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Socially Response-able Mathematics Education: Implications of an Ethical Approach

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This paper discusses an approach to mathematics education based on the concept of ethical responsibility. It argues that an ethical approach to mathematics teaching lays the theoretical foundations for social justice concerns in the discipline. The paper develops a particular understanding of ethical responsibility based on the writings of Emanuel Levinas and discusses its implication for decision making on the curriculum and pedagogy in mathematics education. The paper argues that such an approach is consistent with a critical mathematics approach; however, it highlights the need to balance the concern about equity with that of quality. The paper concludes that this ethical stance, rather than being a normative criteria which dictates a particular line of action in different situations, it establishes a means to reflect on action and policy towards the achievement of more equitable access to high quality mathematics education.

Keywords: Mathematics Education, Social Perspective, Social Justice, Ethics, Pedagogy, Curriculum

INTRODUCTION

The "social turn" in mathematics education (Lerman, 2000) is well illustrated by the intensification and diversity of research issues in the discipline during the past five decades that adopted social and critical perspectives. These include concerns about equity, participation and social justice (Burton, 2003; Secada, 1989); consideration of the political dimension of mathematics education (Mellin-Olson, 1987); sociology and mathematics education (Dowling, 1997); cultural perspectives (Bishop, 1988); critical mathematics education (Frankenstein, 1983; Skovsmose, 1994;); ethnomathematics (D'Ambrosio, 1985; Powell& Frankenstein**,** 1997**)**; philosophical analysis (Ernest, 1994); and the history of mathematics movement (Furinghetti, Kaisjer, & Vretblad, 2004). While these agendas have different foci, and often are at variance in their conclusions and implications, they share a few common foci. There is a strong rejection of the dominant view that mathematics is a singular, objective and value free discipline that is isolated from human interest. They also discuss the relationship of mathematics to the social and cultural context in which it arose and in which it is applied – hence they raise concerns about the privilege that certain groups and cultures have as they access this mathematics. Similarly, on the teaching of mathematics, they challenge the dominance of the traditional mathematics curriculum outlined in many syllabus documents and the traditional teaching practices in mainstream classes around the world. Further, they question the assumption that the teaching of mathematics should follow set procedures and pedagogies that, once supported by rigorous research findings, are generalisable to *all* contexts and for the teaching of *all* students.

In particular, concerns about social justice, or its variants of equity, and diversity (Atweh, 2007), are often

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raised in writings from these social perspectives. However, the discourse of *ethics* is raised very infrequently in mathematics education. This is not to say that there has been no concern about ethical conduct or ethical implications in the design of curricula and the teaching of mathematics. Nor do we mean to imply that ethics and social justice are two divergent discourses. Here we posit two reasons why thinking about ethics in mathematics education supports, and lays the foundation for, concerns about social justice. First, social justice issues are often constructed as concerns related to the participation of social groups in social activity and their enjoyment of their fair share of social benefits[1]. Such a construction has less to do with the outcomes achieved by a particular individual - unless the outcomes are due to their belonging to a social group; it is often silent on issues related to the interaction between two people – say of the same social group. Ethics, on the other hand, is concerned with a face to face encounter and interaction between people. Secondly, ethical considerations highlight moral responsibility of one to, and for the other. This focus on responsibility establishes social justice concerns as a moral obligation, rather than charity, good will or convenient politics. In other words, adopting a social justice approach places knowledge as a servant to justice, whereas an ethical approach places justice at the service of the moral (Cohen, 2001).

