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Sobre a formação de professores e pesquisadores em educação matemática: Pontos para uma agenda

On the formation of teachers and researchers in mathematics education: Points for an agenda

Sobre la formación de profesores e investigadores en educación matemática: Puntos para una agenda

Sur la formation des enseignants et des chercheurs en didactique des mathématiques : points pour un agenda

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Resumo

Registro integral da conferência de abertura do IX CIBEM (Congresso IberoAmericano de Educação Matemática), este artigo propõe três discussões para a integrar uma agenda para a educação matemática, a saber: (a) a necessidade de redimensionar e ampliar objetos, enfoques, estratégias e abordagens metodológicas para o estudo acerca da formação de professores que ensinam matemática; (b) a necessidade de dar maior atenção à perspectiva historiográfica, valorizando os estudos em história da educação matemática e incluindo essa perspectiva nas políticas educacionais; e (c) a possibilidade de incorporar a divulgação científica e projetos de popularização da ciência entre os interesses do campo e, mais especificamente, nos mestrados profissionais que, com isso, teriam a oportunidade de reconfigurar e/ou cuidar com mais clareza de seus objetivos e intenções.

Palavras-chave: Formação de professores, Formação de pesquisadores, Mestrados profissionais, Educação matemática.

Abstract

This paper, a written version of the opening conference of the IX CIBEM (Congresso IberoAmericano de Educação Matemática), presents and discusses three items to integrate an agenda for Brazilian mathematics education: (a) the need to search new dimensions to objects, approaches, strategies and methodological frameworks for the researches related to the

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education of teachers who teach mathematics; (b) the need to pay greater attention to the historiographical perspective, valuing studies developed in the field of history of mathematics education and including this perspective in educational policies; and (c) the possibility of incorporating dissemination and popularization among scientific projects of the field and, more specifically, in professional graduate courses that, with this, would have the opportunity to reconfigure and/or take care of their objectives and intentions in a more precise way.

Keywords: Teacher education, Researcher formation, Professional graduate courses, Mathematics education.

Resumen

Íntegra de la conferencia inaugural del IX CIBEM (Congreso Iberoamericano de Educación Matemática), este artículo propone tres discusiones para integrar una agenda para la educación matemática brasileña, a saber: (a) la necesidad de redimensionar y ampliar objetos, enfoques, estrategias y enfoques metodológicos para el estudio sobre la formación de profesores que enseñan matemáticas; (b) la necesidad de prestar mayor atención a la perspectiva historiográfica, valorando los estudios en historia de la educación matemática e incluyendo esta perspectiva en las políticas educativas; y (c) la posibilidad de incorporar la divulgación científica entre los intereses del campo y, más específicamente, en programas de posgrado profesional que, con ello, tendrían la oportunidad de reconfigurar y/o atender con mayor claridad sus objetivos e intenciones.

Palabras clave: Formación de profesores, Formación de investigadores, Programas de posgrado profesional, Educación matemática

Résumé

Cet article est le compte rendu complet de la conférence d'ouverture du IX CIBEM (Congrès Ibéro-américain de Didactique des Mathématiques) et propose trois thèmes pour composer un agenda pour la recherche en Didactique des Mathématiques au Brésil, à savoir: (a) la nécessité de redimensionner et étendre les objets, les approches et les méthodologies pour les études concernant la formation des enseignants de mathématiques; (b) la nécessité d'accorder une plus grande attention à la perspective historiographique, en valorisant les études en Histoire de l'enseignement de mathématiques et en incluant cette perspective dans les politiques éducatives; et c) la possibilité d'intégrer la diffusion scientifique parmi les intérêts du domaine et, plus spécifiquement, dans les Masters Professionnels qui, avec cela, auraient la possibilité de réaménager et/ou de prendre en charge plus clairement leurs objectifs et leurs intentions.

Mots-clés: Formation d'enseignants, Formation de chercheurs, Cours d'études supérieures professionnelles, Didactique des Mathématiques.

On the formation of teachers and researchers in mathematics education: Points for an agenda

This article is the full transcript of the opening conference of the IX Ibero-American Congress of Mathematical Education (Congresso IberoAmericano de Educação Matemática - CIBEM), held in 2022 remotely. Having not been published in the Proceedings of the event, I judged that these notes could be shared in this edition of the journal *Educação Matemática Pesquisa* that, in this year 2023, celebrates 25 years of activity. Once again, I am immensely grateful for the invitation to participate both in the opening activity of the IX CIBEM and this commemorative edition and, more particularly, I thank Professor Ana Lúcia Manrique and Professor Saddo Ag Almouloud for their patience when taking care of all the details that preceded the presentation I made that December 2022.

Due to specific circumstances, I have faced growing difficulties participating in events, whether face-to-face or online, and contact with me requires much patience. I have severe hearing problems that have worsened dramatically over time, and this condition expedited my withdrawal from many activities. That is also why I have recently retired and have been gradually moving away from research work.

I report this situation because it directly impacts what I am presenting here. Undoubtedly, other researchers could bring more recent contributions and interesting unpublished productions than I can bring. However, when I was invited to deliver this opening speech, vanity spoke louder than common sense, and I accepted the invitation given the importance of the CIBEM and the possibility of reviewing, albeit online, so many friends and colleagues that I admire and who, in some way, participated in all moments of my production.

