Brief Considerations on Educational Directives and Public Policies in Brazil Regarding Mathematics Education

Antonio Vicente Marafioti Garnica

Abstract Taking into consideration the historical context, this chapter considers Brazilian public policies related to mathematics teaching as they are embedded in broader educational policies, while also reflecting on how Brazil has been influenced—more in the past than the present—by foreign models. For a brief overview, we turn first to the curricular directives and the changes they have undergone. This discussion will reveal how education policies in Brazil have suffered from a lack of continuity of programs aimed at developing, implementing, and monitoring these policies, as well as regional inequalities in a country where income inequalities are huge and the cultural diversity is immense. Finally, in general terms, we discuss some points of convergence and divergence between mathematics education research in Brazil, its application within schools, and its effect on the public policies that shape the Brazilian educational system.

Keywords Educational public policies · Brazil · Mathematics education · History · National reforms and programs · Curriculum · Math teachers formation

The Proposal of This Text

Public policies related to education and mathematics education cannot be studied appropriately without taking into consideration the historical context and sociocultural influences of the field from which they originated and to which the policies apply. The case is no different for Brazil or on the international scene, nor is it different in regard to mathematics teaching in the various courses that compose school programs.

Thus, the present chapter considers public policies related to mathematics teaching as they are embedded in broader educational policies, while also reflecting on

This paper was translated from the Portuguese by Anne W. Kepple.

A.V.M. Garnica (✉)
São Paulo State University (UNESP), São Paulo, Brazil
e-mail: vgarnica@fc.unesp.br

Y. Li, G. Lappan (eds.), *Mathematics Curriculum in School Education*, Advances in Mathematics Education, DOI 10.1007/978-94-007-7560-2_8,

how Brazil has been influenced by foreign models, perhaps more in the past than the present.[1]

For a brief overview of public policies in Brazil related to mathematics teaching, we turn first to the curricular directives and the changes they have undergone. This discussion will reveal how education policies in Brazil have suffered from a lack of continuity of programs aimed at developing, implementing, and monitoring these policies, as well as regional inequalities in a country where income inequalities are huge and the cultural diversity is immense. Finally, in general terms, we discuss some points of convergence and divergence between mathematics education research in Brazil, its application within schools, and its effect on the public policies that shape the Brazilian educational system.

An Overview of Curriculum Development for Mathematics Teaching in Brazil

The Brazilian educational model only became consolidated as a "system"—a broad network of actors, institutions, constructions, and circumstances that act according to general guidelines dictated by specific legislation for different levels of schooling[2]—in the 1950s. However, evidence can be found of the beginnings of an educational policy for the primary level at the end of the 19th century, with the constitution of the so-called School Groups, clearly based on the American teaching model of three R's—"Reading, wRiting, and aRithmetic"—and also in the 1930s with the establishment of the first university, the University of São Paulo.[3] Mathematics teaching at the secondary and university levels followed mainly French models, as the didactics manuals clearly attest. Primary school teachers were educated in

[1]The consolidation of solid educational and mathematics education research centers in Brazil, mainly in the final decades of the 20th century, appears to have at least challenged this external theoretical dependence by encouraging thinking about education that, despite being an open dialogue with sources from various origins and schools of thought, contributed to questioning its own processes. An overview of the development of mathematics education research in Brazil, in particular, can be found in D'Ambrosio and Borba (2010).

[2]In general, the progressive grade system in Brazilian schools underwent few structural changes with respect to programs and courses, despite frequent changes in nomenclature and classifications. In this chapter, to facilitate understanding of the system by foreign readers, we use the expressions "primary education" to signify the first five years of school (the initial grades, which consisted of only four grades until 2009), "secondary education" to signify the seven years following the primary grades, and "higher education" to refer to the university level. "Basic education" in Brazil refers to the first nine years of schooling, and "middle school" refers to the last three years (high school) which precede the university level.

[3]The first Brazilian university, in the sense of an educational complex of higher learning composed of a significant number of different fields managed under a single organizational model, was founded in 1934 in the city of São Paulo, the capital of the state which until today is the largest economic power in the country. Prior to this, there was a small and disperse network of higher education institutions that offered mainly the "classic" fields of engineering, law, and medicine, although it was common at the time for sons of the upper class to study in Europe.

Normal Schools in the 19th century (so called because they were institutions where the norms of civility were to be promoted). Courses for secondary and university level teachers only became available in the 1930s and were based more on the programs aimed at primary level teachers than on the teacher education program at the first Brazilian university.

