MATHEMATICS FOR ALL AND THE PROMISE OF A BRIGHT FUTURE

Paola Valero

Aalborg University

That "Mathematics is for all" is a recent statement in mathematics education research. Nowadays it is closely linked to the promise of social, economic and cultural development. It has become a commonsense statement positions mathematics education centrally in achieving a bright future. I examine the statement using an analytical strategy grounded on the cultural historical analysis of Michel Foucault and the examinations of the school curriculum as social epistemologies as presented by Thomas Popkewitz and collaborators. Three distinct but related elements allow me to examine the ideas on which "mathematics for all" emerged during the 1980's. The elements point to the relation between the statement and the construction of exclusion for groups of students, particularly those of "low socioeconomic status".

THE COMONSENSE OF "MATHEMATICS FOR ALL"

That people's scientific and mathematical knowledge is important for the future well-being of society has become an idea that plagues commonsense. Parents, politicians, employers, teachers, and even children themselves have all learned the lesson well. Who would question the need for scientists, engineers and mathematicians for producing the great technological progress that has made the world reach this high point of advancement —and decay, as well? The idea that mathematics —as well as science— with all its applications in technology is the motor for achieving the promises of Modernity and that, therefore, their teaching and learning are central to the constitution of massive school systems is as old —or new— as the end of the 19th century. While towards the end of the 19th century those who had learned mathematics were struggling to find a place for its teaching in the classic curriculum of many European countries (Howson, 1974), now at the beginning of the 21st century the school curriculum without mathematic is unthinkable. Even more so, recent policies in various countries start over privileging mathematics at the expense of other subjects. The involvement of mathematicians with education was during most of the 20th century concerned with securing that an intellectual elite of highly competent youth would feed the production of mathematicians at universities. The issue was not a matter of quantity, but of quality (Jurdak, 2009): Enough but few would be educated in the finest form of human thinking. With the configuration of contemporary universities, those people would provide a highly valued knowledge to other disciplines in the pure sciences and the growing amount of applied scientific and engineering fields. They were the ones to educate mathematics teachers. They were the ones to produce the highly desired and needed knowledge for the progress of society.

Nevertheless, the idea that mathematics should be for all —for each one and everybody, not only for all those who engaged with the study of mathematics— is an even more recent idea that is made intelligible at the end of the 20th century. The grid of conditions on which the statement of "mathematic for all" emerges is more complex than the natural evolution of education in an increasingly technological society or a response to the demands of the knowledge society. The statement is produced on the grounds of the advancement of mathematics education research as a field of scientific inquiry on the teaching and learning of mathematics and all its associated social and cultural phenomena. While until the 1970's the beginning of systematic reflections about the teaching and learning of mathematics were focused on securing the excellence of those few who had an interest in the subject, the 1980's started to be the time of the democratization of mathematics, of mathematics for all to empower all, and, more recently in the 2000's, of mathematics for all to secure the national competitiveness in the global knowledge economies. Such formulated statement is an expression of a desire, of a normative vision that should guide policy proposals and, above all, research-based interventions to provide access to as many as possible to the important and valued knowledge. Such statement is however not an innocent declaration of good wishes for the future. The aim of this paper is to explore how at least three connected events during the 20th century set the ground on which it becomes possible for mathematics educators and now for the public in general to desire a "mathematics for all".

For such exploration I start by locating my analytical strategy within the area of cultural studies of schooling and the curriculum and making available some of the main concepts in my theoretical toolbox to examine the school mathematics curriculum. I then deploy my tools on three elements which, I will argue, make part of the grid on which nowadays the statement "mathematics for all" can be thought. I conclude with some remarks on the usefulness of a cultural historical approach in the study of mathematics education.

ANALYTICAL STRATEGY: DECENTERING THE COMMONSENSE

The appropriation of the work of Michel Foucault in education has prolifically nurtured critical studies of schooling and the curriculum (e.g., Popkewitz & Brennan, 1998). In mathematics education it has been appropriated to think about the constitution of learners and teachers as subjects within the web of power of the institutional discourses of mathematics education practices (e.g., Walkerdine, 1988; Walshaw, 2004). Such studies have provided insightful interpretations of students' and teachers' identity formation in terms of their process of subjectivity in the practices of mathematics education. Walshaw (2004) claims that thinking mathematics teachers' practices with the analytical strategies and concepts of Foucault help her decentring the essentialist assumptions that other types of literature build around teachers' knowledge, believes or experiences as being the fundamental core of their identity as mathematics teachers. Although important in a quest for understanding the socio-political constitution of mathematics education practices,

such approach that still focuses on some of the traditionally defined actors and elements of the classic didactic triad of mathematics education research is, from my view point, not enough to decentre the many essentialisms that the discourses of mathematics education have established.