Definitely, I do not believe in individual production, made without formal or informal dialogue with the many ideas circulating in our midst. So I also take the opportunity to thank all the colleagues who shared with me their work, understandings, and perspectives in these many years in which I was active. In particular, I thank all the researchers in my research group, GHOEM, who have for sure been the driving force behind much of my understanding of the academic world in general and mathematics education in particular.

In addition to a sense of self-importance, another element was decisive for me to have accepted this invitation: the political circumstance we went through during 2018-2022. We are ending a disastrous four-year sequence of a federal administration that has managed to radically and mercilessly massacre or delay many possibilities for the future. What was experienced in

the federal administration that now, fortunately, ends, was a brutal incompetence of the Presidency that joined the profound and widespread disqualification of an entire government. The complete paralysis in the creation and implementation of public policies in the last four years implies a slow, costly, and exhausting resumption both from an economic and social point of view.

In science, in general, denialism was linked to the lack of funding and the interruption of research formative and promotion policies (the disregard for Brazilian science, it should be noted, was already announced very clearly in Temer's government, which preceded Bolsonaro's government). The researchers project rather bleak prospects, due to the lack of funding, for all fronts of ongoing scientific research in the country. The funds allocated to MCTI in 2019-2022 corresponded to 30% of what was invested in research in Brazil ten years ago. Humanities as a course was systematically targeted since the presidential campaign, visibly suffering as it was continuously flogged for four years since the first moments of Bolsonaro's government. The lack of investments in science, technology and innovations must be added to the frequency of attacks on researchers and research institutions and the notorious incompetence of a minister and the entire management team of Brazilian science and technology.

From the point of view of values and customs, the delay may have been even more sensitive. It is astonishing to realize the fragility of our belief in democratic values that until then have always seemed to us unquestionable. It is alarming, as we can clearly see today, how a large part of society, from one moment to another, to preserve its privileges, is readily willing to abandon democratic values that cherish equity and social justice. Every day we see, renewed and strengthened, the persistent structures of prejudice, machismo, colonialism, and racism. It is striking how skillful our speeches are at blaming the immigrant and making invisible women, blacks, indigenous people, and people with low incomes. Four years have been characterized by the total absence of public policies related to family, human rights, public safety, the environment, culture, the economy, education, foreign relations and health. We face daily chaos imposed by fascism, by the inefficiency and incapacity of the Federal Government, chaos that has spread through the most distinct spaces, and very little positivity has flourished in this generalized climate of hopelessness, radicalization, inefficiency, violence, helplessness, authoritarianism, false moralism, prejudice, and exclusion. What we experienced in Brazil from 2018 to 2022 was much more than a mere delay: it was a civilizing delay. It is necessary to remember Albert Camus's warning: be attentive at all times because "plague bacillus never dies

or disappears for good. To the bain and enlightening of men, the plague would rouse up its rats again and send them forth to die in a happy city".

Being one more among the narrators of this uncomfortable memory is another of the reasons that led me to accept the invitation to this opening lecture and also what drove me to try to seek, in my production, some points that could be brought to this discussion in order to list some of the tasks I consider essential for an agenda for mathematics education. I discuss, here, more specifically, issues related to the education of teachers and researchers in mathematics education.

I have been working in mathematics education for a long time. From the first scientific initiation project – which I carried out during my graduation, at UNESP in Rio Claro, in the 1980s – until today, it has been more than 40 years. At first, I apologize for my daring to think that some diagnoses and prognoses for our area, formed in these years of operation, could be brought to my presentation.

Research on the training of teachers who teach mathematics

The formation of teachers who teach mathematics is positively one of the central thematic axes in the mathematics education field, in such a way that it can be said that, somehow, all our research actions, explicitly or implicitly, directly or indirectly, respond, refer, can respond or can refer to this axis.

Since 2002 we have been conducting, in my research group, a project whose central theme is the formation of teachers who teach mathematics in Brazil. It is no mere coincidence that this project arose simultaneously as we began our studies on the potentialities of oral history as a research methodology. Oral history is rooted in subjective narratives, in the register of experiences that social actors tell us. It has been increasingly evident that it is a potent instrument to highlight the diversity, multiplicity and plurality of points of view that are often rendered secondary but more usually neglected when, dispensing with other registers, we launch ourselves only to the study of standard sources such as school records and legislation. This diversity that oral history promotes has become, for us, a political commitment, clearly manifested in the affirmation that it is not enough to respect and defend plurality and diversity: it is necessary to promote them.

Aiming to highlight different perspectives and maintain, project and promote diversity and plurality, we have tried to sketch a mapping of the times, spaces and ways mathematics

teachers have been educated in Brazil. We have tried to understand the territories, the institutions and the dynamics in which this formation takes place. In twenty years, we have managed to create a huge, varied, and diverse collection of perspectives, addressing very different realities from each other, whether from a temporal, spatial, cultural, or economic point of view. This collection of understandings involves from the state of Maranhão to the state of Santa Catarina, through Bahia, Minas Gerais, Rio Grande do Norte, Ceará, Paraíba, Tocantins, Goiás, Mato Grosso, Mato Grosso do Sul, Paraná, and São Paulo, in a movement in which regions are visited and revisited at the same time as we strive to include other "realities" in this set of spaces that we have studied. Region, here, is not a term that should be read as merely linked to physical geography, but, as Simon Schama warned in the beautiful *Paisagem e Memória* (Landscape and Memory), as a space intersected by stories, affectivities and memories and, therefore, mobile, fluid, flexible, being more marked by desire than, alone and properly, by reason. Ivete Baraldi's doctorate (Baraldi, 2003) makes use of this conception of the region in a very clear and pertinent way when studying the surroundings of Bauru. In conversations with former teachers, the reports about this region cover much of the state of São Paulo and go beyond, given the decisive way in which, for example, the railroad network of the old Companhia Paulista shows itself vigorously in the testimonies. This is a study that, due to impositions, begins with a geographically and physically (de)limited space, but ends by sketching networks, connections, paths, and relations of which no static trace counts, with which one can perfectly marry the notion of a created, occupied, lived, dynamic space, as opposed to a marked, static, fixed, delimited space.