At least thirty years passed between the time the first university program was established to educate secondary level teachers and the consolidation of such programs in universities throughout Brazil. The number of secondary schools grew at a dizzying pace in the 1950s before there were enough teachers to meet the demand, and the proliferation of universities with teacher education programs only occurred in the 1960s.[4]

Mathematics education in secondary schools in Brazil was divided among three basic courses until the end of the 1930s—algebra, arithmetic, and geometry—with no "mathematics" course, as such. Historians of mathematics education agree that the first movement to modernize mathematics teaching in Brazil took place when these three courses were unified and came to be known in the schools by a single name: "mathematics." The three subjects were to be taught at the same time, with the unifying thread being the concept of function. For the teaching of geometry, Euclides Roxo, a central figure in this 1931 reform, proposed that the deductive focus should be preceded by a practical approach. In addition to the reformulation of the program, this reorganization was characterized by a well-founded series of didactic guidelines for teachers and school administrators. The 1931 reform provided the basis for the elaboration of a collection of textbooks, written by the same Euclides Roxo, in which the links between the three components of the mathematics curriculum essentially followed the guidelines proposed. However, the reform, as well as the textbooks that were a reflection of it, was short-lived. Little more than a decade later, in 1942, changes in public policy dismantled Roxo's initial proposal, which, according to Pires (2008), illustrated how curricular decisions in Brazil have historically been marked by questionable procedures on the part of some groups or individuals, influenced by political issues.

The second half of the 20th century was characterized, according to Pires (2008), by three very distinct phases: the first, from 1960 to 1980, corresponds to the period in which the Modern Math Movement (MMM)[5] euphorically established itself in Brazil, introduced by groups promoting a "new" educational reform; the second, from 1980 to the mid-1990s, is characterized by the emergence, in some states, of a discourse contrary to the MMM, leading to some reformist activities (essentially a counter-reform movement) based on this counter-discourse; and, finally, a third phase which began in 1995 with the publication, at the national level, of the first set of systematic directives developed for the Brazilian school system.

[4]Until the end of the 1960s and beginning of the 1970s, emergency teacher training programs were common, for primary as well as secondary level teachers, but the lack of secondary school teachers was conspicuous.

[5]In some countries, *Modern Mathematics Movement* is also known as *New Math Movement*.

The MMM was implemented in Brazilian schools through an intense policy of production and distribution of textbooks. Thus, it was mainly thanks to a set of teaching manuals that the MMM directives effectively entered the classroom. The MMM was presented to teachers and school administrators in short courses that were insufficient to meet the demand and maintain the expected pace, as there were few teachers prepared to face the demands imposed by the new contents and approaches. The criticisms faced by the MMM on the international scene were intensified internally at a time when the schools were still coping with the mere technical implementation of the proposal. Working with Modern Math at that time meant "teaching set theory." Teachers did not comprehend the idea behind Modern Math, much less the criticisms of it.

It was this general climate of discontent that allowed the emergence of the proposals, most of them regional, that guided mathematical curricula in the 1980s and 90s for the primary grades and the initial secondary level grades. Mathematics came to be seen—at least in the programs and directives during these two decades—as having a double function: "as necessary for practical activities that involve quantitative aspects of reality—such as those that deal with sizes, counting, measurement, and calculation techniques—and as being necessary for the development of logical reasoning, ability to abstract, generalize, and transcend what is immediately perceivable"[6] (Pires 2008, p. 22). Integration of the contents was also sought and, inspired by Bruner, the spiral approach to teaching was defended. The directives stated that evaluation should not be limited only to passing or failing, but should diagnose the learning process to suggest changes in teaching activities. Nevertheless, Pires concludes that the new discourses that condemned repetitive practicing of skills and memorization of algorithms while defending problem-solving as a methodological basis, comprehension of concepts and procedures, and balance between arithmetic, geometry, and algebra encountered implementation difficulty due to deeply rooted conceptions, such as mathematics learned through repetitive practice and solving exercises based on a given model. These "new" curricula were regionalized, proposed by states and cities. If, on the one hand, this strategy favored greater flexibility and allowed curricula to attend to different needs in different contexts, on the other hand it also clarified regional differences, and the regions characterized by greater social and economic development, like the south and southeast, proved to be more capable of developing alternative curricular approaches based on current academic research. "Thus, it was found that the deep social segmentation that resulted from the unequal distribution of income in Brazil was also an obstacle to access to education and to the development of contemporary, high quality teaching programs" (p. 25).

