# LIVES, LEARNING AND LIBERTY

# THE IMPACT AND RESPONSIBILITIES OF MATHEMATICS EDUCATION

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## ABSTRACT

*In this paper I draw out themes that run through the three plenary panel papers for PME28 (Johnsen Høines, 2004; Santos, 2004; Vithal, 2004). The linking themes for me are children's lives, their learning of mathematics and their right to liberty.*

## INTRODUCTION

I should perhaps explain my choice of title for this plenary panel - "*Suffer the little children*". Some will know, but I am not presumptuous enough to assume everyone does, that is it a translation of a quote for the Bible. The story is: Jesus was preaching and became an attraction not only for the general public, but understandably for large groups of little children who had been bought by their parents to see the great man. The disciples pushed them out of the way because the great man would not want to be bothered with children; his message was too important. The story goes:

> And they brought young children to him, that he should touch them: and his disciples rebuked those that brought them. But when Jesus saw it, he was much displeased, and said unto them, suffer the little children to come unto me, and forbid them not: for of such is the kingdom of God. Verily I say unto you, whosoever shall not receive the kingdom of God as a little child, he shall not enter therein. And he took them up in his arms, put his hands upon them, and blessed them. (Mark 10:13-16; Luke 18:16-17)

Now believe it or not, that is the first time I have *ever* quoted THAT source! It resonates with a post card I have on my office wall that I bought in Mozambique in 1979. In it a Mozambican girl is smiling and holds in her hand a literacy book. The slogan goes "*Forge simple words that even children can understand*". So the message stretches to the Marxist revolution in Mozambique in the early 80s of which I am proud to have played a small part as a mathematics teacher.

Of course, I am playing games with the English language here, (well it is my language and control of language gives one power!) and in particular the word "suffer" but the message is one that I think can be metaphorical. Let us consider Jesus as a metaphor for mathematics - and I apologise to anyone who finds that offensive. But it does suggest that there is the view that the power is too great for children to appreciate. Yet, if we can't make it understandable and more challengingly meaningful to children, which is surely why we are all here, then we are lost. The kingdom of heaven will not be ours – whatever your heaven is to you.

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To find exactly where that quote came from, I did a Google search, and I found the following photograph, which made me stop in my tracks and want to cry. Some of you as old as me may be able to remember the day (9.15 am on Friday, October 21, 1966) when a coal waste heap slid onto a primary school in Aberfan, Wales, and killed 116 very small children. I think I still have the newspaper of the day. You will all have similar catastrophes that stand out for you. This one is pertinent to us because it happened while they were in school. Was it a natural disaster? Was it just one of those things, an "act of god" as they say? Well, we were shown in the opening plenary to PME25 in Utrecht, where the manned space rocket exploded just after take-off. In Aberfan, someone somewhere did not use mathematics enough to work out the dynamics of coal dust and water. But it probably was a question that was not even asked. In such communities, the coal is king. The communities are secondary; coal is after all what the houses and the school are there for. Michael Apple has suggested however, that many "natural disasters" may be "natural" but are far from "neutral". He asks why they usually seem to befall people on the margins of society. There are clear answers to this as he points out.

## THE CULPABILITY OF MATHEMATICS

The argument then is that if you cannot understand mathematics as simply as children on the margins, then you do not understand it well enough. The challenge for us is how do we ensure that pupils from disadvantaged backgrounds achieve highly when the mathematics we present is intended, organised and structured to advantage the more prosperous student? That is of course a controversial claim which I hope many of you will engage with at this conference, whose theme is "*Inclusion and Diversity*". I go further and ask how we satisfy the needs of pupils from diverse cultural backgrounds when the mathematics we present is fundamental white and Euro-centric. I offer here a quote from Claudia Zaslavsky:

> It is the content and methodology of the mathematics curriculum that provides one of the most effective means for the rulers of our society to maintain class divisions. (Zaslavsky, 1981, p. 15)

