INTERNATIONALISATION AND GLOBALISATION IN MATHEMATICS AND SCIENCE EDUCATION

Internationalisation and Globalisation in Mathematics and Science Education

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PREFACE

The past 100 years have witnessed a rapid increase of international contacts and collaborations between academics around the globe in the form of conferences, publications, courses for international students, exchanges of curricula and professional development programs and, of course, a multitude of cross-national comparative studies and other projects. In spite of their prevalence, ethical implications, and possible economic and political consequences, these international activities have rarely been subject to explicit research and critique.

Moreover, these interactions occur within a wider context of the globalisation of every aspect of our personal, social and academic lives. Mathematics and science education might be two of the most globalised subjects of the school curriculum under the masks of objectivity, valuelessness, universality of their respective "truths" and their perceived relationship to the economic development aspirations of every nation. These assumptions are often inadvertently carried over to the disciplines of mathematics and science education themselves, including teacher education, curriculum development, professional development and research. This volume is a contribution towards putting these assumptions under our collective critical gaze.

At the same time that trends of globalisation might be providing increasing opportunities for our academic work, consultancies and publications, it is also leading to an ever-increasing gap between the *haves* and *have-nots*, between the rich and the poor. Although these increasing differentiations are found within each country, they are more prominent along the south-north and west-east divides. This edited collection of diverse works is intended to maintain our vigilance about the prevalence of these patterns in our attempts to promote the international standing of our professions.

In calling for proposals for contributions to this volume, the editors identified the following aims for the collection:

- Develop theoretical frameworks of the phenomena of internationalisation and globalisation and identify related ethical, moral, political and economic issues facing international collaborations in mathematics and science education.
- Provide a venue for the publication of results of international comparisons of cultural differences and similarities rather than merely of achievements and outcomes.

- Provide a forum for critical discussion of the various models of international projects and collaborations.
- Provide a representation of the different voices and interests from around the world rather than a consensus on issues.

The call for expressions of interests for authoring chapters was widely circulated around the world using electronic lists, international conference attendance and the editors' personal contacts and networks, inviting academics in both mathematics and science education to consider sharing their experiences and learnings through authoring chapters related to the above aims. In particular, the call for chapters targeted a variety of authors with varying levels of accomplishment on the international scene and authors from non-English speaking backgrounds. To achieve this variety of voices several mechanisms were put in place. Firstly, the composition of the editorial team itself represented a wide geographical spread from Latin and North America, Europe and Africa, and East Asia and Australia. Secondly, the editors deliberately encouraged joint authorship between less experienced and more experienced authors, and from English speaking and non-English speaking backgrounds. Thirdly, a multi-loop peer review and editing process generated iterative writing and constructive comments from a variety of critical friends. Chapters were reviewed by at least three peers from within the community of authors and editors.

As a result the authors – all of whom are or have been involved in some bilateral, regional or multinational projects – represent voices from a wide range of nations including Argentina, Armenia, Australia, Brazil, Brunei Darussalam, China (including Hong Kong and Macau), Denmark, Germany, Israel, Laos, Mexico, New Zealand, the Philippines, Romania, Singapore, South Africa, the United Kingdom and the United States of America. Projects relating to Colombia and Japan are also reported upon.

This book is sponsored by the Mathematics Education Research Group of Australasia (MERGA). Previous volumes in this series include *Research and Supervision in Mathematics and Science Education* published in 1998 and *Sociocultural Research on Mathematic Education: An International Perspective* published in 2001.

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SECTION 1

THEORETICAL PERSPECTIVES

1

MATHEMATICAL LITERACY AND GLOBALISATION

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Abstract: If mathematics and power are interrelated in a globalised world, what does that mean for a mathematical literacy to be either functional or critical? The discussion of this question is organised in three steps:

First, different processes of globalisation are outlined. The thesis of indifference – that mathematics is a pure science without any socio-political or technological significance – is contrasted with the thesis of significance – that mathematics in action can operate in powerful ways, and power can be exercised though mathematics in action

Second, the processes of constructing, operating, consuming and marginalising are analysed. Here mathematics is operating, and mathematical literacy might be either functional or critical: (1) Processes of construction include advanced systems of knowledge and techniques, by means of which technology, in the broadest interpretation of the term, is maintained and further developed. (2) Processes of operation refer to work practices and job functions where mathematics may operate, although without surfacing in the situation. (3) Processes of consuming refer to situations in which one is addressed as a receiver of goods, information, services, obligations, etc. (4) Processes of marginalising turn out to be an aspect of globalisation, governed by a neo-liberal economy, which is far from being inclusive