Only in the 1990s did national curricular directives emerge for all levels of teaching that aspired to break the limiting mechanisms detected in the earlier policies. Still, implementation of these proposals met with yet other serious obstacles. According to Pires:

> Very decisive factors, such as low teacher salaries, turnover of school personnel, and especially poor teacher education interfered negatively in the development of the process. One

[6]Quotes translated from the original in Portuguese.

> of the marks of Brazilian public policies relative to curricular issues is the lack of actions aimed at curricular implementation, as though the new ideas would be transformed into practice with a wave of the magic wand. Another mark is the lack of monitoring and evaluation of the innovations proposed, which makes it impossible to judge them adequately and document mistakes and correct moves. These gaps have provoked a sort of 'eternal' situation characterized by prescriptive curricula (the official ones) and real curricula (those implemented by teachers in the classroom). Thus, a phenomenon common to the different levels of the educational system (federal, state, and municipal) is the periodic introduction of curricular changes that are supported neither by preceding concrete experiences nor the involvement of teachers who are the protagonists of their implementation. (Pires 2008, pp. 39–40)

So in practical terms, then, how are the curricular directives for education in Brazil operationalized? The curricular proposal determined by federal legislation in the National Curricular Parameters for Basic and High School Teaching is still enforced. These documents establish the directives for all schools in the country and function as a national curriculum in the sense of outlining, based on the literature, themes and ways of approaching the contents of all the disciplines composing the school programs at each grade level.

With respect to mathematics, the Curricular Parameters for the basic education level indicate a need to move beyond the linear organization of contents and interconnect them, inspired by the metaphor of constructing knowledge like a web. Contents are addressed in blocks (Numbers and Operations; Space and Form; Sizes and Measures; Information Handling[7]), and general didactic guidance is provided, including discussion of possible obstacles to learning and ways to overcome them. The Curricular Parameters for the middle and high school level approach mathematical contents as instruments for developing abilities and competencies. The competencies should be organized according to three principal aspects: "Representation and communication, aimed at developing communication skills; Investigation and comprehension, with the objective of developing the ability to question natural and technological processes, identifying regularities, presenting interpretations, and laying the groundwork for the development of reasoning and the capacity to learn; and Sociocultural contextualization, aimed at understanding and using science as an element for interpretation and intervention, and technology as systematic knowledge of practical sense" (Pires 2008, p. 235).

The mathematical contents addressed in the schools remain essentially very similar to previous programs: the curriculum proposes a new way of addressing them and even changes the sequencing, but does not fundamentally change the themes. The Modern Math Movement played an important role in this sense when it included in the list of "classic" contents some themes considered to be "current" in the 1960s such as the discussion of matrices and a more contemporary approach to geometry and equation systems, which is still used today. More recently, the emphasis on themes related to the block "Information Handling" led to the emergence of

[7] "Information Handling" ("Tratamento da Informação" in Portuguese) is how is known a block of content that covers statistics, probability, and combinatorial analysis, similar to what in the NCTM Principles and Standards is called "Data Analysis and Probability" (Campos and Lima 2012).

approaches and contents that had previously been somewhat overlooked in elementary education, and there was a significant parallel increase in research on statistics education. In general, the contents are not addressed using a radically formal model; the emphasis in textbooks and curricular guides is not on formal demonstrations or rigorous proofs. Greater emphasis has been given to the processes of conjecture, experimentation, testing, exemplification, and validation. In the earlier grades, principally, the attempt is to work in a way that approximates students to the mathematical contents using operationalization and problem-solving more than rigor in language and formal argumentation. This approach continues into high school, with the appropriate modifications.

While the official documents at the federal level address more general questions related to teaching the various disciplines, the regional curricular guides (state or municipal) have fulfilled the role of operationalizing these directives, providing teachers with strategies for specific interventions and theoretical details that complement the general guidelines and effectively prepare them for the classroom.

Finally, it is worth noting that "debate and research about curricular questions are not yet a tradition in the community of mathematics educators" (Pires 2008, p. 39). While some research has been conducted in this field, studies have either focused on very general questions, such as the need for and/or appropriateness of official curricula, or more specific issues, such as those that address the teaching of specific contents and ways of implementing given approaches (for example, research on the use of information and computer technology, the emphasis to be given to a given specific mathematical content, or the importance and potential of strategies involving problem-solving).