From all the arsenal of narratives that we have created and studied, we can affirm that, in Brazil, the movement of formation of mathematics teachers occurs marked by the signs of lack, urgency and transience. Formal courses, formal models of teacher formation and formal institutions of higher education (the repetition of the adjective is, here, deliberate) are clumsily created, aiming to meet sensitive needs – mainly given the unplanned expansion of primary and secondary education – on an urgent basis, in total dependence on local, regional and state political and economic powers that, in the absence of public policies and action plans, necessarily imply discontinuities and changes in agreements, rules and interests depending on the powers of duty. In the São Paulo countryside – one of the economic engines of the country – a more significant expansion of undergraduate courses occurred only in the 1960s and 1970s – when thirty years had passed since the creation of our first university. This time delay is even

more absurd when we consider that some northern states created their courses fifty or sixty years after our first university was established.

Knowing these realities – I think – is essential for those who study mathematics teacher education in Brazil. Otherwise, we will continue to stumble upon the same problems that have characterized many of the studies in our area. We have thought of the concept of EDUCATION, as a rule, in a narrow and reductionist sense since, very often, the term occurs allied to school and formal schooling, disregarding the variety of spaces, moments, conditions and alternative actions in which this education has EFFECTIVELY occurred in our country. We not only reduce education to school formation, but we also do not properly consider, when talking about teacher education, the different cultural and socio-economic environments in which this education takes place (or in which these formations/educations – in the plural – take place).

It is from the study of the dynamics of education and performance of teachers who teach and taught mathematics in Cariri Ceará, for example, that we come to an understanding that the credentials for their teachers to become teachers escape from the mere formalization and legal provisions enforced at the time, which leads us to affirm that the legitimacy of the condition of teacher does not necessarily reside in their institutional status nor their legal framework, but in the networks of relationships and the pulsating, living movements shaped in these networks of relationships. Concepts such as initial education, continuing education, and in-service practice do not account for expressing the flows, intensities, and multiplicities that insinuate themselves in the plane of forces that act in the formative processes (Alencar, 2020).

Teacher education goes beyond any normative classification and is beyond and below rigid, delineated, temporalized, institutionalized processes. Thus, we think of this education as a crack that occurs in various and varied spaces and times; it is interstitial, sometimes indeterminate, whose beginning and continuity can be triggered sometimes at specific times and conditions, sometimes throughout a lifetime. Graduating, therefore, is not about fixation or "training", but about invention, creation, reinvention, and recreation, in the course of a professional trajectory (which takes place with or without formal education) and a trajectory of life, flows, and passages.

In the interviews conducted for this research in Cariri Ceará, it was possible to identify that, despite all the normative effort to educate teachers in disciplinary processes, segmented content, levels of education and institutions, there has always been, in fact, a series of formative processes that escape these devices and indicate to us what we call, as other authors (Baraldi,

2003; Both, 2021; Cury, 2007 e 2011; Fernandes, 2011; Gonzales, 2017; Moraes, 2017; Martins-Salandim, 2012) *teacher education as an ongoing professional trajectory*, a formation in which teachers invent themselves as teachers, in different, varied ways, many of them not even catalogued or known to us, who study teacher education.

Traditional research on teacher education – those that privilege (a privilege often considered "natural") the formal instances – the formal courses, the degree programs, the current legislation – although valid and for the most part exceptionally meritorious, say little or almost nothing about these multifaceted realities but very vividly operative, even today, in Brazil. This parallel universe of teacher education can be felt in several other states of the federation, and the study of each of these regions has surprisingly allowed us to know, in our mapping, examples of practices, actions, resources, and subversions that are always new and always different from what we had already perceived.

If we go, for example, towards the Brazilian midwest region, another configuration is required. In the study carried out in the geographical space between the states of Mato Grosso and Goiás (Both, 2021), a space characterized by its diamond mines, religion does not play a preponderant role in public practices and policies related to teacher education, as occurs sensibly, for example, in Ceará's Cariri. However, in this diamond pole, a precise alignment is maintained between human experiences and partisan political practices that, in the case of Cariri, were guided by popular religiosity.

In fact, in this space of Goiás/Mato Grosso, education has always been at the service of political interests, operating as a bargaining chip between the needs of local society (jobs and places of study, for example) and the aspirations (votes and political support) of the dominant groups of the most diverse spheres, a classic relationship parameterized by the political "coronelism" (rule of the colonels, large landowners) in force in the municipalities studied. Talking with these teachers allows us to realize, for example, that the regional schools, at least those maintained by religious institutions, even after the officialization of a national regulation for primary education (initial years of elementary school), were guided according to their own precepts, flagrantly neglecting the official guidelines. To know and understand the education of teachers in this region, research on standard school documentation and official guidelines issued by the state or federation is of little or no use. In general, when the deponents of this research told us about their daily school activities, they were explicitly and radically opposed to any action that attempted to subvert or transgress what was imposed by the powers and

colonels of the localities, although going against the formal educational provisions. In addition, subjected to a closed political system, hostage to this controlling and authoritarian system, local teachers perpetuated it in their teaching practices.