Arguably, this absence of ethics discourse in mathematics education is paralleled by its absence from general discourses in education and humanities in Western culture. With the rise of scientific rationality, ethics has often been associated with questions of morality, dogma, codes of behaviour and legal imperatives and often seen as belonging to the domain of metaphysics rather than philosophy proper. Cohen (2005) explains this avoidance of ethical discussion in philosophy as a fear of moralising, preaching and questions of values by philosophical discourses mainly focused on ontology rather than meaning. Similarly, in Western thinking there is a movement away from essentialist thinking represented in the universality of ethical principles (Christie, 2005) and their foundation on rationality as established by philosophers such as Kant. Going back to the philosophical and ethical discourses of Socrates, who argued for the primacy of the knowledge of the *good* over the knowledge of the *truth*, Cohen raises the question "has the philosopher abdicated responsibilities" by only dealing with questions of knowledge rather than values (p. 39). However, this avoidance of ethical discourse is slowly dissolving. As Critchley (2002) indicates, it was only in the 1980s that the word ethics came back to intellectual discourse after the "antihumanism of the 1970s" (p. 2). Further, the post-ontological philosophical writings of Levinas (1969, 1997) have been influential in the re-introduction of ethics within philosophy by establishing ethics as the First Philosophy. As Christie (2005) argues, when it comes to ethics, it is possible to "work with and work against" (p. 240) the construct at the same time. In other words, we adopt a critical stance on the concept by discussing both its usefulness and limitation.

This paper invites a discussion of the social aspects of mathematics education framed by the construct of ethical *responsibility*, with one particular interpretation of the term as *response-ability*. It attempts to argue for the need to raise ethical concerns as a basis for principles of politics, critique and social justice in the discipline. It bases this understanding on one approach to ethics as the 'first philosophy' principles espoused by Levinas. Secondly, it discusses the implication of such an approach to two areas of mathematics education; namely, for supporting the social response-ability of the student through the curriculum and for supporting the social response-ability of the teacher through pedagogy.

We will commence with a discussion of ethics and the concept of responsibility.

Ethical Response-ability

The demand for responsibility, or more often in its related term accountability, is an increasing concern in educational discourse, policy and practice. However the term is used with a variety of meanings. Responsibility is often presented as a requirement or duty that restricts (as in, it is the teachers responsibility to cover the curriculum) as well as enables (as in, evaluating students' learning is the teachers' responsibility) or sometimes in the placement of blame (as in, who is responsible for the students' lack of achievement?). It often posits a conflict between self-interest and the interests of the other, or the collective - giving a priority to the latter. Ethical codes are constructed under the assumption that norms and regulations need to be set and agreed upon otherwise our "natural instincts" would find some teachers lazy or dishonest, and leave students under the threat of marginalisation or exploitation. In other words, while ethical codes may be drafted to guard the students' interest from malpractice, they may not be as useful in a positive sense for promoting fruitful and effective relationships between students and teachers. Taylor (1989), using an ontological approach to ethics, draws attention to the limitation of contemporary moral philosophy, by pointing out the narrow focus on morality as a guide to action rather than ethics being concerned with what it is good to be.

[1] *Feminist critique has constructed social justice as having two main agendas - distribution and of recognition (e.g. Fraser & Honneth, 2003; Young, 1990). Equity concerns in mathematics education literature have often been constructed in re-distribution terms (Atweh, 2007) – hence only this aspect of social justice is referred to here.*

If the law or the system does not form a valid foundation of ethical responsibility, what does? Philosophy? As discussed above, Western philosophy has often avoided the consideration of ethics. Further, as Levinas argues, philosophy is mainly concerned with questions of being (ontology) and knowledge (epistemology). The discussions of being and knowledge are achieved by reducing the other to the same (Critchley, 1992) and by dealing with consciousness (Bergo, 1999). For Levinas, ethics is before any philosophy and is the basis of all philosophical exchanges. It precedes ontology "which is a relation to otherness that is reducible to comprehension or understanding" (Critchley, 2002, p.11). This relation to the other that precedes understanding he calls "original relation". Chritchley goes on to point out that the powerful contribution of Levinas is that he "does not posit, *a priori*, a conception of ethics that then instantiates itself (or does not) in certain concrete experiences. Rather, the ethical is an adjective that describes, *a posteriori,* as it were, a certain event of being in a relation to the other irreducible to comprehension. It is the relation which is ethical, not an ethics that is instantiated in relations" (p. 12). Using a phenomenological approach, Levinas argues that to be human is to be in a relationship to the other, or more accurately, in a relation *for the other*. This relation is even prior to mutual obligation or reciprocity. Roth (2007) argues that this original ethical relationship discussed by Levinas consists of an "unlimited, measureless responsibility toward each other that is in continuous excess over any formalization of responsibility in the law and stated ethical principles".