School Makes a Difference

Evaluation of educational systems focuses on strategies to improve teaching systems, results, and impacts, endeavoring to support public policy in education. Among other findings, data collected on the Brazilian system of basic education—implemented beginning in 1995—revealed "a persistent disparity among the conditions in schools attended by students of different social and ethnic origins," despite significant improvements with respect to the "universalization of the school[8] and democratization of the composition of the study body." According to Ortigão (2008), evaluations have nevertheless shown that "school makes a difference" in Brazil, contrary to studies carried out in the 1950s and 60s, which suggested that "students' performance was strongly determined by their socio-economic context and schools could do little or nothing to change this reality." In general, evaluations of the Brazilian educational system suggest that (a) the physical conditions of the school and the

[8]Ninety-seven percent of children aged 6 to 14 years have access to the educational system today in Brazil.

school environment have a considerable impact on student outcomes;[9] (b) the simple habit of requesting and correcting homework implies improvements in students' mean results; (c) in those schools where teachers have higher educational levels, students with higher socio-economic levels benefit more from this characteristic; and (d) when teachers emphasize problem-solving as a teaching strategy in mathematics class, students tend to perform better in this subject.[10] In summary, the research on the Brazilian education system as a whole shows that schools differ not only in the diversity of pedagogical and administrative approaches adopted, but mainly in the variety of internal practices and structures such as the environment, the level of teachers' commitment, and the emphasis given to teaching and learning processes. School makes a difference, and in a country characterized by clear socio-cultural differences, public policies should pay closer attention to the differences among the schools.

A Research Project to Update the Debate

According to D'Ambrosio and Borba:

> The participation of Brazil in World War II as part of the so-called Allied Forces was decisive for the strong pursuit of national unity. Measures were adopted in this period that resulted in the unification of the entire educational system, including religious schools and schools maintained by communities of German, Italian, and Japanese immigrants. The result was the emergence, in the second quarter of the twentieth century, of a homogeneous educational system, subordinating public, private, and religious schools to official programs defined by special commissions of the National Ministry of Education, to be applied throughout the country, from the Amazon region to the prairies of Rio Grande do Sul. These programs, aiming at cultural unification, disregarded seasonal specificities (school periods were the same), cultural and environmental contexts (the program was rigorously the same), and labor and professional needs, according to specificities of the productive sectors. For example, the extractive economy of the north would follow the same programs of the rural south or the industrialized central east. This standardization was applied at all educational levels, from elementary school to higher education. This scenario started to change in the fourth quarter of the twentieth century. (D'Ambrosio and Borba (2010), p. 274)

This standardization, which undervalued the cultural and economic differences among the various regions of this vast country, certainly implied the need for adjustments, which one moment may manifest themselves as subversions of public policy, and another moment express possible ways to carry out this standardization. Preliminary results of a research project that has been underway since 2002, aimed at un-

[9] "Differently from what one observes in more developed countries, the conditions of infrastructure and environment of the schools constitute relevant factors for raising academic outcomes" (Ortigão 2008, p. 85).

[10] It has been shown that an emphasis on problem-solving results in improved mathematical knowledge appropriation by students. However, this knowledge is not appropriated by everyone in the same way—students with above-average socio-economic levels benefit more, obtaining better results than their classmates of lower socio-economic status.

derstanding the mechanisms behind public policies related to teacher education, reinforces the belief that the Brazilian education system is hostage to socio-economic inequalities. The project[11] strives to document the conditions under which mathematics teacher education and practice occurred, or are occurring, the different ways teachers are/were engaged in their teaching practice, how they appropriate(ed) and use(d) teaching materials, and how they either follow(ed) or subvert(ed) the legislation in force. It is a broad mapping process involving a large number of researchers and a great diversity of information, given that historical records can contribute to understanding regarding the centers and the extremes when one considers the sociocultural aspects that require the consideration of teachers, students, other workers, and lawmakers.

According to Garnica (2010), three findings from this project are important for the study of public policy in Brazil related to mathematics education: (a) the lack of an identity for mathematics teachers and, consequently, the impossibility of classifying their trajectory in "cycles"; (b) the characterization of processes of teacher education for mathematics teachers in Brazil as resulting from policies designed to meet urgent needs, in which transience becomes a constant; and (c) the erroneous discourse of teacher education policies which says teaching is founded on conditions of equality, when in fact opportunities are very unequal.

