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Mathematics education and social justice

Facing the paradoxes of the informational society

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During the last two decades there has been an increase in research work connecting mathematics education with society and concerns for equity, social justice and democracy. In particular we discuss the role of mathematics education and mathematics education research in the 'informational society'. This society contains contradictions that we express in two paradoxes. The *paradox of inclusion* refers to the fact that current processes of globalisation, although stating a concern for inclusion, exercise an exclusion of certain social sectors. The *paradox of citizenship* alludes to the fact that education, although seeming ready to prepare for active citizenship, exercises an adaptation of the individual to the given social order. Much research in mathematics education ignores these two paradoxes. We try to point out what it could mean for mathematics education research to face the paradoxes of the informational society in search of more just social relationships.

Mathematics education, equity and social justice

There are no easy ways to describe and theorise the relationship between mathematics education and democracy. The difficulties emerge, on the one hand, from the complexity of defining the concept 'mathematics'. It may in fact refer to a variety of ideas, techniques and practices, carried out by a multiplicity of people in different geographical sites and various historical times, which need not contain any unifying characteristic. Thus, we can talk about the mathematics of the Western mathematicians through history, of professional mathematicians nowadays, of mathematicians doing applied mathematics in industrial development and even in warfare, of the Inca indig-

enous people in Peru, of carpenters in their workshops, of street children, of nurses and doctors, etcetera. Furthermore, formal mathematics education and informal learning of mathematics can take place in a variety of sites, with its own rules of practice, demands and expectations. Thus, we can talk about school mathematics education in urban and rural areas in South Africa, mathematics education for adults at the working place, in-practice learning of mathematics of newspapers vendors in Cape Verde, and so on.

On the other hand, the notion of 'democracy' is also complex and needs critical examination, particularly at this moment in history. Elsewhere we have extensively examined the meaning of democracy and its relevance in relation to mathematics education. Democracy is an open concept that is not restricted to the individual sphere, neither to the formal aspects of the political administration of society, nor to the characteristics of electoral systems. Rather, it refers to a 'way of life' in which "people everyday relate to each other in order to produce their cultural and material living conditions" (Skovsmose & Valero 2001, p. 46). Furthermore, democracy is "purposeful, open political action undertaken by a group of people. This action is collective, has the purpose of transforming the living conditions of those involved, allows people to engage in a deliberative communication process for problem-solving, and promotes coflection, that is, the thinking process by means of which people, together, bend back on each other's thoughts and actions in a conscious way." (Skovsmose & Valero 2002, p. 397). This conception of democracy focuses on social action and highlights the importance of people's everyday experiences, interactions and shared values in the construction of relationships that seek respect and equality.

The placing of the notion of democracy at the level of social practice, however, should keep the connection between the realm of agency and the realm of discourses and structures. The direction that the world has taken, made explicit with the explosion of conflict after September 11 2001, has placed the notion of democracy highly on the scene and awareness of many people in the world. A new challenge to the notion has emerged from the configuration of an international world order. Such an order can be traced in discursive changes emphasising the "diffusion of 'neo-liberalism' as a political project and set of policies tied to a form of (economic) globalisation […], 'new public management' in social governance (e.g., the governance of welfare), the 'knowledge-based economy' and the 'learning society', and a new regime of international relations and international security" (Fairclough in press, p. 2). In this scenario the term 'democracy' has been given meanings which do not necessarily fit

with the old, good idea that democracy is "what we cannot have but, still, we cannot stop desiring" (Zemelman 1992). Nowadays the term appears in a bipolar portrayal of the world where the 'good guys', whose civilized, progressive values, norms and forms of economic development, have the task of redeeming human kind from the 'bad guys', who embody the evil forces of oppression and terrorism and endanger the world.[1] In this discursive world 'democracy' is used as a justification for the use of military force against peoples and countries, creating unrecoverable destruction. In the name of democracy the most undemocratic methods are constructed as legitimate replacement for strategies that seek dialogue, negotiation, respect to difference and tolerance. In other words, 'democracy' has become the key value of a dominant form of social, economic, political, and cultural organisation which generates equality and social justice for those who are on the team of the 'good guys', but which create enormous inequity, poverty and despair for those who do not classify into that group.[2]