In his later work, Levinas (1997) introduced the distinction between *saying* and the *said* in the face to face encounters with the other. The *said*, for example, philosophical dialogue, is propositional while the *saying* is the ethical. Neyland (2004, p. 517) explains the distinction in this way:

When I speak to another person, I *acknowledge* him or her as another person. Thus, [Levinas] puts it, before every 'said" there is a "saying". When I acknowledge another person, when I focus on his or her "face" I do more than just gaze, I actually *encounter* him or her. This encounter, Levinas argues, is, at its deepest level, an awareness of the other as one who in some way needs me. This … is the source of the social bond. He emphasises that there is compulsion involved. I am not obliged to respond to the other. I can choose to break the encounter. But in doing so, I weaken the social bond. Further, because my selfhood my self concept and self identity – depends on my responding to the need I recognise in another, when I break the social bond, I impair my selfhood.

Neyland uses Keman's specifications on how this 'original relation' can be eroded to specify three conditions "(i) particular procedures are *authorised*, (ii) actions are *routinised*, and (iii) people are *dehumanised*" (2004, p. 817, italics in original).

The construction of ethics based on the "original relation" with the other is not apolitical. Critchley (2002) points out that many of Levinas's writings present ethics as a critique of politics. He adds that Levinas "wants to criticise the belief that political rationality can answer political problems" (p. 24). Rather, ethics inevitably leads into political concerns of social justice (Caygill, 2002). In a chapter on *Politicizing the Mathematics Classroom*, Noddings (1993) discusses the role of the mathematics classroom in hindering the development of students as responsible persons. She highlights the need to involve students with shared responsibility for content assessment, the level of mathematics they engage in, and assessment. The challenge is not only to produce competent mathematicians and mathematics users but ultimately to promote "the growth of students as competent, caring, loving and loveable people" (p. 159). She calls for an increasing need for mathematics educators to "consider the ethical and political dimensions of learning mathematics as well as the cognitive aspects" (p. 159).

Puka (2005) argues that the distinction some feminists1 make between responsibility and "response-ability" is a significant contribution to ethical thinking. Response-ability highlights the ability to respond to the demands of our own wellbeing and the ability to respond to the demands of the other. This is similar to what Roth (2007) points out, that responsibility "etymologically derives from a conjunction of the particles *re-*, doing again, *spondere*, to pledge, and *–ble*, a suffix meaning "to be able to." Responsibility therefore denotes the ability to pledge again, a form of re-engagement with the *Other* who, in his or her utterances, pledges the production of sense. Each one, on his or her own and together, is responsible for the *praxis* of sense, which we expose and are exposed to in transacting with others" (p. 5).

Puka goes on to state that A "response-ability" viewpoint makes better sense of our responsibilities toward ourselves as well, including our growth or development and our personal integrity. The standard picture of self-responsibility, where we force ourselves to do things, cannot represent the self-discipline or self-determination involved as true freedom--except through sleight of hand abetted by self-delusion. And ethics must be free; it must organize voluntary cooperation, not cooperation-or-else. By contrast, self-response-ability focuses us on our own worth and the value of our talents or potentials. It enhances our self-appreciation and rests on our predictable response to what we really are and can become.

Towards a Socially Response-able Mathematics Education

Undoubtedly, mathematics is an important subject in the curriculum and in the current and future lives of students. In the minds of many, such importance is given to the subject due to the increasing importance of technology and science, two essential areas in problem solving and raising living standards. Mathematics, like science, is often associated with the economic development of a nation (Kuku, 1995). At the personal level of the student, mathematics is often justified as opening doors to many careers and courses of further study.