Regarding the teacher's identity, it is necessary to point out that we begin with the assumption that every identity is a reading, and that, therefore, there is nothing like "the identity" of someone or something. There is a plurality of perspectives according to which we "read" the other, and in this reading we attribute an identity to him/her. Each subject is, in itself, multi-identity. I attribute a given identity to someone according to the lens through which I view the world. Thus, it becomes impossible to group mathematics teachers under a single heading, as though one could define a stable identity capable, therefore, of being subjected to global policies and pressures of the same nature and intensity. Testimonies from teachers throughout Brazil clearly show the diversity of difficulties they face, of the successes they promote, of the challenges they face daily in the classroom. Each region, city, and

[11]The project "Mapping of mathematics teacher education and practice in Brazil" (Garnica et al. 2011) is being conducted by a group of researchers with the objective of understanding the way policies related to teacher education and practice are effectively implemented in different regions of the country. It is characterized by distinct methodologies, among them oral history. What is known today as "oral history" is a research methodology which, in Brazil, has been widely used in the field of cultural studies by sociologists, anthropologists, and historians. In Brazil, although there are earlier records of research developed using this approach (the Brazilian Association of Oral History was founded in 1975, and the application of this resource by universities and other institutions became quite evident in the 1980s), only recently—in the first years of the 21st century—does oral history emerge as a method applied to mathematics education research. A certain ambiguity should be noted with respect to the expression "oral history" which, at first glance, induces one to place this rigorous research procedure specifically within the territory of history. In Brazil, it would be more correct to refer to it as a "qualitative research approach that links orality and memory," given that, in this country, the influence of historians (who are still arguing over whether oral history is a field, a technique, or a method) is relative, given the influences coming from the social sciences, for example.

school imposes very special conditions for classroom practices, for the ways meaning is attributed to everything surrounding these practices, and for the way textbooks are employed. We must therefore use caution when speaking of THE mathematics teacher, and it would be more prudent to specify, for each study and for each proposed intervention, WHICH teacher we are talking about, WHICH teachers will be our spokespersons, and to WHICH teachers certain public policies are directed.[12] This would preclude us, for example, from considering a priori, as being the target of public policies, an idealized teacher, devoid of geographic, sociological, political, economic, and personal specificities. Studies regarding elements/characteristics that are common to what we refer to as mathematics teachers remain the order of the day, as do studies about different types of interventions (for example, the development of textbooks that meet diverse geo-socio-cultural needs as well as "common" or "minimal" curricular directives) that take into account the multiplicity of mathematics teachers that we hope to reach in a national education system.

With respect to the urgency that has historically characterized the implementation of teacher education programs in Brazil, one of the more important initiatives that stands out is the Campaign for the Improvement and Dissemination of Secondary Education (*Campanha de Aperfeiçoamento e Difusão do Ensino Secundário*—CADES), a mathematics teacher education program implemented in the 1950s to meet the demand resulting from the expansion in secondary education at a moment when the educational system was becoming consolidated in Brazil. Teachers educated at Normal Schools (and therefore prepared to teach only at the primary school level), and professionals from various other fields (such as engineering, accounting, pharmacy), enrolled in specific courses during the school vacation and, upon passing the necessary exam, were allowed to teach at the secondary school level until specific, university-level teacher education programs became available in their regions. Since the few universities existing at that time were unable to meet the demand,[13] CADES was, in fact, an extremely efficient model for mass teacher education from a quantitative point of view and because of its agility. It was not successful in the education of teachers, in a strict sense, as its activities were limited to "formalizing" teaching practice by regularizing the situation of professionals and ended up promoting the continuity of practices that were anachronistic and inconsistent in the face of the demands imposed by curricular changes, for example. The interruption of CADES led to increasing competition for openings in special weekend courses which were offered by some private institutions mainly in the 1970s and 80s, but which later lapsed. This model of "teacher education," characterized by urgency and a lack of human, conceptual, and technical resources, still exists today in various states in Brazil, albeit under different names.

[12]Therefore, thinking of a "life cycle" of Brazilian teachers becomes a futile exercise in fiction. In the not-so-distant past, this expression served to categorize teachers' practice from the beginning to the end of their careers, temporally and linearly, with important consequences for educational research.

[13]There are records of serious teacher shortages in official bulletins at the end of the 1960s, more than 30 years after the founding of the first Brazilian university.