Even if we take as an object of study socio-political spaces somewhat similar at some point – as, for example, is the case of the states of Goiás and Mato Grosso that went through a division for the creation of Tocantins and Mato Grosso do Sul (Cury, 2007, 2011; Gonzales, 2017) – we perceive clear distinctions in how divisionism influenced public policies for teacher education and, consequently, teaching practices in schools. In addition, while these political issues interfere in different ways in the configuration of formal institutions and institutionalized teaching practices, several accommodation and subversion strategies in which teachers effectively become teachers run out of this scenario, despite research based on concepts such as initial education, continuing education, official legislation and in-service practice.

I believe that one of the central points in the agenda of mathematics education is to consider this diversity of practices in our research on the education of teachers who teach mathematics. There are implications of this in the research we conduct. One of them, for example, is the need to create alternative methodologies that take account of this still very little explored reality (it seems to me that oral history and the other various ways in which narratives have been mobilized in our field are highly positive factors in this scenario) as well as it becomes urgent to expand theoretical approaches that, from my point of view, have been highly productive and promising (this is the case, for example, of decolonial studies). Despite my lack of knowledge about this line of research, I think it is urgent to include and emphasize, in these studies on (de)coloniality, an "internal" perspective, since traditional research on teacher education has operated (in my view, radically) as a provider of models of action and regulations that act as a colonization of the perspectives of southeastern Brazil on the rest of the country. We must be careful to avoid this internal colonization, from ourselves to ourselves, in a country of continental dimensions marked by an enormous diversity of practices, customs, histories and specific needs.

This, then, is the first point that I present here as a proposal to compose an agenda for mathematics education and, more specifically, for research that deals with the education of mathematics teachers. It is not, of course, a question of abandoning or neglecting the formal instances of education, but allowing, in our research, another dimension to be added, hitherto very little cared for by us.

The formal instances of education, the schooled educations (in the strict sense) are, today, dominant, and therefore must continue to be points of attention of the researchers. However, even in these formal instances, we cannot let diversities, desires, local networks of relationships, the situations experienced, the different ways of occupying spaces, the varied and diverse daily subversions that integrate a whole plane of forces in which the formation processes are constituted, go unnoticed. These forces insinuate themselves in interstitial spaces, in gaps, in different environments, and respond to varied dynamics, being configured and reconfigured continuously, adding cultural, local and subjective components that have escaped our studies. The integration of these questions into our studies will require the creation of alternative and complementary methods, procedures and protocols to those that are already familiar to us, will require the incorporation of foundations not yet visited or still little explored, and will thus take care to move not only the production of research on a specific topic, but to move and revitalize the entire field of research in mathematics education.

History as an ally

The second point I bring here to the discussion concerns the potentialities of historical studies. And, in this case, I get closer to my particular area of expertise, as I have developed some research related to the history of mathematics education.

It is true that historiography has no use, in a pragmatic sense, and that historiographical studies alone cannot alter pictures of deformation that seem stronger than reason. Hanna Arendt once said that if history had taught us anything, we would not have been victimized by the totalitarian phenomenon that affected the world in the mid-20th century. Updating what Celso Lafer states in the preface to Hannah Arendt's book *Entre o Passado e o Futuro* (Between Past and Future), we can say that the totalitarian phenomenon that once again plagues the world and is clearly evident in the present, in ultra-right policies, in fascisms of various types, in the dynamics of economic and cultural impoverishment, in the neglect of environmental causes, in the rejection and demonization of all forms of sexuality other than heteronormatized ones, in the neglect of all families other than the classically nucleated ones... all this barbarism visibly shows us that there are no limits to the deformations of human nature and that the bureaucratic mass organization based on terror, ideology, lies, and hatred, continually creates new forms of government and domination whose perversity we cannot measure. From my point of view – and this is what I will continue to defend – no perspective, no methodology, no scientific practice makes sense if it is not backed by the intention to contribute to the reversal of this

current framework of human, economic, political, and environmental catastrophe in which we are entangled. Considering historical studies more effectively may help us. We surely do not expect everyone to start researching the history of education or the history of mathematics education, but the efforts of those who have developed these studies must be considered more consistently, considered more seriously, more effectively. As a rule, history has been regarded as a preamble to a wide variety of research. However, it appears as a mere addendum, an initial enchanting artifice, a curiosity quickly dismissed for the introduction of some theme.

Whenever I defend this perspective, a phrase from Oswald de Andrade, in the early-30s newspaper *O homem do povo* (The Common Man), comes to mind. In a critique of how foreign capital has deformed the country's economy, he says: "*Dum paiz que possue a maior reserva de ferro e o mais alto potencial hydraulico, fizeram um paiz de sobremesa. Café, assucar, fumo, bananas*" *(A country with the largest iron reserve and the highest water potential made a country for dessert. Coffee, sugar, tobacco, bananas*). To this statement, my updating regarding the potentialities of history would be an approach that allows us to understand mechanisms that make us who we are, living situations with which we continually struggle until today, an approach that allows us a panoramic, temporal and spatial view to overcoming particular bottlenecks and negativities that insist on perpetuating themselves in the field of education... an approach that can both become a mere appetizer, a snack that we use decoratively to illustrate our research and give it, perhaps, some flavor of erudition.