However, these assumptions about the value of mathematics education for the student and society should not be accepted uncritically. First, the relationship of mathematics to general economic development is far more complex than is often assumed. For example, Woodrow (2003), citing the example of the development of the Asian economies and the high achievement by their students in international testing, argues that increases in mathematics education standards have occurred after their economic development, and arguably as a result of it, rather than the other way around. Further, Ortiz-Franco and Flores (2001) demonstrate that during the period between 1972 and 1992, the mathematics achievement of Latino students in the USA have increased in comparison with other students, although their socioeconomic status has decreased.

Similarly, the assumption that mathematics is needed to increase access of students to jobs as a justification of its place in the curriculum should be regarded with care. The dominance in school mathematics of content needed for careers that are seen as mathematically based – mainly science and engineering, is unwarranted and, perhaps, is a residue of times when few students finished high school and went to university. Notwithstanding the importance of jobs in science and engineering for social technological development, only a few students end up in such careers. Further, with advances in technology, the demand for most calculations and algorithms that still dominate the majority of school teaching are increasingly becoming obsolete. Indeed, Jablonka and Gellert (2007) point out that, in certain areas, mathematics has become mostly invisible due to the wide spread of technology. Arguably, the nature of mathematics used in society has changed more rapidly than school curricula. This leads to our argument that all students need a considerable amount of mathematical knowledge for effective citizenship in the increasingly mathematised world of today – albeit different type of mathematics. Not only is a significant amount of mathematical thinking behind most day-to-day decisions that people make, but also as Skovsmose (1998) asserts, mathematics plays a role in "formatting" the world. In other words it creates a social and physical world after its own image. This power of mathematics is, of course, double edged. While many great achievements in science and technology were facilitated by mathematics, mathematics is also implicated in technologically caused catastrophes such as wars and mass destruction (D'Ambrosio, 1998). Hence, a *utilitarian* approach to mathematics falls short of developing a response-able student. As Ernest (2002) argues a critical approach to mathematics and citizenship is needed. This ethical response-ability discussion applied to mathematics education posits the primary aim of mathematics education to enable the response-ability of students in their current and future lives as citizens.

Developing mathematical knowledge and capacity helps the students to not only, using Freire's (in Gutstein, 2006) terminology, 'read the world', i.e. understand it, but it should lay the foundation for their capacity to 'write the world', i.e. change it. In the traditional wisdom of school mathematics, reading the world (at least some aspects of it) is the function of the school, whereas writing the world is often constructed as a possible capacity that might arise later when the students enter the workforce and civil society. Borrowing the terminology from Down, Ditchburn and Lee (2007), the role of mathematics education as it relates to citizenship can be at three levels. Mathematics education can contribute to the ability of students to function as effective citizens in the world. The authors call this a *conforming* ideal. This is consistent with the dominant justification of mathematics as developing skills and knowledge useful for preparation for work. However, mathematics can also be used to enable students to understand how the world works (or does not work) in order to change some aspects of their world. This, the authors refer to as *reforming*. However, mathematics has an additional capacity. It can be used to create the world in a new way. The authors call this the transforming capacity. This focus on mathematics education is consistent with the critical mathematics movement.

Similarly, an ethical responsibility approach to mathematics education changes the focus of interactions between teachers and students. Increasingly, schools and classrooms are controlled from outside (Fullan, 2000) by increasing demands of the system. Teachers increasingly feel deprofessionalised when faced with continuous changes imposed from above (Hargreaves, 1994). Perhaps relevant here is the discussion by Habermas of his theory of communicative action in which he makes the distinction between the *lifeworld* and the *system* world (Habermas, 1987). While the lifeworld is the taken for granted, pre-interpreted, everyday life existence, communicative action in this world is

saturated by tradition and routine. Through the lifeworld, individuals construct their own identities, create social solidarity, participate in, and create culture. On the other hand, the social world consists of social organisations dominated by technical goals and outcomes. The function of the systems level of society is to coordinate and control natural and social forces, as well as the resources and organisations required to administer them through bureaucratic structures. Seidman (1998) explains that whereas in the lifeworld "action is oriented to mutual understanding", the emphasis is on "instrumental control and efficiency" at the systems level (p. 197).