Therefore, more than using the term 'democracy' we feel inclined to use other terms which capture what we think to be the essence of that idea, namely, the possibility of building social relationships, imaginaries and discourses which represent inclusion, social justice and equity particularly for those who are excluded from the group of the 'good guys'. These other terms also point to the fact that there exist different dynamics of power associated with mathematics and mathematics education. It is impossible for us to think about mathematics education practices and research without a serious reflection of the ways in which they are social spheres for the struggle of worldviews and positioning for gaining access to the dominant culture and its generation of particular rationalities and organising principles in society (Valero 2004b).

These considerations are of the most relevance for mathematics education. Elsewhere we have presented literature reviews of studies (of theoretical or empirical nature) that have addressed the connection between mathematics education and democracy (Skovsmose & Valero 2001). We have identified three types of discourses about this relationship. Each one of these discourses also embeds particular definitions of the meaning of power in relation to mathematics education. In some research there is the argument that due to its very preoccupation with mathematics, mathematics education becomes an education for democracy; that is, there is an *intrinsic resonance* between mathematics education and democracy since mathematics (and its proper learning and teaching) bring empowerment to students. Contrary to this idea, other researchers have argued that it is not possible to assume such a

positive connection; rather, there exists evidence showing that in many cases, mathematics education has systematically functioned as a means of exclusion of different students on the grounds of their race, language, gender, social class, ethnicity and ability. Therefore it is more likely to suppose a *dissonance* between mathematics education and social justice, inclusion and democracy. Given these two positions, we have argued that the relationship between mathematics education and equity is *critical* in the sense that there is no intrinsic resonance or dissonance. Depending on the context and the way mathematics education is organised it may turn to support social justice or create and perpetuate processes of exclusion.

The link between mathematics education and justice, equity and democracy is extremely complex, not only because of the meaning of each of the concepts involved, as argued above, but also because these notions help people to operate and act in the world. Therefore, in what follows, we will concentrate on an examination of some traits of the current social order in which we live and reflect on the implication of such an order for the relationship in question. We will try to illuminate various aspects of society and of the role of mathematics and mathematics education in it by referring to two paradoxes of the informational society. These paradoxes set a scene for a discussion of mathematics education and equity in the current global order.

The complexity of the informational society

Notions like post-modernity, liquid modernity, reflexive modernisation, risk society, hyper-complexity, network society, information age have all been used to characterise aspects of our present era. Following Manuel Castells (1999), we choose the notion of 'informational society', to emphasise that the impact of technology (and with it mathematics and science) goes far beyond industrial production and affects political, economic, social and cultural structures. Furthermore, we would like to add to this notion (produced in a world scenario before September 11, 2001) a dimension of political and cultural conflict, which has recently impacted social life both at local and global levels.

A discussion of the current state of the informational society must include considerations on globalisation as the process responsible for establishing the 'world village'. It refers to the fact that events in one part of the world may be caused by, and at the same time influence, events in others parts. Thus, our environment is continuously reconstructed in a process receiving inputs from all corners of

the world. At the same time, our actions have implications for even the most remote corners of the planet. This connectedness also puts in place processes of inclusion and exclusion. According to Castells (1999), the "structural logic of the information age bears the seeds of a new, fundamental barbarism" (p. 60). Structurally irrelevant areas of the informational society constitute what Castells (1998) calls the 'Fourth World'. The processes of globalisation, linked to the emergence of the informational society, also include the creation of the Fourth World.