If that does not get you going, little else I can say will! Notice here she maintains that not only is there a problem for those of us concerned about equity in mathematics education, but that the culpability lies both with what we teach as well as how we teach it. Consequently we all bear some of the responsibility for the failings of mathematics education and therefore need to consider what we can do to change things. Before I go onto consider what we might do, I need to consider in some detail just what I see as the problem. I argued this in PME21 and PME25. The Australian mathematics educator, Sue Willis, forcefully argues:

> Mathematics is not used as a selection device simply because it is useful, but rather the reverse. (Willis, 1989, p 35)

In other words, mathematics education plays its part in keeping the powerless in their place and the strong in positions of power. It doesn't only do this through the cultural

capital a qualification in mathematics endows on an individual. It does this through the authoritarian and divisive character of mathematics teaching. Mathematics thus performs a social function, and by engaging in mathematics teaching, teachers are consequently involved in a social function. Hence in order to understand better the nature and functioning of mathematics teaching we need to look for foundations, predilections and structuring frameworks that would support a social model for understanding the discipline (Gates, 2000).

Yet unfairness, injustice and prejudice are not abstract concepts of some macro-social analysis of an internecine class war. They are felt through the disappointment, hopelessness and frustrations of ordinary people as they get though their everyday lives. They exist in the knots in the pit of the stomach and the tears in the eyes. Injustice exists in the disappointments many children face when they are not endowed with financial resources to have what other children have and take for granted. Injustice exists in the frustration, anger and self-depreciation when a pupil is placed in a low set for mathematics based on some assessment procedure over which they have no control and which they feel is unfair. Injustice is a process that goes on all around us, even when - and arguably especially when - we do not look for it or recognise it (Gates, 2001).

There is a rather nice mathematical problem doing the rounds at the moment, thanks to Michael Moore (Moore, 2001).

1. Who won the 2000 presidential election in the USA?
2. Why then isn't he the President of the USA?

Why is this a mathematical question? Well because it demonstrates the fallibility of numbers. God may have created the integers, but we do the counting, and of course, it's unfair. But look what damage a disagreement over a few numbers has done to the world. (I hope that is not too controversial) But it does demonstrate that mathematics is often not far from issues of power, whether it is being used to take control, or to construct a reality that permits the continuation of control.

When I was writing this paper, a UK magazine for teachers published an article titled "*Stolen Lives*" (Monahan, 2004) which describes how millions of children around the world are forced into work that robs them of their basic human rights. According to the International Labour Organisation (ILO, 2004) there are 246 million children between the ages of 5 and 17 who are deemed to be involved in child labour (Monahan, 2004, p. 9). According to the World Bank, 1.2 billion people subsist on incomes of less than one dollar a day. Now THAT is an awful lot of people.

Jerome Monahan offers teachers some lesson ideas on child labour, offering activities in religious education, citizenship, geography, history, English - all of which are really helpful. But, hold on. Something's missing here isn't it? Isn't one of the purposes of mathematics to help us understand and operate on our world? So why is it so common for mathematics not to appear for purposes such as this? And when it is, it is used in a perfunctory way?

It does not have to be like this of course and there are examples of how mathematics may be used to challenge the ills of society – so called critical mathematics education (Ernest, 2001; Gates, 2002; Powell & Frankenstein, 1997; Shan & Bailey, 1991). The issue here – and this is reflected in each of the panel papers here today - is, how is mathematics culpable in the social exclusion of children on the margins. The questions for us are, exactly how does it happen and what can be done about it? This panel and all the research associated with it, is a part of that response. What is particularly illuminating in all three of the papers, are the insights into children's daily lives, for it is here that we will find many of the answers to the two questions.