Habermas goes on to argue that these two life spheres are highly differentiated into subsystems and that their interactions are complex. In analysing late modernity, Habermas makes two key observations about this interaction. The first he terms the *uncoupling of the system from the lifeworld*. This refers to the fact that systems have become increasingly autonomous from the concerns of the lifeworld. Systems seem to have developed a rationality of their own and act according to their own imperatives even at times when they contradict the processes of the lifeworld that sustain them. The second observation that Habermas makes about late modernity relates to the *colonisation of the lifeworld by the system imperatives*. This is seen, for example, in the dominance of the systems language of efficiency, productivity, goals and roles on the lifeworld on people. For instance, our roles in social systems functioning contribute to our notions of our own personal identity, for example as clients and consumers.

For example, Neyland (2004) argues that in mathematics education the demand for accountability or responsibility as portrayed in the world-wide push towards standards and testing reflects a 'scientific management' rationality that posits institutions and norms as the cause of ethical behaviour. Using Levinas's writings, he goes on to argue that such institutions externalise and mechanise ethical behaviour and thus "sometimes erodes a primordial ethical relation between people" (p. 517). In this context, we argue that a focus on ethical responsibility shifts the focus of interactions between students and teachers to an encounter between two human beings, and although it is not totally free from system demands, it allows for teachers' decision making based on the interest of the student. At the same time, it re-establishes the professional status of teachers and frees the lifeworld of the school from some of the colonization of the system. It implies a collaborative and mutually respectful classroom environment where the participants are constructed as co-learners, an environment to which Vygotsky and Freier aspire.

In the following two sections we will examine both implications of an ethical stance for the curriculum and the pedagogy respectively in mathematics education.

Supporting the Students' Response-ability through the Curriculum

In the dominant mathematics education discourse, intellectual quality is often understood as mathematical abstraction and the rigor of academic mathematics (e.g. Juter, 2006). This includes formalized symbolic language, axiomatic thinking, standard efficient algorithms and proofs. It also includes sophisticated modelling of mathematically-based problems - usually from areas such as physical reality, engineering, and the economy, in which there is a unique or best fit solution. This is often contrasted with practical mathematics that focuses on real world applications, routine problem solving – on personalised (often called student-invented) algorithms, solutions and presentations of mathematical arguments. In many Australian curricula these two types of mathematics are contained in separate alternative streams that students chose between depending on their previous mathematics performance (often taken as a sign of ability) and post school aspirations. This construction of intellectual quality of mathematics as a dichotomy between formal and practical mathematics is presented as a *common sense* argument for providing a greater choice (a valuable endeavour in neo-liberal politics) for students and to cater for the needs of a larger number of students. However, this binary might be counter productive by denying the majority of students (that is, those taking the so called social or practical mathematics), the opportunity and the ability to develop their generalised abstractions of mathematical concepts and procedures. Further, in spite of the rhetoric of curriculum documents, and the assurances of many teachers that the two streams deal with equally valuable mathematics – albeit for different needs - for many students a hierarchy of values exists (resulting in a higher status for the formal academic mathematics).

Seen in this way, the intellectual quality of mathematics is measured primarily from within the discipline itself rather than the usefulness of that knowledge for the current and future everyday life of the student. In other words, intellectual quality is measured by the level of decontextualisation and abstraction of the discipline and in isolation from social questions and issues into which it can be applied. In particular there is a resistance by many mathematics teachers and curricula developers to deal with controversial social issues as a source of examples of mathematical problems. Perhaps because of the common belief that mathematics provides objective tools to deal with reality (Bishop, 1988), less often does

school mathematics deal with issues of socio-political aspects in society such as distribution of wealth, disadvantage and demographical changes. These social issues are often seen by mathematic teachers and curriculum designers as belonging to other subjects in the curriculum. This demarcation is consistent with the separation of the realm of the *know-how* of science and technology and questions of values and morality dealt with in the social sciences and philosophy.