Recent studies inspired by the work of Foucault deploy analytical strategies to explore the epistemological functioning of mathematics education discourses and their effects of truth in generating ways of thinking about mathematics education. Knijnik and collaborators (Duarte, 2009; Knijnik, 2012; Knijnik & Wanderer, 2010) have been not only examining ethnomathematics philosophically, but also providing cultural histories of statements that navigate as thruths and have become the common sense of mathematics education. That "we need to bring reality to the classroom" as a pedagogical strategy, that "we need to use concrete materials for teaching", or that "we have to promote mathematics for all" are not simply the accumulated knowledge that comes from applying research into the improvement of practice. Such statements epitomise culturally and historically inscribed forms of thinking about mathematics education. The work of Foucault and his strategies to perform a "social epistemology" (Popkewitz, 1991) of mathematics education as part of the school curriculum is an important move in order to:

> "[…] place the objects constituted by the knowledge of schooling into historically formed patterns and power relations. Epistemology provides a context in which to consider the rules and standards by which knowledge about the world and "self" is formed. Epistemology also provides the means to investigate distinctions and categories that organize perceptions, ways of responding to the world, and the conceptions of "self." Concurrently, social epistemology locates the objects constituted by the knowledge of schooling as historical practices through which power relations can be understood. Statements and words are not signs or signifiers that refer to and fix things, but social practices that generate action and participation." (Popkewitz & Brennan, 1997, p. 293)

In other words, thinking mathematics education with Foucault in terms of making a social epistemology of mathematics education as part of the school curriculum allows us evidencing the way in which mathematics education and mathematics education research practices together and inseparably generate concepts, distinctions and categories that regulate the possibilities of thinking and being in/with mathematics as a privileged area of knowledge in the school curriculum.

It is important to my examination of the taken-as-truth statement that "mathematics education is for all" Foucault's analysis of the involvement of fields of academic inquiry and knowledge in the production of the ordering of Modern life (Foucault, 1971), and of the organisation of different technologies of gobernmentalisation (Foucault, 1997; Lemke, 2001). As I have argued elsewhere (Pais & Valero, 2012; Valero, 2008), understanding mathematics education as political enlarges the research gaze to notice and indeed focus on the way mathematics education research is implicated in producing and organizing what is conceivable as "mathematics education". In my exploration in this paper I build on Popkewitz' (Popkewitz, 2008)

insights in how educational sciences have provided the tools for fabricating the cosmopolitan child through being a cornerstone of the planning of social life for the promise of a better and brighter future. In this paper I connect the statement of the need of a mathematics education for all for creating a brighter future with the way in which educational sciences in the 20th century have produced the elements for the reasoning making possible such statements.

One important effect of the school (mathematics) curriculum as a process of governmentalisation is its operation as mechanisms of classification of people. As technologies that embody the norms of reason and reinscribes them in populations and in individuals, the mathematics curriculum operates inclusions/exclusions. Popkewitz (2008) argues that any cultural thesis about the subjects of schooling effects abjections. Abjection is the way that exclusion is generated as the effect of defining the norm for inclusion and its hope for those who are not part of that norm. The statement "mathematics education is for all" functions as a discursive device that declares the necessity of making of success in mathematics learning the norm. While the statement apparently sounds as the expression of an intention of exclusion, it operates simultaneously the exclusion of those who do not comply with the norm (Popkewitz, 2004). The mathematics curriculum as a technology of the self effects in children's mind, bodies and conduct the compliance with the norm, and thus operates inclusions and exclusions. This way of thinking brought me in my inquiry to focus on the doubleness of the words "mathematics for all". If mathematics for all embeds those for whom learning mathematics is not possible, I looked at how, historically and in the formation of the social sciences and mathematics education research there were forms of identifying for whom learning mathematics is not possible.

This means that an examination of the statement that mathematics is for all as part of the logic of the curriculum as governmentality techniques invites to consider how the formulations of inclusion in relation to education and mathematics education identify those for who are not meant to be included and be successful in school mathematics. In other words, the emergence of mathematics for all as an important statement in in the current functioning of the mathematics curriculum emerges on the grounds of many children who had been abjected and for long time had been excluded from having a chance of success in school mathematics. Thus the examination of the statement of mathematics needs to be for all goes hand in hand with the examination of statements about those who do not succeed. In this case I will concentrate on the relationship between statements such as students with low socio-economic status do not succeed n mathematics and the statement of mathematics is for all.