Regarding teacher education, for example, a more consistent dip in historical plots could show us the many gaps, the many mistakes and the few successes of emergency teacher education, which is still a necessity in Brazil today. At the same time, an immersion in these historiographical plots could show some accommodations and subversions that occurred in the creation and expansion of the formal network of higher education courses in which mathematics teachers were formed. The Secondary Education Improvement and Dissemination Campaign (Campanha de Aperfeiçoamento e Difusão do Ensino Secundário), created in the early 1950s, still operates, in large part, as a model for emergency formative courses in regions where the offer of formal education is deficient. This model today is allied to technological strategies for distance education that are also not, properly speaking, new in this scenario (there were already correspondence courses in Brazil in the late 19th and early 20th century. The educational broadcasting service was created in the 1930s, gaining prominence in the 1960s, when television teaching was implemented). The 1960s and 1970s – when these emergency formative courses and the delay of CADES and the already existing degrees in placing secondary teachers

on the market in sufficient quantity to serve the education network – saw the emergence of the famous *cursos vagos* (attendance-free courses) that ended up, in many cases, being models for the creation of formal degree courses. Everything occurs in a scenario of chaos, emergency, urgency, motivated by the lack (of public policies, planning, structural actions, etc.) that make exceptions the rule, consolidating as a model provisions that should be, at most, circumstantial. I believe that the history of education and the history of mathematics education would serve to reflect on this scenario in which courses that, due to the circumstances, operated more as formalization than as formation for the exercise of teaching were rooted.

In a country of continental dimensions, teacher education – formal or not – occurs in a relatively chaotic way and in very different times and spaces, so that any guideline emanating from anywhere is appropriated in very different ways, which necessarily leads to a mischaracterization of these same guidelines with the intention of making SOME education possible. In fact, historiographical studies on teacher education lead us to understand, for example, that many of our practices and even our institutional dispositions are based on the assumption that "any education is better than no education", which has been flagrantly disregarded in the research agendas on teacher education. It is also from studies about the history of teacher education in Brazil that we realize – which I have already addressed but reinforce now – that in a country that only very recently constituted a national education system, emergency and alternative projects for teacher education are necessary. The slow process of creating higher education courses for teachers in Brazil operates so that alternative forms of education impose themselves as legitimate. From non-deterministic and non-personalist historiography, for example, we understand that (a) learning "listening here and there", (b) rapid and sporadic courses promoted by "central" institutions, (c) textbooks and the daily subversions that occur in schools from these materials, (d) the use of students from later grades for teaching in previous grades, (e) the migration of professionals from other areas to meet teaching demands, (f) "homemade" formations and (g) neglect of norms, among many other possible examples, are much more common strategies than we might think and much more important than what we are considering as a background in our research on mathematics teacher formation. Note that even the public school has been very little understood by us researchers, mainly because public schools have been poorly thematized in research in education and much less considered in mathematics education. This lack of knowledge about the public school itself and as a place of work for high school and elementary school teachers, this lack of knowledge about the public school, leads to the maintenance of discourses that disqualify their teachers,

also leading, as a result, to the disqualification of the public education system itself in the country.

If this neglect of the historical component has characterized research in mathematics education, in general, it is even more noticed in public policies aimed at education. The educational legislation, in general, and the documentation related to the teaching of mathematics and projects and instances of regulation and evaluation (for example, the National Plan of the Textbook (Plano Nacional do Livro Didático)) blatantly disregard the historiographical perspectives related to the teaching of mathematics, treating, at most, and in an incidental way, based on a discourse that has changed little over the years, the history of mathematics, i.e., how the creation and development of mathematical objects, concepts, and techniques took place, with little or no attention to the way these objects, concepts, and techniques attend the classrooms or the other instances in which mathematics is taught and learned. It has not been possible for us, so far, to create a political movement that intervenes to update this official discourse on the importance of history for the movement of teacher formation and teaching, and even today, when we talk about history, we actually talk about the history of mathematics, and never about the history of mathematics education or the history of mathematics teaching. Changing this framework involves not only disseminating this point of view among us researchers, but also creating a specific policy agenda, in a scenario in which several policy agendas are essential.

The dissemination and popularization of mathematics education: professional master's degrees as allies

Finally, as a third point (in this list that could and should have several other points, but which is already getting too long), I bring to the discussion the need to think collectively about scientific dissemination strategies, which our field of studies is visibly lacking, especially if we take into account an area very close to ours, science teaching, in which scientific dissemination, as well as projects to popularize science, are central axes of research.

Science museums, natural history museums, living history museums etc. are very common in other countries, but not in Brazil. The proposals for scientific dissemination in science education are no longer reduced to preparing and circulating kits. It has lagged behind. Today the projects are bolder, they try to enable traveling museums, easily executed materials, tasks and very current resources, which at the same time enchant students and motivate the learning of relevant topics in science, physics, chemistry, biology, environment, public health

etc. In mathematics education, initiatives for scientific dissemination of mathematics are, at most, rare. Perhaps what we have closest to a scientific dissemination agenda in mathematics education today are the events promoted by publishers in which textbook authors talk to teachers and students of elementary and high schools. There are also a few – few – channel and podcast initiatives that, while important, are insufficient.

Despite the apparent difficulty in preparing materials for scientific dissemination in mathematics – especially if we consider the interest that particular experiments arouse in areas such as physics, biology and chemistry, fields in which the ease of access to these experiments and the possibility of building them with common, affordable materials, many of them described in textbooks – it is certain that this strategy would be a great resource for teaching and for raising the awareness of students and teachers.

