini & Lorenzato (2007) characterized the 1980s and the following periods as the emergence of a community of mathematics educators, of expansion of the investigation scope and consolidation of lines of research as well as programs for master / doctoral degrees in mathematics education. Therefore this period marks, very clearly, the construction of a place for 'professional' mathematics educators in academia.

[5] Around the periods mentioned, other events can be highlighted, such as the movements in the area of teaching science and mathematics, occurred in the 1970s and 1980s; the creation of Science Teaching Centers (*Centros de Ensino de Ciências*), still in the 1960, that introduced an emergent discussion about teacher training in those areas; or the discussions that arose from the Modern Mathematics Movement. These indicators, far from being less important,

Even with the evident growth in the number of research centers in mathematics education, in graduate programs in Education before and after the 1980s (Miguel, Garnica, Igliori & D'Ambrosio, 2004), the creation of a graduate program in mathematics education is an important milestone: the availability of a space for education and action of individuals with advanced degrees in mathematics education in the Brazilian scientific and academic scenario, a position which is believed to have served as an important driving force in the constitution of mathematics education as institutionalized knowledge.

The circulation of individuals with masters and doctoral degrees not only has subjective importance, characterized by the institutionalization in the scientific and academic community of the status of *being* a mathematics educator, but also produces developments in other areas.

The first development is linked to the manner this subjective position, of mathematics educator, assumes various forms through time, in a process through which identities are produced, to the extent that these subjects are linked to certain content and formations. The questions that could be asked concern the relationship between subjective positions and the domain of objects: what knowledge, disciplines, content or understanding were institutionally associated with mathematics educators through time? What archetypes related to being a mathematics educator have been constructed? What discourse is authorized or banned for this subjective position? Thinking about these issues is therefore thinking mathematics education among the representations, the processes by which it becomes identifying and identifiable.

A second development would be the questioning of the academic spaces in which mathematics educators are allowed to navigate. One would then seek to understand how institutions work in creating spaces that allow or restrict their movement, regardless of the demands, agreements and disagreements, and the foreseen and unforeseen occurrences resulting from such creation.

A third and final development focus the attention on the manner by which this emergence of the mathematics educator in relation to policies takes place. Here, it is interesting to discuss the alliances, games and interplay of interests and needs, the articulations that define ways of thinking, acting and also of being a mathematics educator. A development that is concerned with the mechanisms of invention of mathematics education amidst the negotiations of the scientific and academic universe; which turns its attention to the responsiveness of mathematics education to greater policies, or those effected in smaller domains.

It is important to emphasize that these three developments – *representation*, *institution and policy* – are not dissociated. To mobilize any of them is necessarily to mobilize them all. The division that is proposed is only a guide, a way to organize issues prior to the proposal of an agenda. It is important that each one of them promotes, in a specific way, the questioning of mathematics education knowledge, thinking it within lives, while creating it among the powers that curtail it.

To finish: joaquín vayreda

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contribute for the reflection of how a series of historical events – scattered, chaotic, momentary, concomitant or not – enabled the constitution of mathematics education.

Image 1. Joaquín Vayreda, *Procesó de colegiales*, 1890.

Joaquím Vayreda (1843-1894) is considered one of the greatest Catalan painters of the nineteenth century. With subtle approaches to Impressionism, the painter devoted his work to religious and *Costumbrism* themes, also venturing in representations of landscapes, later inspiring many Catalan painters.

In his work *Procesó de colegiales*, Vayreda depicts an everyday scene in which some young women seem to walk in procession. Very similar attire seems to show that all the women belong to a "common". This work shows the girls walking together, step by step, while a nun instructs them: they seem to work according to norms established by someone, which show how a procession must take place. In his great lyricism, characteristic of this painter, the clothes, the lines, the sorting by height and objects that the girls hold demonstrate that, together, they form a unit and want, as the author desires, to constitute an identity from this unit.

There is, however, something that cannot be seen in this painting: the faces. It seems as if there is no interest in the features of each of the young women. The hidden faces might reveal the fragility of such identity. Or, they could suggest that this identity can be seen through different eyes. This painting by Vayreda, amid the apparent triumph of equalization of the dissimilar, introduces silence, a silence that is pettiness ready to be uttered. A silence which may reveal wickedness in the eyes, or condescending smirks. A silence that may bring about struggle and resistance. Silence that is never hollow.

This agenda may be a commitment to the search for such faces. In our hopelessness, however, let us make masks…

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