## THE CULPABILITY OF PSYCHOLOGY

And what has it all got to do with PME anyway? Now I want to get controversial – yes, quite unusual for me I know. I want to ask, how many of these plenary panel papers would have been accepted as research reports to this conference? In my view it is not at all clear any of them would and as a member of PME since PME10 I make no apologies for having a view on this. Michael Apple throws some criticism at psychology for the damage it does to certain people and to the discipline and this resonates greatly with me and I am sure with many who have had papers rejected:

> In the process of individualising its view of students, it has lost any serious sense of the social structures and the race, gender and class relations that form those individuals. Furthermore, it is then unable to situate areas such as mathematics education in a wider, social context that includes larger programs for democratic education and a more democratic society. (Apple, 1995, p. 331)

This clearly makes some sense when one looks at the examples that are used in many school mathematics textbooks and resources. School mathematics has the effect of alienating certain social classes but also of pathologising them. Valerie Walkerdine (Walkerdine 1988), has written about the process by which school mathematics alienates women and racial groups for example. Barry Cooper has shown how the national Standard Assessment Tasks in the UK can result in discrimination between pupils of different social classes (Cooper 1996). Renuka Vithal draws our attention to this in her contribution (Vithal, 2004).

Two other quotes seem pertinent here, one from one of our own past presidents.

> Traditional psychology, for all that its field of study is human behaviour, has offered little that can help to improve society. (Lerman, 2001)

> Modern psychology has been incapable of making serious contributions to Third World development…it is important to point out that mainstream psychology has also failed to make significant contributions to national development and the lives of the poorest sectors of Western societies. (Harré, 1995)

Of course, this begs the question of whether it ought to be focussed on contributing to the lives of the poor. But we are at a conference whose theme is "*Inclusion and Diversity*" so I am taking that as read.

## CHILDREN'S SOCIAL WORLD

There is much research in our field on children's differential ability in mathematics. It is often supposed that one can do maths or one can't, but an accusation or admission that you 'can't do maths' is more than just plain fact of capability; it is a positioning strategy – something that locates one in particular relations with others. It locates you as unsuccessful, and lacking in intellectual capability; it locates you on the edge of the employment and labour market, as virtually unemployable. Mathematics education thus serves as a "*badge of eligibility for the privileges of society*" (Atweh, Bleicher, & Cooper, 1998, p. 63). How do these badges get given out - or more importantly, what hurdles are there in the race to collect the badges (Gates, 2002)? These badges of eligibility, of which success at mathematics is one is tightly regulated by their place in society and by their consciousness – which, as Bernstein argues

> … is differentially and invidiously regulated according to their social class origin and their families' official pedagogic practice. (Bernstein, 1990, p 77)

Of course, this is all very well and good, but it so easily (and so often) remains at the level of theory. Here is another offering from Pierre Bourdieu

> The attitudes of the members of the various social classes, both parents and children, and in particular their attitudes towards school, the culture of the school and the type of future the various types of studies lead to, are largely an expression of the system of explicit or implied values which they have as a result of belonging to a given social class...the same objective conditions as those which determine parental attitudes and dominate the major choices in the school career of the child also govern the children's attitude to the same choices and, consequently their whole attitude towards school. (Bourdieu, 1974, p. 33)

What we need, if we are to improve pupils' lives and their attainment in mathematics, are more studies of the detailed mechanisms and interrelations that bring about the global processes of exclusion. One such has been provided by Andrew Noyes, who has illustrated how teachers of mathematics contribute, sometimes unwittingly, but very definitely, to the gradual process of social reproduction through the way they interpret, process and respond to historical, cultural and attitudinal evidence they take from children who suddenly appear in their classrooms at age 11 (Noyes, 2004).

And this differentiation extends to reducing the opportunities to non-white ethnic groups through the assessment structures of the mathematics curriculum.

> Black pupils were significantly less likely to be placed in the higher tier, but more likely to be entered in the lowest tier. This situation was most pronounced in mathematics where a majority of Black pupils were entered for the Foundation Tier, where a higher grade pass (of C or above) is not available to candidates regardless of how well they perform in the exam. (Gilborne & Mirza, 2000, p. 17)

Jan Winter, who has been engaged for some while now in a study of mathematics and children's home context, puts it quite forcefully:

> I believe that we cannot teach children to be numerate if we do not pay attention to the broader experience of their learning. The mathematical skills that are so highly prized are meaningless if a pupil does not have the personal, social and moral education to make sense of the world and thus know when to use them. So, at all levels, mathematics and real life are all part of the whole experience of children and it is up to us to find ways of making our teaching of mathematics reflect that. (Winter, 2001, p. 211)

## MATHEMATICS AS AUTHORITY

In "*Do We Welcome Children's Mathematics?*" Marit Johnsen Høines raises the issue of authority and reminds us that one does not have to be at the margins of society to experience the "*formatting power of mathematics*" (Skovsmose, 1994). For as Ole Skovsmose writes

> Mathematics not only creates ways of describing and handling problems, it also becomes a main source for reconstructing of reality. (Skovsmose, 1994, p. 52)

This is nowhere more true that in the old South Africa, where as Herbert Khuzwayo indicates, mathematics was constructed to bring about an "*occupation of our minds*" (Khuzwayo, 1998). Yet, things can change with changing social circumstances. Renuka Vithal (Vithal, 2000) has looked at establishing a social, cultural and political approach in South Africa, where she integrated, project work, critical mathematics education, and ethnomathematics (Powell & Frankenstein, 1997). This created a reflective atmosphere where democracy and authority were seen as complimentary because they were made explicit. In her contribution here "*Researching, and learning mathematics at the margin: from "shelter" to school*" Renuka reminds us of the ways in which the social conditions of some children in South Africa impinge upon and restrict their opportunities for learning mathematics.

> Many mathematics classrooms are permeated by communication forms that assume the existence of an omniscient authority, represented, if not by the teacher, by the textbook or by technological tools. Communication, then, gets structured around a bureaucratic absolutism, according to which no particular justification for the different learning activities presented for the students is needed. (Skovsmose & Valero, 2001, p. 50)

Mathematics colonizes part of our reality and reorders it (Skovsmose, 1994) contradicting the purist view of mathematics that it is a neutral sublime purity. Marit tells us of her involvement with another Norwegian – Stieg Mellin-Olsen whose premature death left a great hole for many of us. Yet when discussing his words and ideas for mathematics education, can we ignore who or what he was and in what he believed? Of course the same is true for all teachers.

In "*Learning (and researching) as participation in communities of practice*" Madelena Santos introduces us to the ways in which mathematics is being used outside of what many of us would see as normal everyday activity. But while this activity might be outside most children's activity, it is exactly the activity these children are engaged in.

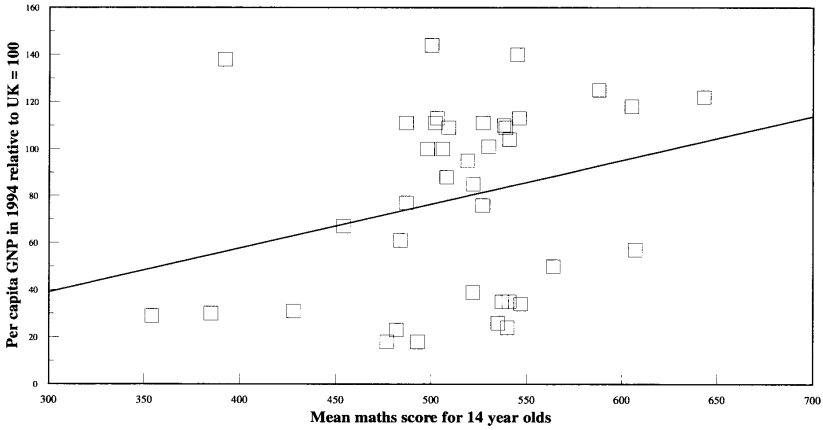
## IS MATHEMATICS IMPORTANT? FOR WHAT?

I am sure, we all would support the claim that mathematics is important for all children to learn. So why is it important? I do not actually think the answer to this is as clear cut as we would like to hope. All the papers in this panel have pointed to difficulties between children's lives, their liberty and their learning of mathematics. Yet we go on teaching it to all children. One key answer to this question is, yes of course mathematics is vitally important, because it is one way in which both people and countries can develop and improve. It is important to raise living standards; it is important to improver the GDP of a country.