The materials of the American NCTM, for example, prove that it is possible to build scripts, problems, apparatuses, and materials that involve very creative situations and playful resources, quite different from those that frequent our textbooks. There was a time when the construction of models, for example, was a very common resource in educational proposals for teaching mathematics. Perhaps I am uninformed and outdated, but games and the formerly called recreational mathematics today have little frequented research, formative, and teaching environments. It may be necessary to revisit and revitalize these resources so that, updated, grounded in other ways and from other perspectives, they can integrate scientific dissemination initiatives in mathematics and mathematics education.

One possibility to implement this proposal, that is, a way to intensify scientific dissemination in mathematics education, would be to resize the guidelines of professional master's degrees. In fact, the point of the agenda here is not so much to defend the potentiality of scientific dissemination – I think that this idea is neither new nor strange, and I am sure that no one would be against it. What I propose as an agenda point, appropriately speaking, is to involve professional master's degrees in this initiative. I think that if we think about scientific dissemination with professional master's degrees, not only would scientific dissemination be intensified, but also the dynamics itself, as well as the nature and objectives of such degree, could be re-signified. To argue about this statement of mine, it is necessary to go back to the history of professional master's degrees in Brazil[2].

[2] In the following paragraphs, I use a good part of the Preface I wrote for the book organized by Marcele Mendes Tavares and Andresa Maria Justulin, from the Professional Master's Program in Mathematics Teaching (Programa

The professional master's degree (PM) as a *stricto sensu* modality of graduate studies stems from a Capes ordinance dated November 1998. This ordinance[3] distinguishes between two master's degree modalities – the academic and the professional – from what follows that, having been established from specific legislation, professional master's degrees cannot be discriminated against in a negative way or public competitions, whether those of filling vacancies of professional function, or those of selection to doctorates. Renato Janine Ribeiro sensibly warned us about this in one of his well-known texts on the subject[4]. It is not outdated to remember this disposition when we still hear in the corridors of the departments of our universities comments such as "It is possible, but should not be able to" or "It is possible, but it is necessary to discourage", assuming that education in these professional modalities is of inferior quality than academic education.

Although legally established in 1998, the postgraduate professional modality did not find significant repercussions among HEIs, at least until the middle of the following decade. Having been created under the terms of the legislation as a priority to meet the demands of the labor market, the resistance to the creation of PMs was justified by the statement that, as proposed, these master's degrees would be more in the interest of companies than of the centers of production of disinterested knowledge, which included the universities and, as a result, the scientific community of the most diverse areas. Being interesting to the business sector, one would run the risk of making research "subordinate to the interests of capital"[5].

Capes' Head of Asses This ordinance sments, Renato Janine Ribeiro, in a text published in 2005, pointed out that a continuous and constant dialogue was critical between those who pointed the focus more directly to the interaction of this education with the world of production and those who had a greater appreciation for the need for a commitment to social sectors and public policies. Without this dialogue, Ribeiro said, serious risks were run: "First, that effectively the increase in economic production takes place without a good discussion about who benefits from productivity gains/.../; second, that the center of decisions on research moves

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[3]This is Ordinance 80, of November 16, 1998, which "Provides for the recognition of professional master's degrees and other measures", published in the Official Gazette of January 11, 1999, section 1, page 14.

[4] This is the text "Ainda Sobre o Mestrado Profissional" [Still About the Professional Master], by Renato J. Ribeiro, in the *Revista Brasileira de Pós Graduação [Brazilian Journal of Postgraduate Studies]*.

[5] This is the article "O mestrado profissional na política atual da CAPES" [The professional master's degree in CAPE'' current policy], by Renato J. Ribeiro, published in *Revista Brasileira de Pós-graduação Graduação [Brazilian Journal of Postgraduate Studies]*. All quotations presented in quotation marks in the body of this text were extracted from one of Renato Janine Ribeiro's two texts, explained in these footnotes.

from the university and the academic environment *at large* to companies; third, that the areas of human and social sciences, although the most appropriate, by definition, to contribute to the improvement of our social indicators, close in the university world and do not transfer, to those who, in fact, act in the world of practice, the newest and most apt means to fight against misery and iniquity".

It is important to remember that, until now, there have been discussions to carry out the proposal of professional master's degrees in such a way that they could be implemented in the most diverse universities and linked to the most distinct areas of knowledge. The exemplifications of what these degrees would be, how they would work and what their results would be, came most often, until then, from exercises and postulations in very varied areas – such as public health, business administration, agricultural production, architecture and urbanism, public security, etc. – all suitable for a clear (and often unprecedented) exploitation of possible practical results (such as work on agricultural production) that could increase crop profit, promote a reform in the labor laws of farmworkers, reduce pollution caused by production debris, improve the management of agricultural inputs, take care of the health and social environment of the rural workers, fixing them to the land and avoiding rural exoduses, explore the potential of innovative technological strategies etc – or urbanism – whose results could positively interfere in the construction of cheaper, safer, thermally more adequate and more comfortable housing; in the organization of urban conglomerates and viable public leisure areas; in attention to the differences between conditions and opportunities in the cities, etc.); but rarely included education or teaching areas. The relative absence of these areas in the discussion, at that first moment, was perhaps because the approximation with "the demands of practice", in the case of these two fields, was limited to the approximation of the projects with the school, with the effectiveness of school practices, and this approximation, in one way or another, already gave ballast – or was familiar – to all (or most) of the investigations developed in academic master's courses in the areas of education and science and mathematics teaching (to restrict ourselves to the two fields that are more familiar to us). For the areas of education and teaching, therefore, the differentiation between academic and professional modalities still seemed very obscure. This difficulty of differentiating a professional master's degree in mathematics teaching and an academic master's degree in mathematics teaching, by the way, is still very much alive in most of the courses in operation.