This observation draws attention to the complex dynamics of globalisation. At the same time that we are brought together by a new network of interconnections, we are also moving apart. So while in some parts of the world connectedness brings participation in central processes within this society, it also brings a close in access to participation of different people in what is valued as central in this society. The interplay between the global and the local is a game that connects many parts of the world in a network of flows, and simultaneously excludes regions and people from specific communities and countries. The Fourth World includes not only large portions of the 'developing world' (Africa, Latin America and most of Asia), but certainly also carves out large chunks of Europe, USA, Japan and Australia. More crudely, inclusion and exclusion in the 'Fourth World' can happen among people in the same city, and even in the very same mathematics classroom!

We find that the 'informational society' is a contested concept (Young 1998). It contains contradictions, and it can develop in different directions. We shall try to summarise this fact by formulating two paradoxes, which we find to be of particular importance for discussing the relationship between mathematics education, social justice, equity and democracy.

The *paradox of inclusion* refers to the fact that the current globalisation model, which embraces universal access and inclusion as a stated principle, is also conducive to a deep exclusion of certain social sectors. Among other things, this brings about a Fourth World whose many new citizens are already to be found in mathematics classrooms. The *paradox of citizenship* alludes to the fact that the current discussions in education (including the references to the learning society) emphasise the need of relevant, meaningful education for social challenges, while, at the same time, much education appears to reduce learning to a matter of adapting the individual to social demands. On the one hand, mathematics education seems ready to prepare students for active citizenship, but, on the other hand, it seems to ensure adaptation of the individual to a given social order. We find

that some of the complexities of the relationship between mathematics education and equity can be revealed by addressing these two paradoxes of the informational society.

The paradox of inclusion

The discourse of globalisation appeals to the participation of all for the benefit of all. However, globalisation processes associated with a free-growing capitalism are exercising a brutal discrimination. As an illustration of this one can look at the steady growth of squatter and impoverished communities in big cities in the world to testify that there is not an inclusive economy. Instead it marginalises people to a large extent. Most people in the Fourth World will see and know about the nearby affluence, although the latter is far out of their reach. Theft becomes a wide spread form of survival, and what we could call 'perverted' or 'illegal' forms of economic activity are naturally established between marginalised groups and globalised capitalism. Drug dealing in Colombia, the classic shoe-polishing in Wall Street in New York, and even the less profitable business of selling stolen video-cameras to tourists in the streets of Paris are examples of this. A different form of relationship to an expanding capitalism is exemplified by many groups of Brazilian Indians, who struggle to maintain their own traditions and who do not define themselves with reference to what they miss from the globalised world. However, they certainly feel threatened, as their environment turns into sites for commercial exploitation.

Marginalisation of different groups is the consequence of the advance of the global capitalism, where new forms of apartheid emerge (Hardt & Negri 2004). This segregation is not strictly related to racial categories, although still with a strong correlation to racial and cultural factors. Thus, a Brazilian favela maintains an overrepresentation of black and mixed people compared to other predominantly white communities in Brazil; and what has been called the 'new working class' in Denmark is constituted mainly by immigrants from developing countries and their descendants, most of them who happen to be Muslim. The principal point of the new globalised apartheid is to isolate groups that do not represent potential markets for the globalised economy, nor provide resources for production, but who instead could turn into a disturbing factor. So globalisation keeps processes of ghettoising in full swing.

What could mathematics education mean in this scenario? From a neo-liberal perspective, it could be argued that there is no real incitement to invest in the (mathematical) education of marginalised people

because it will not represent a clear and profitable outcast in relation to the input needed in such action. From other perspectives, still interested in the economic benefits that educational investment represents, it is important to secure a well-trained working force. Therefore, (mathematics) education should be provided in order to integrate people, at least as the raw workers of the informational society. Other views will argue for (mathematics) education as the key to the success of the informational society in the sense that such a society does not only need raw workers, but specially consumers with a capacity to participate, at different levels, in the production and reproduction of economic, political and cultural structures. Some other will argue that a critical position towards the brutalities of the new global order is necessary and that education should provide sites for resistance and construction of alternative social imaginaries. Independently of the perspective, it is clear that in such a society mathematical qualifications play an important role and therefore people have to possess them. When the concern for equity and social justice is highlighted, then the questions of how teaching and learning practices open opportunities for students to gain access to the power resources connected to mathematical knowledge and competencies, or how they actually close those opportunities, become central.