So let me give you some data from the TIMMS study, and taken from Peter Robinson's pamphlet on *Literacy, Numeracy and Economic Performance* for the Centre for Economic Performance (Robinson, 1997). **Figure 1** shows the correlation between attainment in mathematics and per capita GNP for 39 of the 40 participating countries. The correlation is so weak as to be meaningless. "*There is effectively no correlation between doing well in international tests of attainment in mathematics in 1996 and overall economic performance as measured by per capita GNP*" (Robinson, 1997).

**Figure 1**

**The correlation between mathematics attainment in 1995 and average living standards in 1994**

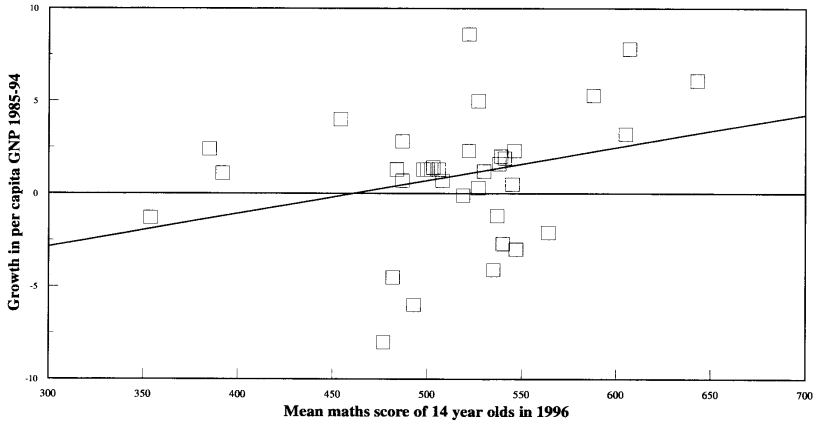



Sources: Third International Mathematics and Science Study. GNP estimates in PPP, World Bank. R2=0.07.

**Figure 2** shows the correlation between mathematics attainment in 1996 and economic growth over the previous decade for 36 countries. "*the relationship is so weak as to be meaningless*" (Robinson, 1997).

**Figure 2**

**The correlation between mathematics attainment in 1995 and economic growth 1985-94**




Sources: Third International Mathematics and Science Study. GNP growth data, World Bank. R2 = 0.09.

Robinson's argument is backed up and further substantiated by Alison Wolf in her book "*Does Education Matter. Myths about education and economic growth*" (Wolf, 2002). What she does point out however, is the good-news story; the only UK post-16 A-level qualification that has any bearing on the labour market, is mathematics.

> Even after allowing for every other factor imaginable, people who took A-level mathematics earn substantially more – around 10 per cent more – than those who did not.
>
> (Wolf, 2002, p. 35)

Of course, you can guess where this is going – which social group is most represented in those children who go on to study mathematics A-level? Surely you do not need me to tell you they tend to be the already advantaged. Peter Robinson goes on to conclude, from analyses of longitudinal studies in the UK that the single most important factor in children's attainment in numeracy and literacy was their measure of social and economic disadvantage. All other factors were relatively insignificant (Robinson, 1997).

## FINALLY…

One clear message for me in all these papers, is that for many people, many children, life and learning mathematics is a dally struggle. We think of problems for them to solve and strategies for them to learn. But for many children, our problems pale when compared to theirs. I ought to apologise for taking up so much time of the conference but like the three panel presenters today, I feel it is so vitally important for us to understand the lives of the children we teach, and how it impinges upon their learning. For too long, mathematics education has tried to remain neutral to the daily struggles of the children we teach and the politics behind it. I'll finish with the words of Ole Skovsmose and Paolo Valero

> Breaking political neutrality demands deliberate action to commit mathematics education to democracy.
>
> (Skovsmose & Valero, 2001, p. 53)

The struggle for me, and I know for many of you, is to use mathematics as a tool for liberty and liberation of the soul, the spirit and the poor; hence my title.

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