A set of factors[6] led Capes to defend and motivate the professional master's degrees: one of them is the realization that the contemporary world demanded (still requires) increasingly qualified and specialized formation and, as a result, that the university plays a fundamental role with its undergraduate courses in relation to the needs of these professionals sought by the market, while part of the masters and doctors graduated in our postgraduate programs did not (and does not) follow working in higher education teaching. Judging that, on a large scale, the function of taking care of the training and performance of higher education professionals had been fulfilled by Capes, it became necessary, according to the speech of the agency itself, to take care of the masters and doctors who, after graduation, would work outside the academic environment[7]. This discourse underlies Capes' defense of the need to create professional master's courses, also considering, in the words of the agency's Head of Assessment himself at the time, that although there was no prejudice in relation to the transfer of scientific knowledge to companies or the market, "it is also relevant to society that the public sector and social movements are targets of this transfer", which results from Capes' "commitment to facilitate, to the different areas of knowledge, its practical application beyond the walls of academia". Added to this –with a weight that, in my opinion, is quite decisive when taking into account the large number of private universities that have embraced, over time, the proposal to create PMs – is the fact that professional masters have "the vocation of self-financing"[8].

But also, these arguments did not echo much in the communities of education or researchers of science teaching, at least regarding public universities. When some recognized researchers in the field of science teaching[9] dedicated themselves to the defense of professional master's degrees[10], implying the defense of fundamental changes in the functioning of the

[6] These provisions follow those of Ribeiro, available in the aforementioned 2005 article.
[7] According to INEP data, for the years 2000-2010, two-thirds of the master's degrees and one-third of the PhDs graduated in the country did not work in higher education.
[8] This obviously reinforces the "vocation" of private HEIs for professional master's programs. In public HEIs, as Janine Ribeiro himself recalls, the self-financing of professional master's programs does not occur: "/.../ the difficulties that there are in financing the PM in public HEIs, although they make their institution more time-consuming and complex, can be largely compensated by their scope. /.../ the PM is not essentially a way for the public HEI to finance itself, but is part of its mission in the highly reflected transfer of knowledge, also expressing the commitment /.../to give public allocation to resources that are from the State /.../".

[9] It should be remembered that, at the time, the area of education – unlike what happened with science teaching – was extremely resistant to the creation of professional master's programs. This resistance lasted until recently, when professional master's courses in education began to emerge.
[10] The most definitive implementation of the professional master's programs proposal required many meetings. Renato Janine Ribeiro cites, in his article, a seminar promoted by the Capes Board of Directors with representatives of the various areas of knowledge, aiming to promote the professional master's degrees, held in March/April 2005, at USP, in São Paulo. Also in the area of mathematics education, there was a specific seminar, held at PUCSP, with representatives of the community of researchers in ME from USP, Unesp, UNICAMP and PUC. As far as I

Capes science teaching[11] area in order to promote this postgraduate modality, with specific advice and facilities regarding the implementation of new courses, there was a real explosion in the proposition of APCNs[12] of professional master's degrees.

This somewhat accelerated opening – unbridled, according to some – of professional master's degrees resulted in some distortions that still remain. It should be noted, for example, that many professional master's degrees programs were created by institutions that already had academic master's degree and doctorate programs, some to promote a greater connection with school communities, others to improve the assessment of their "usual" programs in the Capes ranking, still others to expand their clientele that, now, could incorporate those teachers who, for different reasons, dodged the academic master's degree. Some others thought "natural" and well-regarded the creation of a professional course – clearly supported and motivated by the emphasis with which the Capes teaching area defended this "new" modality – for the future creation of the desired academic master's degree and/or doctorate.

Thinking that the objectives, development, and results of the different master's degrees' modalities somehow, although close, differed, it became difficult to operate in this distinct registry in institutions that maintained both professional and academic modalities using the same faculty, whose (panoramic) research projects would hardly change from moment to moment to meet a requirement for the creation of a PM. From this, it follows that many of the PMs were implemented with merely declaratory projects, which, in practice, functioned as a shadow of existing courses. Thus, it was easy to find, at the beginning of the courses, a lack of clear boundaries between one thing and another, and the results of the professional master's degrees, in large part, were either an extreme simplification of what was understood by research or were similar to the dissertations resulting from the academic master's degrees. This confusion has even created prejudiced movements within the academic communities – in our case, an emblematic example is the decision of the organizers of one of the Brazilian Meetings of Postgraduate Students in Mathematics Education (Encontros Brasileiros de Estudantes de

remember, this meeting was organized by Professor Romulo Campos Lins, from UNESP in Rio Claro, and was attended by Professor Marco Antonio Moreira, from physics teaching, an enthusiastic supporter of the proposal.

[11] It is important to consider that, at the time, Capes' areas had a slightly different configuration from the current one, with a science teaching area, now incorporated into the teaching area, which brings together Programs from different fields of knowledge, not only science and mathematics. The nature of the PMs, usually interdisciplinary, led, for example, to the discussion about the relevance of these courses to enroll not in the respective areas or in the area of education or science teaching, but in the multidisciplinary area of Capes.

[12] Acronym for Avaliação de Propostas de Cursos Novos [Evaluation of Proposals for New Courses], which in practice has become an expression that means the set of documents submitted to Capes for the request to open postgraduate courses.