The paradox of citizenship

The whole discourse of the learning society is addressed to competent, competitive, active *citizens* who can decide and choose what they consider to be relevant for them and their lives. However, the way in which different actors and institutions, from the State to other co-citizens, constantly address to people, through the media or even in everyday conversations, seems to reduce them to simple *consumers*. Thus, experts present their opinions on diverse public issues, and figures concerning elections, economic indicators and war casualties, among others, are mixed with advertisements of any kind of special offers in supermarkets. People are interchangeable construed as citizens or consumers depending on the situation. More often than not we are addressed as possible consumers, when all kind of offers are presented to us. While products have increased in variety, prices have increased in complexity. A product may not be something tangible, but could well be a service such as an insurance offer. Prices turn into a complexity of conditions for payment including rates and terms. Consumers could make investments or take a loan. They could also vote, receive services, fulfil obligations, or, in other words, be citizens.

A report of the Danish Technology Council (Teknologirådet 1995) discusses the increasing use of computer-based models in political decision-making. The report refers to 60 models, covering areas such as economics, the environment, traffic, fishing, defence, and population. It emphasises that this extended use of mathematical models may erode conditions for democratic life: Who constructs the models? What aspects of reality are included in the models? Who has access to the models? Who is able to control the models? If such questions are not adequately clarified, traditional democratic values may be hampered. The report emphasises, in particular, that models related to traffic and environmental issues, such as the construction of a bridge, are often used in support of decisions which cannot be changed. In several cases it appears that models are used in order to legitimate *de facto* decisions because they provide figures that justify an already made decision. So, mathematics operates in the space between establishing justification and dubious forms for legitimating decisions and actions. As consumers or as citizens we are constantly facing justifications and legitimisation for decisions, which are based on complex mathematical models.

What does the paradox on citizenship mean for mathematics education? First of all, one could consider citizenship from a 'receiving' or consuming perspective. A citizen should be able to receive information from 'authorities'. If the citizen is not able to read information and put it in numbers, then society would not be able to operate. The idea of 'consumers' mathematics' has been developed from a highly pragmatic perspective. This pragmatism has dominated many textbooks with elaborated examples of mathematics in daily-life situations. However, one could also consider citizenship as the capacity to 'talk back' to authorities. Then it is important to ask whether a critical citizenship can be supported by the development of a critical mathematical literacy. What could such literacy mean in this context? Here there are not a lack of attempts and examples. The question of how much people can make use of mathematical knowledge and competencies in acting as citizens and transcending their positioning as raw consumers is of extreme importance if a concern for equity and social justice is adopted.

Challenges for mathematics education research

The characteristics of our current social order represent big challenges for those who consider that mathematics education has a role to play in the pursuit of a more fair, inclusive society. Such challenges have

different implications for people involved in mathematics education (students, teachers, researchers, policy makers, textbook authors, etcetera). As researchers we constantly question how research in mathematics education takes into account the paradoxes of the informational society. On a previous survey of research literature in mathematics education (Skovsmose & Valero 2002), we have found that mathematics education research has concentrated on restricted interpretations of the relationship between mathematics and democracy, for example, interpretations that emphasise either the logical (within mathematics) or psychological (within and among individual's learning) dimensions. Interpretations that address the cultural and sociological dimensions in larger social settings have been underprivileged. This illustrates not only the priorities of research in mathematics education, but also indicates that the paradoxes of inclusion and of citizenship to a large extent are ignored in research. What could it mean, then, for mathematics education research to face the paradoxes of the informational society? We shall try to indicate possible answers to this question by pointing to some areas that could be strongly emphasised in mathematics education research with a concern for equity, social justice and democracy.