Undoubtedly, developing the capacity of students to master the language and findings of mathematics, and even its formality, is a contribution to students' response-ability as active citizens. As Ernest (2002) argues, empowerment of students in and through mathematics necessarily includes *mathematical empowerment* which consists of the ability to critically read and produce mathematical texts as well as pose their own problems and solve problems. With the *transforming the world* aim of mathematics education, perhaps a different type of mathematics and different ways of teaching may be necessary. First, the development of mathematics in isolation from the capacities developed in other areas of school curriculum limits the role of mathematics in achieving its transformative potential. A more interdisciplinary approach is essential. Further, the privileging of abstract knowledge over contextualised knowledge becomes problematic. As Christie (2005) argues, "current times require the consideration of both universalistic, abstract knowledges and particularistic, contextualised knowledges" (p. 244). Seen from this perspective, intellectual quality looks different from the above construction. Quality in mathematic education is measured not as, or not only as, formal abstraction and generalisation, but by its capacity to transform aspects of the life of the students both as current and future citizens.

Mathematics can only contribute effectively to student response-ability if it engages with the world of the students. Perhaps every teacher of mathematics at one time or another has faced the question from a distressed student "but why are we studying this". Perhaps not surprisingly the usual answer, that you need this for future jobs, leaves many students unsatisfied, if not unconvinced. Here we argue that the usefulness of mathematics should not only be demonstrated by using examples from the real world of the student as applications of mathematics, but also that mathematical knowledge should be developed through such activities. The development of mathematical knowledge through real world activities demonstrates the usefulness of mathematics at the same time as engaging students. Further, this engagement of mathematics with the life of the student should be an engagement not only with the physical world and the economic world, but also with the social world; not only with the world as the student will experience as an adult, but their current world; it should aim at developing an understanding not only of mathematics but also an understanding of the world. Finally, such engagement should aim at not only *reading the world* but also, whenever possible, at *transforming the world* – even to a small degree.

Interrogation of the concept of connectedness of mathematics to the life of the student is consistent with many of the writings in the discipline from critical mathematics and social justice discourses. What does the focus on ethical response-ability add to the discussion? The focusing of critical mathematics on social issues and data is in harmony with the principles argued here. Arguably, the focus on supporting the response-ability of the student highlights the need for activities that are designed to change the world rather than merely to read the world – albeit critically. Response-ability for transforming the world has two implications for mathematics education. First, the isolation of mathematics from other discipline areas may hinder the development of the ability to deal with social transformation. Issues of values, politics and social action have to be joined with mathematical knowledge in order to identify factors that need changing as well as to implement them. The call here is for a more interdisciplinary approach to mathematics education and the willingness to deal with controversial topics in which debate and difference of opinion and interests are part of the equation rather than nuisance variables. The challenge for the mathematics teacher is to identify areas for activities that are not only of interest to students, but also that are important for students to know and engage with. The implication here is that students can learn about their social world while they are learning mathematics and, at the same time, learn about mathematics as they are engaging with real world activities. Second, in working towards social transformation, the teachers and students develop a new relationship of co-inquirers or co-learners in contrast to the traditional construction of expert and novice. In such real life activities, while the teacher is not the source of knowledge about what needs to be changed, the students need support in identifying these needs and in negotiating change. As Atweh and Bland (2005) point out in their evaluation of one such project, there needs to be a balance between the teachers abdicating their duty of care by minimizing the risk of student failure, the silencing of student voice, and their willingness to take risks when needed.

Supporting the Teachers' Response-ability through Pedagogy

The above section discussed the type of mathematics curriculum that enhances students' social response-ability. It posited the meaning of *quality* mathematics education not as measured by the discipline itself, but by

the power of that mathematics to enable students become more active participants in their current and future lives. In this section, we deal with another important challenge to mathematics teaching, namely that of *equity* (Burton, 2003; Secada, 1989). Atweh and Keitel (2007) note that social justice concerns with regards to participation in mathematics study by different social and cultural groups are no longer seen at the margins of mathematics education policy, research and practice. Issues relating to gender, multiculturalism, ethnomathematics, and the effects of ethnicity, Indigeneity, socio-economic and cultural backgrounds of students on their participation and performance in mathematics are regularly discussed in the literature. Many of these have found their way into policies in educational systems around the world.