Discourses defending equality are common throughout the history of education in Brazil—equal access as well as quality of teaching offered in the various modes of education for teachers and students. Such discourses indicate a lack of awareness of the differentiations promoted implicitly by educational policies, and the expression "equal conditions" always echoes very positively: students in rural schools were provided with the "same conditions" as students in urban areas; technical school students would have the "same conditions" to face the demands of life as regular middle school students; students living in the Northeast would have the same conditions as students in the Southeast with respect to jobs and wages as long as they passed through the school system. It can be noted, however, that the discourse of equal conditions was never accompanied by the implementation or defense of strategies that promote equal opportunities.[14]

On the Other Hand …

Despite the negative aspects of public policy in Brazil related to education, and mathematics education in particular, some successful strategies have made it possible to circumvent the fragility of Brazil's relatively new educational system. The continental dimensions of the country and the marked cultural differences of the states that compose it, as well as the schools which reflect this diversity, have not prevented the State from implementing actions such as the free distribution of textbooks that have undergone rigorous evaluation by the federal government. The National Textbook Program (*Plano Nacional do Livro Didático*—PNLD) is one of the public policy success stories in Brazil.

The first commission formed in Brazil with the objective of paving the way for the production, importation, and utilization of textbooks was created in 1938 (Carvalho 2008). Today the evaluation of school textbooks in all fields of knowledge is carried out in partnership with universities and is based on the quality of the materials produced and on the synchronicity between the relevant legislation, modern trends in teaching, and the conceptual correctness of the contents. Publishers submit their books to the PNLD for evaluation and, if approved, they are recommended and purchased by the federal government, which distributes them for free to all public schools in the country. One of the largest programs for free textbook distribution in the world, the PNLD delivered 105 million "recommended" books to 140,000 schools in 2009. Evaluation of mathematics textbooks is based on current trends

[14]The history of teaching in rural schools in Brazil is an excellent example of this disparity between "having conditions" and "giving opportunities." In the past, students living in rural areas had the conditions to enroll in primary school AS LONG AS they were able to get to the city to complete the last year of primary education; and they were evaluated with the same rigor and depth as students in urban schools, by the same teachers, EVEN THOUGH the percentage of repeating grades was much higher in rural schools, EVEN THOUGH rural students rarely managed to finish all the grades, EVEN THOUGH the urban authorities and public policies never took into consideration the different "times" and "ways" of living in rural areas.

in research regarding mathematics teaching and learning, and involves researchers and teachers at various teaching levels, coordinated by mathematics educators. Naturally, the evaluation conducted by PNLD was based on recommendations in the official documents, and focused not on minimum contents, but rather on the determinations regarding the competencies and abilities to be developed in each grade.

Graduate programs in Brazil are also evaluated by a specific agency of the federal government, the Coordination for the Improvement of Higher Education Personnel (*Coordenação de Aperfeiçoamento de Pessoal de Nível Superior*—CAPES), which was founded in 1951, the same year the National Council for Scientific and Technological Development (*Conselho de Desenvolvimento Científico e Tecnológico*—CNPq) was created. Both federal agencies evaluate and fund research projects, and most states also have governmental agencies dedicated to this end. The first graduate program in mathematics education in Brazil was created in 1983 at the State University of São Paulo (UNESP) in the city of Rio Claro. Today there is a considerable network of research centers in the field, many of which offer specialized and graduate-level studies aimed not only at preparing researchers, but also providing continuing education for practicing teachers. Currently, graduate programs are associated with both public and private universities and have been submitted to systematic evaluation since 1976. They are based on the teaching and scientific productivity of the students and professors, which emphasizes the vital need for researchers to be engaged in regional efforts that promote the growth and development of research centers to better serve the population. In the specific case of graduate programs in mathematics education, special attention is given to serving schools that provide basic education, and the involvement in research activities of students enrolled in undergraduate teacher-education courses is highly encouraged. Policies regarding teacher education for all levels of teaching have been carefully taken into account by mathematics education researchers in Brazil, a concern which is reflected in the rapid development of lines of research that focus directly on preparing teachers.

There is, however, an established common-sense discourse that claims research in mathematics education has been ineffective in provoking significant changes in the state of affairs in national education with respect to the mathematics classroom and the teaching and learning of mathematics. In my opinion, this is a pseudo-discourse that does not hold up in the face of the facts.