Pós-graduação em Educação Matemática - EBRAPEM) to prohibit, at the event, the presentation of projects developed in professional master's courses.

In this movement to create a new modality and to differentiate it from the already established modality, there were several attempts to configure what, effectively, the master's degree differed from, betting on the simple elaboration (and perhaps, for this reason, one of the most mistaken, although lasting) that professional master's degrees are practical postgraduate courses, aimed (in the case of PMs in training) at teaching performance and disconnected from the theoretical elaboration, almost operating as centers of denial of the importance of theory, environments in which only the affirmation of practice is in force. In these unfortunate propositions, the argumentation about the feedback between theory and practice, ubiquitous – implicitly or explicitly – in all research work in education and related areas was crumbled, often without being noticed.

In fact, no practical intervention, if legitimate, occurs without theoretical support, taking here a theory as a set of tools with which to face a particular practice or theme. Often the most simplistic discourse confuses the mobilization of a theory with the elaboration of a theoretical critique. The aim of the professional master's degrees is not a theoretical critique but the mobilization of a theory for the elaboration of a consistent and well-founded practice. Moreover, each and every theory is, in the end, a set of tools at our disposal to understand the world, and a theory, therefore, is only given in use in the way it manifests itself effectively. However, this way of thinking about the professional master's degrees – from the use of theories – can be misleading, not due to what occurs in the professional master's degrees, but, on the contrary, due to what occurs in the projects developed even in academic master's degrees, where it is common the absence of any theoretical criticism, and the so-called "theoretical" references are, not infrequently, empty statements that do not find resonance in what is developed, since such "theories" are very often abandoned as soon as the texts in which they are presented, in a thesis or dissertation, end. Renato Janine Ribeiro agrees with this perspective by stating that "dissertations and even theses in which the bibliographic discussion and the author's own work move in totally independent worlds are not uncommon. /.../ in the case of the professional master's degrees, if the student is not expected to challenge the theories used, he/she is at least expected to effectively apply the research /.../ in his/her professional work.".

We are, therefore, moving through a set of observations aimed at differentiating the modalities of professional and academic master's degrees, and a more objective answer seems

to be the one that places the difference between them in the product resulting from the studies. If an academic master's degree is responsible for educating a researcher so that the potential of this education must be manifested in a dissertation, in the professional master's degrees, in which research immersion must also occur, "the objective is to form someone who in the professional world outside the academy knows how to locate, recognize, identify and, above all, use research to add value to their activities".

It is precisely because the distinction between professional master's degrees and academic master's degrees more often hides when we try to characterize it from the use of theory or the reduction of one of these courses to practical action that it is necessary to emphasize the importance of the educational products generated in the professional master's degrees, given that it is in this result that the distinction that we discuss here is most clearly shown. And it is due to the importance of these educational products that the total absence of strategies proposed, implemented, promoted and/or financed by Capes to sell this production that is vital to professional courses sounds inconsistent.

If the difference between the formative modalities in master's courses has not been established even from the teaching staff – since, usually, the same set of researchers acts, at the same time, in courses of both modalities – nor from the modes of action used for the works to develop – usually, in the day-to-day of postgraduate courses, the emphasis has been placed on the development of works in research groups that, in turn, also concentrate students from courses of different modalities – and if the products generated in professional master's degrees, when made written texts, are necessarily different from the scientific articles that we usually read in specialized journals, in which the production of PMs is usually rejected[13], we must ask what spaces there are for the dissemination and socialization of these so many educational products.

I myself consider insufficient the requirement that each course should maintain a digital collection for the socialization of productions. This initiative is obviously necessary for any postgraduate program, whatever its modality, since the full and unrestricted dissemination of productions is an essential part of the transparency that must characterize scientific practices. The transformation of an educational product into a chapter or article implies an effort beyond,

[13] Scientific journals tend to reject contributions that do not follow an academic perspective because the more general norms, imposed by evaluation and promotion agencies of journals, advise against journals keeping a space reserved, for example, for reports of experiences in the classroom and texts of a more "practical" nature.

that is, that of working with language, of communicating more quickly, without losing quality, what was long produced. It is also another possibility to expand the audience of these products and, thus, expand and effectuate the social commitments of the courses with the most distinct communities, school or not.

It is necessary to go further; it is necessary to streamline and intensify the flow of these productions. It is necessary to create policies and promotion lines that support the creation of vehicles to disseminate the production of the educational products of professional master's degrees. It is necessary to promote collective forums for the discussion of these products and to value the production and circulation of books in which this production is registered. It is necessary to create journals specialized in classroom experiences, in teaching experiences. It is possible to re-signify professional master's degrees in mathematics teaching, thinking about the potentialities of including, as one of its themes, the creation and foundation of projects and processes of scientific dissemination and popularization of science. These initiatives should be on the horizon of professional master's degrees but also on the horizon of Capes and SBEM.

In short

I presented three questions that may be part of the agenda for mathematics education, which are: (a) the need to resize and expand objects, focuses, strategies, and methodological approaches for the study of the education of teachers who teach mathematics; (b) the need to provide further attention to the historiographical perspective, valuing studies in the history of mathematics education and including this perspective in educational policies; and (c) the possibility of incorporating scientific dissemination and projects to popularize science among our interests, which is perhaps an action that, in addition to being natural to professional master's degrees, could reconfigure the objectives of these postgraduate programs.

There are three points, and if time allowed, many others could be incorporated as a proposal into this agenda.

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