My analytical strategy involves visiting a number of interconnected spaces that without any linear or strict logical connection, but rather with discursive resonance, map different aspects of the statement under examination. A rhyzomatic analytical move (Deleuze & Guattari, 1987) of how this idea is made thinkable becomes a strategy. I also move in the connection of ideas in time and space. As mathematics education research is thought as an international field of inquiry, and probably

because for many of its practitioners mathematics is still conceived as a universal activity, then as much as there are particular reinscriptions of these ideas in national or local contexts, at the same time there is a tendency to an abstract, internationalized discourse about what those ideas are and how they could be played out. In keeping my eye on the ideas that circulate across nations I try to make evident how a field of inquiry generates truths that seems to be transferable from place to place and from time to time, contributing in this way to the reification of mathematical ability as a human ability and right that equates with reason, and with that installs one unified logic of being.

EDUCATION, SCIENCE AND THE SOCIAL QUESTION

The social sciences and educational research can be considered as expert-based technologies for social planning. In the consolidation of Modernity and its cultural project in the 20th century, the new social sciences were seen as the secular rationality that, with its appeal to objective knowledge, should be the foundation for social engineering. The invention of statistical measurements in the social sciences generates constructs that help identifying the ills of society that science/education needed to rectify. This is an important element in how educational sciences address the differential access of different children to the school system. Constructs such as students' "socio-economic status" —later on expanded to school's and communities socio-economic status— emerged in the 1920's in a moment where the newly configured social sciences were addressing *The Social Question*, that is, the growing problems with crime, poverty, alcohol abuse, sexual abuse, school underachievement, etc., of the growing population in urban centers (Popkewitz, 2008) caused by immigration and the urbanization of many other types of populations. In Europe and in other societies, the association between the religious and normative grounds of educational thinking and the emergence of educational sciences made possible to articulate salvation narratives for facing the social problems for which education was a solution (Tröhler, 2011). How "the Social Question" was addressed in different countries in the turn between the 19th and the 20th century allows to see the different religious, political and economic rationalities behind making of education the motor of modern development (e.g., Tröhler, Popkewitz, & Labaree, 2011).

Despite particular inscriptions in space, there is a common thread in the way in which the social sciences were devising technologies to deal with difference from the values of a dominant class that at that time has already established itself as the norm for measurement of all types of deviation. The "nurture–nature" debates —on whether it is the innate, genetic charge of an individual what is determinant in people's "right" development, or whether it is what the environment makes available the determinant of one's development— emerge hand in hand with the dilemma of how to govern a growing unfit population, and the pressures of democratization of education to tame the masses and make them productive, well trained work-force. Measurements of intelligence, measurements of achievement and measurements of socio-economic status were and still are technologies to provide the best match between individuals

and educational and work possibilities. The double gesture of educational sciences of, on the one hand keeping a rhetoric for the importance of access to education, and on the other hand reifying difference by constructing them as a fact, inserts human beings in the calculations of power.

MATHEMATICS AND PROGRESS

The emergence of the connection between people's mathematical qualifications and social progress can be traced to the end of the 19th century. During the second half of the 19th century, mathematics teachers in different countries struggled to make mathematics part of school the classic school curricula. Its place was relegated to vocational and military forms of education (See Howson, 1974 for the case in England). In the first number of the journal in 1899, Laisant and Fehr (1899), envisioned the important mission of the journal in contributing to the international, systematic and serious reflection on and study of mathematics education. They recognized the importance of the *preparation* of teaching staff, a group of "teachers deeply engaged with their mission, consecrated to it with all their devotion, instruction and intelligence" (p. 1, my translation). During the second industrialization, a time of tremendous scientific advancement, teachers had realized that *betterment* is always possible, no matter which pedagogical strategies teachers had used. The justification for the need for betterment was formulated as follows:

> "The future of civilization depends greatly on the direction of mind that the new generations will receive in relation to science. Within the scientific education, the mathematical element occupies a dominant place. From the point of view of the pure sciences or from the point of view of the applications, the 20th century that is about to begin will place demands which nobody must or can avoid." (Laisant & Fehr, (1899)

In the times of the Cold War, a similar argument emerged, however the justification was related to keeping the supremacy of the Capitalist West in front of the growing menace of the expansion of the Communist Soviet Union (Kilpatrick, 1997). Nowadays, professional associations argue that the low numbers of people in STEM fields can severely damage the competitiveness of developed nations in international, globalized markets (e.g., National Academies, 2007).