The history of the educational system in Brazil is characterized by various changes in legislation and program proposals for the different teaching levels, and today the system and the strategies being implemented are very different from those of the past. Today, the graduate programs in mathematics education are perfectly integrated with international research agendas and Brazilian researchers are involved in defining the directives for preparing teachers at all levels. The time of importing theories and materials is behind us, as we have abandoned the role of mere consumers and assumed the role of partners and participants in the international centers that, until recently, disseminated guidelines that we followed unquestioningly. Today we are aware of our own needs. These changes in the educational scene are the result of the efforts of a wide range of actors, including members of the research community who, despite the lack of a clear, consolidated directive and the

absence of a strong professional society that intervenes in a critical and politically significant manner, have participated in the definition of public policy, programs, textbooks, and teaching strategies.

Not everything has changed as we would have liked, however. History, which teaches us how things stay the same or change over time, clearly reveals the points at which advances have been made and those characterized by stagnation or retreat. The difficulties that plague the national educational system in Brazil and affect public policies related to the teaching of mathematics are many and varied, although one advantage of the current situation is that we have the maturity to face the issues and diagnose the problems. Below, I outline, in general terms, some of the issues currently underlying the public policy problems in Brazil today related to education and mathematics education, with an emphasis on the aspects that contribute to the disconnection between research proposals and reality in the classrooms:

(a) The practices and discourses currently in force in the classroom are strongly characterized by conservatism. Teachers and administrators in the school system, as a general rule, consider it impossible or undesirable to step outside their comfort zone and abandon well-known, familiar practices. The school is, in this sense, subversive: it subverts recommendations for changes in legislation and educational directives. The array of alternatives offered to the schools as possible ways of countering existing negative situations are incorporated and adapted to the predominant conceptions in the educational institutions, rather than serving to change them. Curiously, these "subversive" day-to-day practices are not addressed by research in the fields of education and mathematics education.
(b) There is little research on public schools in Brazil.[15] Considerable research is conducted IN the public schools, with data collected IN the public schools, pointing to changes FOR the public schools, but little research is conducted ABOUT public schools related to education as well as mathematics education. Even fewer studies have been conducted regarding the public school as a workplace, as a space inhabited daily by the professionals educated in the university

[15]The educational system in Brazil is free; public education at the elementary, high school, university, and graduate level is free and administered by a complex network of secretariats and agencies. However, there is a distortion with respect to the quality of public education that often escapes the eyes of foreigners: the distinction regarding quality (or the discourse about quality) when the public system is compared with the private system. Public elementary and high schools are often characterized negatively. Speaking about public schools brings to mind a series of problems, such as: violence (physical as well as symbolic); poor student performance in state, national, and international assessments; poorly prepared teachers, which leads directly to poorly prepared elementary students; poor infrastructure; and low teacher salaries. The private elementary and high school system is considered to be far superior. At the university level, however, the situation is radically different: the public universities (state and federal) are institutions of excellence in teaching and research. Students undergo highly competitive exam processes to gain entrance. The private university system is considered very inferior, with the exception of a few more traditional institutions. One of the phases of this distortion is reflected in the fact that a large proportion of the students who studied in public schools, who tend to be from the lower income brackets, do not gain admission to the public universities, which end up serving predominantly students who studied in private schools and are, therefore, mostly from the more privileged classes.

programs which have been the subject of considerable research in the field of mathematics education.

(c) In addition to the public school being a work "place" or "space" that has been the subject of little research, it is also a "place/space" of work that is not homogenous, neither in terms of its physical premises nor in relation to the community it serves, its organizational and administrative structures, location, and identity of the teachers.[16] Thus, public schools are not a singular entity, which has many implications for research, including the impossibility of approaching public schools using standardized or generalist conceptions, theories, and methodologies.

(d) There are no movements or effective, consolidated political entities in Brazil that bring mathematics educators together to interfere more decisively in education policy. Such institutions, rather than seeking consensus, could serve to promote discussion, create representative forums of debate, and generate positions—albeit mutable and dynamic—as a way of defining directives that consider the diverse actors in the mathematics education scene in Brazil. While we may have influenced public policy, we have not done so in a systemic, legitimate, and representative manner.