Making the students real

It is possible to conceptualise the mathematics learner in different ways. Research literature includes descriptions of students who seem to be eager to engage in mathematical learning. Some of these students may face difficulties, but they seem ready to face their learning difficulties and to struggle with their handicaps. In other words, students, as portrayed in research literature, do not always resemble real students. This has naturally much to do with the research perspective, which includes priorities for selecting the episodes from the classroom to be analysed. The totality of selected episodes reveals paradigmatic priorities and assumptions of the current research in mathematics education. It seems presupposed that noise in the classroom, students making obstructions, students not turning up in schools, etcetera do not reveal adequate information for researching the learning of mathematics. However, we do not think this is the case. We find that it is important that students become 'real' (Valero 2004a).

Students must be grasped as human beings in a complex situation, of which the learning of mathematics is only one particular aspect. Students are not simply members of a classroom, they are part of a school and of society. Students act with reference both to their

background and *foreground* (Skovsmose 1994). The foreground refers to the way students interpret and conceptualise – explicitly or implicitly, consciously or unconsciously – their future, their possibilities, and their life conditions given the social, cultural, economic and political environment in which they live. The foreground frames what students do and want to do. It provides resources and reasons for the students to get involved – or not – in their learning as acting persons. Society may assign very different foregrounds to different groups of students. Some societies, such as for example apartheid South Africa, 'steal' the future of certain groups of children. This act of 'stealing' destroys the foreground of some children, and in this way many possible motives for learning mathematics are eliminated. Identifying those acts of stealing is, to us, more important for understanding the learning obstacles of certain groups of children than, say, detecting certain mathematical 'misconceptions'. If research in mathematics education should interpret the meaning of learning mathematics for different groups of people, then the social construction of foregrounds must be considered. In this way we can hope to discuss how social processes of inclusion and exclusion determine students' processes of learning.

Humanising the teachers

Much research literature has focussed on the mathematics teachers. An overall assumption has been that teachers' practices are determined primarily by teachers' mathematics-related beliefs and knowledge. As a consequence, 'wrong' beliefs and 'deficient' knowledge can be identified as the cause of 'wrong' and 'deficient' practices. Thus, the dominance of the school mathematics tradition is caused by the fact that teachers, explicitly or implicitly, subscribe to an interpretation of mathematics, which highlights routines and a true-false dichotomy as the basis of mathematical competence. As a consequence, belief systems and knowledge have to be changed if a change in teaching wants to be achieved.

This picture of the mathematics teacher is problematic. With reference to Skott (2000) and Valero (2002) we want to emphasise that teachers' actions in the classroom are as complex as the actions of any human being. They are not simply determined by beliefs and knowledge concerning mathematics. Instead, teachers' actions must be understood in terms of a variety of factors such as the emergence of educational priorities, the demands of teaching-learning situations in the school, the possibilities of fruitful co-operation among teach-

ers in the school, the particular interactions with groups of students, etcetera. In fact, we do not see any particular interest in searching for *explanations* of teachers' actions, but we see a great need for *understanding* teachers' actions.

Furthermore, we do not think of teachers (nor of students) as research objects in mathematics education. In case mathematics education should open possibilities for the development of citizenship, then both teachers and students have to be grasped as human beings with whom we, as researchers, may co-operate. Any process of developing citizenship as part of an educational process does not square with the conception of teachers and students as some individuals who have to be 'treated' in a particular way. Such an approach only makes sense if we try to adapt students to a certain social order. But citizenship cannot be interpreted as an output of a certain educational device. Thus, the paradox of citizenship has much to do with how we conceptualise, in research, the participants in the educational process, that is, the students and the teachers.