Third, as conclusion, I get to the aporia, which questions the very distinction: functional-critical. On the one hand, I find this distinction important with respect to mathematical literacy. On the other hand, the distinction is vague, maybe illusive. Being both important and vague-illusive indicates the aporia we have to deal with, with respect to any critical mathematics education

Keywords: Mathematical literacy, globalisation, ghettoising, uncertainity

'Mathematical literacy' is far from being a well-defined term. Theconcept can be related to notions like empowerment, autonomy and 'learning for democracy'.[1] Talking about empowerment also brings us to talk about disempowerment, and

[1] See, for instance, Jablonka (2003).

B. Atweh et al. (eds.), Internationalisation and Globalisation in Mathematics and Science Education, 3–18.

one could consider to what extent 'mathematical literacy' could connote, say, 'regimentation' and 'indoctrination'.

Michael Apple (1992) has distinguished between two types of literacy being either 'functional' or 'critical'.[2] One could see functional literacy as first of all defined through competencies that a person might have in order to fulfil a particular job function. Working conditions and political issues are not challenged through a functional literacy, while a critical literacy addresses exactly such themes. Such a literacy is also included in what Paulo Freire has referred to as a 'conscientizaçao': a deeper reading of the world as being open to change.

A critical mathematical literacy includes a capacity to read a given situation, including its expression in numbers, as being open to change. Reading the world drawing on mathematical resources means, according to Eric Gutstein (2003), to use mathematics to 'understand relations of power, resource inequities, and disparate opportunities between different social groups and to understand explicit discrimination based on race, class, gender, language, and other differences. Further, it means to dissect and deconstruct media and other forms of representation and to use mathematics to examine these various phenomena in one's immediate life and in the broader social world and to identify relationships and make connections between them' (Gutstein, 2003, p. 45).

Notions like 'functional' and 'critical' might, however, assume very different meanings depending on what context we are considering. What could they mean with respect to 15 year old students in a provincial town in Denmark? To immigrant students in Denmark? To students from a Mexican minority community in a USA metropolis? To students from an Indian community in Brazil? To students from Palestine? To students living in a war zone? To students from an impoverished province of India, just discovered by an international company as a site for production of electronic equipment? And what does it mean for students living in a well-off neighbourhood? One could also think of students in elementary education, or of university students, or of people who do not have the opportunity to go to school. The distinction functional-critical could have very different interpretations depending on the context of the learner. Furthermore, even with reference to a particular practice, it might be difficult to point out what observations and what phenomena signify that we are dealing with either a critical or a functional learning.

As a consequence, we should not have great expectations about reaching a conceptual clarification with respect to the functional-critical distinction. Nevertheless, I want to address the following question: If mathematics and power are interrelated in a globalised world, what does that mean for a mathematical literacy to be either functional or critical? The discussion of this question will be organised in three steps: First, I will make some comments on globalisation and on the power-dimension of mathematics (Sects. 1 and 2). Second, I will refer to four groups of

[2] Instead of 'critical', I have previously talked about 'reflective' knowledge with respect to mathematics. This refers to a competence in evaluating how mathematics is used or could be used. Reflections could address both simple and complex uses of mathematics. See Skovsmose (1994).

people, constructors, operators, consumers and 'disposables' with respect to whom a mathematical literacy might be either functional or critical (Sects. 3–6). Third, as a conclusion, I arrive at an aporia which accompanies critical mathematics education and questions the very distinction 'functional-critical' (Sect. 7).

1. Setting the Scene: Globalisation

Globalisation refers to processes that have been defined and elaborated in very many different ways.[3] Let me, however, limit myself to the following six points.

First, it is generally agreed that processes of globalisation are facilitated by *information and communication technologies*. In theorising technology,[4] a principal issue is to what extent social development is determined by a technological development; but with respect to globalisation, technological impacts seem to be taken for granted. Manuel Castells (1996, 1997 ,1998) has carefully analysed the 'informational age' and the 'network society'. And it appears that the very networking to a large extent is constructed, not by stone and bricks, but by 'packages': those electronic units, easy to install, which establish new procedures, routines and forms of communication.