(e) It should also be considered that conceptions do not change from one moment to the next. We note that, since the 1830s, in the middle of the debate regarding the need to expand schooling in Brazil, teacher education has been pointed to as a constraint to the quality of schools. So it is no accident that it was at this moment in history, specifically 1835, that Normal Schools were created.[17] Has anything changed in the teacher education scenario since then? Certainly there have been changes, but the crucial issues discussed at that time are still debated today. Despite being one of the more economical strategies to achieve quality education in the schools, teacher education is addressed carelessly in educational policy. I am not speaking here of blaming only the system (which is normally considered a large and abstract administrative monster), but ourselves as well: university researchers who have done little or nothing, in our graduate

[16]It should be pointed out that the national system, given the territorial expanse of the country and the enormous social, cultural, and economic differences of each region, is composed of small, medium, and large schools located in small, medium, and large cities, rural and urban areas, serving communities of different economic levels, administered by directors with varying expectations based on gaps in the legislation and the biases present in the directives emanating from the State. Because of the low salaries, teachers generally work in more than one school, often being forced to adapt to systems that are clearly distinct, as in the case of private and public schools. Teachers are unable to complete all of their work in school given the time limitations and difficult conditions.

[17]Normal schools were secondary educational institutions that prepared teachers for the primary school levels—teachers who were expected to know the "norms" (therefore, the name Normal School) for teaching scientific, technical, and moral principles to children. The Normal School model adopted in Brazil was parallel to the *École Normale* model in France, born during the French Revolution, but later re-created during Napoleon Bonaparte´s time. The first university-level Teaching Licensure programs in Brazil, aimed at educating teachers for the high school and university levels, were not modeled after the directives of the first university, but rather the old Normal Schools.

programs or even teacher education programs, to intervene in policies related to the careers, working conditions, and salaries of elementary and high school teachers. This discussion escapes us. These interventions are removed from our concerns, with negative consequences for the relationship between researchers and the schools.

Transitory, but Possible, Conclusions

Education policies in Brazil, and specifically those related to mathematics teaching, suffer from various problems. In this brief history of the re-structuring of curricula in Brazil, one can easily perceive the transitory nature of the decisions and difficulties of implementation that quickly render them outdated. The standardization of programs and curriculums is also a serious problem that must be faced in a country of such great dimensions and cultural diversity and such glaring inequalities in income distribution. In essence, it is more urgent to promote reforms to minimize the huge regional inequities than it is to promote specific educational reforms. While it is true that various researchers in Brazil, known for their competence in the fields of education and mathematics education, have participated in the development, implementation, and monitoring of public policies, reflecting the most recent trends and scientific developments in mathematics education, it is also true that this has occurred in a more or less individualized manner, given that there is no consistent system that organizes these interventions based on the community. From this perspective, we have acted contrary to what we have declared is needed: we have failed to listen to mathematics educators and to teachers so that policies are implemented in a way that everyone agrees on, giving legitimacy to our proposals, and perhaps increasing their chances for success.

References

Campos, M. A., & Lima, P. F. (2012). *Introdução ao Tratamento da Informação nos Ensinos Fundamental e Médio*. São Carlos: SBMAC—Sociedade Brasileira de Matemática Aplicada e Computacional.

Carvalho, J. B. P. (2008). Políticas Públicas e o Livro Didático de Matemática. *BOLEMA, Bulletin of Mathematics Education*, *21*(29), 1–11.

D'Ambrosio, U., & de Borba, M. C. (2010). Dynamics of changes of mathematics education in Brazil and a scenario of current research. *ZDM—The International Journal on Mathematics Education*, *42*, 271–279.

Garnica, A. V. M. (2010). Presentificando ausências: a formação e a atuação de professores de Matemática. In M. C. R. Fonseca (Ed.), *Convergências e tensões no campo da formação e do trabalho docente* (pp. 555–569). Belo Horizonte: Autêntica.

Garnica, A. V. M., Fernandes, D. N., & Silva, H. (2011). Entre a Amnésia e a Vontade de nada esquecer: notas sobre Regimes de Historicidade e história oral. *BOLEMA, Bulletin of Mathematics Education*, *25*(41), 213–250.

Ortigão, M. I. R. (2008). Avaliação e Políticas Públicas: possibilidades e desafios para a Educação Matemática. *BOLEMA, Bulletin of Mathematics Education*, *21*(29), 71–98.

Pires, C. M. C. (2008). Educação Matemática e sua influência no processo de organização e desenvolvimento curricular no Brasil. *BOLEMA, Bulletin of Mathematics Education*, *21*(29), 13–42.