The narrative that connects progress, economic superiority, and development to citizen's mathematical competence is made intelligible in the 20th century. The consolidation of nation states and the full realization of the project of Modernity required forming particular types of subjects. The mathematics school curriculum in the 20th century embodied and made available cosmopolitan forms of reason, which build on the belief of science-based human reason having a universal, emancipatory capacity for changing the world and people. The 'homeless mind' (Berger, Berger, & Kellner, 1974 cited in Popkewitz, 2008, p. 29; Popkewitz, 2008) that school mathematics has operated is a type of individuality where the subject is set in relation "to transcendental categories that seem to have no particular historical location or author to establish a home" (Popkewitz, 2008, p. 30). In this way, subjects are

inserted in a logic of quantification that makes possible the displacement of qualitative forms of knowing into a scientific rationality based on numbers and facts for the planning of society (Poovey, 1998). Thus, from the turn of the 19th century to our days the mathematics curriculum is an important technologies of the self that inserts subjects into the forms of thinking and acting needed for people to become the ideal cosmopolitan citizen.

MATHEMATICS FOR ALL IN RESEARCH

That high achievement in mathematics is a desired and growing demand *for all* citizens is a recent invention of mathematics education research. In the move between the years of reconstruction after the Second World War and the Cold War, where school curricula was modernized with focus on the subject areas for the purpose of securing qualified college students (Rudolph, 2002; Thompson, 1959), mathematics education in the decade of 1980s faced the new challenge of democratization and access. The "Mathematics Education and Society" session at ICME 5 in Adelaide is seen as the first formal session in an international mathematics education conference to have publicly raised the need to move beyond mathematical elitism towards inclusion of the growing diversity of students in school mathematics. The well-documented systematic lack of success of many students in school mathematics was posed as a problem that mathematics education research needed to pay attention to and take care of. Mathematics education researchers, the scientific experts in charge of understanding the teaching and learning of mathematics as well as of devising strategies to improve them, took gradually the task of providing the technologies to bring school mathematics to the people, and not only to the elite. The idea of succeeding in mathematics as an issue of equity was made intelligible in a historical grid of events at the end of the 20th century. The identification of mathematical achievement with the wealth of nations is a result, among others, of the growing series of reports that produced comparative information on educational achievement and development (e.g., Baker, Goesling, & LeTendre, 2002; Heyneman & Loxley, 1982). Such reports can be seen as performances of the comparative logic of Modernity that operates differential positioning, not only among individuals but also among nations, with respect to what is considered to be the desired and normal level of development and growth. "Mathematics for all" can be seen as an effect of power that operates on subjects and nations alike to determine who are the individuals/nations who excel, while creating a narrative of inclusion for all those who, by the very same logic, are differentiated. As Popkewitz (2004) points, the rhetoric of inclusion in mathematics education embeds in itself the exclusion of those whose forms of being are distant from the norm.

BEYOND THE PROMISES OF A BRIGHT FUTURE

I argue that it is on the grounds of at least these three elements that the it is possible to examine the ways in which during the 20th century the statement "mathematics education is for all" came to enter the discourses of school mathematics. The

mathematics curriculum as a technology of governmentalization installs the framework within which it is possible to think of school mathematics. Such ideas that organize populations as well as subjects work on the doubleness of a statement such as "mathematics for all". While apparently declaring the necessity of inclusion, the statement draws clearly the boundaries for who are not part of the "all" included in the statement. In other words, mathematics for all implicitly states that mathematics is not for all, and that those for whom participation in school mathematics is not a possibility need redemption. The redemption and help should of course come from the successful application of the technologies devised by mathematics education research.

My analytical move allowed pointing to at least three rhyzomatically connected nodes. First, the social sciences and educational sciences in particular have during the 20th century built statistical measurements that put forwards constructs such as "socio-economic status". Such measurements identify and reify the people who do not fit with the norm. Second, the association of mathematics with the narrative of progress during the 20th century builds on the operation of the homeless mind citizen of Modernity. Third, mathematics education research brings together the fear for those who do not comply with the norm with the narrative of a bright future with mathematics. Mathematics education research and its statement on the need to make mathematics education fro all incorporates the excluded, the ones who have to be brought into the calculations of power. It redeems them by making low socio-economic students part of the didactical efforts of mathematics education.

I do not intend to say that being one of the persons who does not achieve as expected because of one's differential position of socio-economic status is simply an unimportant "social construction". My intention is to offer a way of denaturalizing the commonsense of a statement such as "mathematics is for all". The denaturalization makes visible the network of historical, social and political connections on which the fact that differential students' social and economic positioning is related to differential mathematical achievement.

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