Opening the curriculum

Who has the possibility to participate in decision-making concerning the curriculum? Do curriculum planning and implementation open possibilities to bring into the classroom different interpretations of what relevant mathematics education practices might mean? The specification of the curriculum could take place as a top-down process or as a bottom-up process. With good reasons it can be argued that a bottom-up strategy makes it possible for both students and teachers to be included in curricular decision-making, and that this is essential for education to make part of democratic processes in society.

Nevertheless there are several issues which have to be considered when the curriculum is opened in this way. For example, it is important to consider how 'local' curricula can come to operate in society. Could a particular curriculum come to constitute 'second-rate' mathematics education that dooms some students to exclusion? Núria Gorgorió and Núria Planas (2000) discuss a research and development project intending to open possibilities for critical mathematics education with immigrant students in Catalonia. They entered in a constant struggle with interpretations of that type of education as a 'soft' program that could be suitable for this particular kind of students, while educational authorities defended the need of 'hard core' mathematics education programs for students expected to succeed within the educational system. Here we directly face the paradox of

inclusion: A curriculum that intends to embrace issues of equity in mathematics education may risk generating yet more exclusion for the students involved.

To us this observation illustrates that the content of what is learnt in mathematics has to be discussed not only from a logical and psychological, but also from a cultural and sociological perspective, in case research in mathematics education should discuss the paradox of inclusion. The observation also emphasises how difficult it is to separate the discussion of the context from that of the content of learning. A particular content might appear relevant and interesting, when students are considered members of a classroom, but the same content might appear less attractive, when the students' opportunities in life are considered in a broader social context.

Tackling the global distribution of learning facilities

Much research has emphasised that Information and Communication Technologies (ICT) open and reorganise new learning possibilities (e.g., Balacheff & Kaput 1996, Borba 1999). We find it important, however, to consider how these learning facilities are globally distributed. Obviously, we have to do with the most unequal distribution of the ICT-facilities around the world. What does this mean for the role of mathematics education in under-resourced classrooms and schools? In particular, what does this imply for the formation of the 'Fourth World'? Does the reorganisation of learning possibilities also include a reorganisation regarding inclusion in as well as exclusion from the informational society? In our view, research in mathematics education is too often set up in such a way that certain social and economic resources are taken for granted although they can be taken as such only in certain (privileged) parts of the world.

Establishing a political economy of mathematics education

Mathematics education provides new opportunities for people; but it might also become an obstruction for certain groups to advance socially. Mathematics education presupposes resources, and we believe that it is necessary to ask how these resources – human and material – create opportunities and, more essentially, how resources and opportunities are distributed around the world. At the same time mathematics education might be recognised as an economic resource

of society as it supports technological development. And these economic and political potentials of mathematics education might operate very differently in different socio-political contexts.

In order not to jump to simplified conclusions, we want to emphasise the importance of opening a new research agenda in mathematics education, which can be referred to as a *political economy of mathematics education*. Such a research agenda might deal with not only the economic basis of the distribution and redistribution of learning facilities but also the whole economic basis of mathematics education around the world. Such a study might consider the economic and political role of mathematics education in the further development of the informational society, including the processes of establishing and maintaining a Fourth World. As already mentioned, it is important to make students 'real' and to 'humanise' teachers. Naturally, we cannot ignore the researchers, and taken as a whole this article makes a suggestion for politicising researchers. We find that a development of a political economy of mathematics education is important in case research in mathematics education should discuss directly the paradoxes of the informational society.

Notes

1. See for example, Norman Fairclough (in press), who presents a critical discourse analysis of the constitution of that world order through the discourses of the English Prime Minister Tony Blair.
2. Suffice to say that those who are construed as the 'good guys' are not only placed in Europe, USA and Australia, but in many 'developing countries' in the world; as well as those portrayed as the 'bad guys' are not only to be found in the mountains of Afghanistan or in Iraq, but also in the middle of Copenhagen and Stockholm.

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