Second, it appears that globalisation is betrothed with a *free-growing capitalism*. Thus, Beck (2000) talks about a 'disorganised capitalism', which could sound misleading, as 'disorganised' might indicate a lack of power and efficiency. But if being 'disorganised' indicates that the growth of capitalism is operating through a new more powerful dynamic and that it is getting out of control (if not getting in control), then the word is well-chosen. Globalisation refers to an opening up of new markets.

Third, the processes of globalisation do not follow any simple predictable route. Determinism assumes the existence of some patterns of social development. I find, however, that processes of social development exceed in complexity what any 'logic' might be able to grasp. In particular, I find that processes of globalisation include so many interrelated factors that any possible pattern gets lost in complexities. This idea is also included in the notions of 'risk society' and 'world risk society' as developed by Beck (1992, 1999). Elsewhere, I have talked about social development as 'happenings', emphasising that the capacity to grasp what is taking place, is not granted to the people participating in the situation.[5] In this sense I find indeterminism a basic challenge to any social theorising addressing processes of globalisation.

Fourth, globalisation includes *distribution and redistribution of 'goods' and 'bads'*. The liberal aspect of the globalised economy can be illustrated by the movements of supply chains, i.e. the chains leading from raw material to the final commodity. The direction of a supply chain can, nowadays, be changed according

[3] See, for instance, Bauman (1998), Beck (2000), and Hardt and Negri (2004).
[4] See, for instance, Ihde (1993).
[5] See Skovsmose (2005b).

to emerging priorities. It can be taken as a given that a 'company belongs to the people who invest in it – not to its employees, suppliers, not the locality in which it is situated' (Albert J. Dunlap, quoted after Bauman, 1998, p. 6). The meaning of this statement is clear: A company is a freely moving entity, and to big companies borders are no restriction. The demands for profit could imply that production becomes located in areas where cheap labour is available, and 'cheap labour' not only refers to the level of salary, but also to the level of security measures to be taken. The permanent possibility of moving the company, the production and the capital is a defining element of a globalised capitalism.[6] Goods are produced and distributed on a global scale, and the production of goods is accompanied by a production of 'bads', that might be in the form of pollution and damage to the environment or to the people involved in the production.

Fifth, poverty accompanies free-growing capitalism, and globalisation turns into *ghettoising*, which also includes huge areas of Europe, USA and parts of their biggest metropolis. Ghettoised people are immobilised people. As Bauman emphasises: 'Ghettoes and prisons are two varieties of the strategies for "tying the undesirable to the ground" of confinement and immobilization' (Bauman, 2001, p. 120). In case we consider ghettos as a reservoir for extra labour force, the erection of the 'modern' hyperghetto seems irrational.[7] This ghetto does not serve as any reservoir, and certainly not as a reservoir for consumers who could help to speed up informational capitalism. The hyperghetto, operates as a dumping ground for people who have no role to play in globalised capitalism. Bauman refers to Loïc Wacquant who observes that 'whereas the ghetto in its classic form acted partly as a protective shield against brutal racial exclusion, the hyperghetto has lost its positive role of collective buffer, making it a deadly machinery for naked social relegation' (see Bauman, 2001, p. 122). Some of the immense favelas rapidly growing around cities like São Paulo and Rio de Janeiro might serve as illustrations. The film *Cidade de Deus* (*City of God*) might give an impression of what 'naked social relegation' could mean.

Sixth, globalisation could be *armed*. While the First and Second World Wars were between two, more or less equally strong powers, the wars of today, as in the time of colonisation, are between incongruent enemies. Armed globalisation tries to control minorities, located at strategic positions, close to oil pipelines for instance. Regions without any apparent strategic significance can, however, be ignored. Thus, the genocides that took place in Rwanda and Sudan were, from the perspective of a free-growing capitalism, without significance.

Certainly other processes of globalisation could be enumerated, but let me raise a different question: How could one judge such processes? Let me refer to just two alternatives. The first position, *globalism*, celebrates the new worldwide market,

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[6] Different techniques, like ranking of 'risk countries', facilitate companies' judgments of where to locate different supply chains, and where to allocate investments.

[7] Contrasting the hyperghetto one could think of the 'classic' ghetto as exemplified by the Jewish communities that maintained a cultural homogeneity that served as a protection against an often hostile environment.