Whereas concerns about quality are about what type of mathematics is worthwhile and valuable and about how students can best develop this mathematics, concerns about equity are about who is excluded from the opportunity to develop quality mathematics within our current practices and systems, and about how to alleviate their disadvantage. It is important first to note that there is no intrinsic theoretical contradiction between the two sets of concerns. In another context, Gough (2006) pointed out that in many policies "equality (or equity) is understood to be a *necessary condition* of quality" (p. 12). However, in practice, a focus on one without the other is problematic. In the above article, Gough refers to several South African writers who argue that the quality agenda in that country is often used as means to justify the continual exclusion of black students from further education. Hence, a concern about quality with no concern about equity may lead to "elitism". Conversely, a concern about equity with no consideration about quality runs the risk of sacrificing it. Luke (1999), referring to the work of Newman and his associates (1996) points out that "the worst enemy of equitable and socially just outcomes is the phenomenon that we could call "dumbing down" (p. 11) of the curriculum. Hence the focus on only one demand is not only misguided - by failing to deal with significant determinants of participation and achievement in mathematics - but also counterproductive - in leading to results contrary to what we are aiming to achieve.

Education is often posited as the most effective solution to disadvantage in society and between societies. After at least fifty years of development and reform in education, it is important to raise the question as to whether education has been able to address this challenge. Perhaps the evidence is not very encouraging. In a study commissioned by the US congress, Coleman, Campbell, Hobson, McPartland, Mood, Winefeld, and York, (1996) reviewed the long term effect of many interventions to alleviate economic disadvantage through education and concluded that schools do not reduce social inequality. Rather, research consistently shows that the family socioeconomic wealth is the best predictor of educational success. Similarly, the increasing gap between the rich and poor in many western countries (and between countries) does not support this utopian view of education. Perhaps Basil Bernstein (1971) was correct in his conclusion that schools do not compensate for society.

However, there is some good news. Coleman and his colleagues demonstrated that under school reform the most disadvantaged students benefited the most. In other words, although good teaching benefits all students, under certain conditions it also closes the gap between the least disadvantaged and the rest of the students. As Christie (2005) commented, "it is for the most disadvantaged children that improvements in school quality will make the most difference in achievement" (p. 245). Further, out of all the school factors that effected students' achievement, one of the most effective was the teacher. Hence good teaching "can make a difference, but not *all* the difference" (Hayes, Mills, Christie & Lingard, 2006, p. 178). Research evidence points to the fact that quality education assists *all* students. The danger is not in challenging disadvantaged and under achieving students to higher intellectual quality, but in "dumbing down" the curriculum for them - thus locking them into marginalization and disempowerment.

Hayes, Mills, Christie and Lingard discuss how concerns about quality pedagogy can also be socially just pedagogy. They refer to a framework developed in the state of Queensland in Australia, called Productive Pedagogy[2] The framework was based on the previous work of Newman and his colleagues (Newmann & Associates, 1996) at the University of Wisconsin on Authentic Pedagogy and based on a longitudinal study conducted in that state (Queensland School Reform Longitudinal Study, 2001). Similar to the previous frameworks, the Productive Pedagogy model does not provide ready made techniques for teaching. Rather, it is an approach to creating a place, space and vocabulary for us to get talking about classroom instruction again. It isn't a magic formula (e.g., just teach this way and it will solve all the kids problems), but rather it's a framework and vocabulary for staffroom, inservice, preservice training, for us to describe the various things we can do in classrooms – the various options in our teaching 'repertoire that we have – and how we can adjust these … to get different outcomes. (Luke, 1999, pp. 5-6).

[2] *Further information about the Productive Pedagogy can be available from the Website of the Queensland Department of Education and the Arts at* http://education.qld.gov.au/corporate/newbasics/

The Productive Pedagogy framework consists of four main categories:

- ✓ *Intellectual Quality*
- ✓ *Connectedness*
- ✓ *Supportive Classroom environment, and*
- ✓ *Recognition of difference*

The above discussion of how pedagogy can support dealing with the dual imperatives for quality and equity in education derives from research on disadvantage and general sociology of education. What does the focus on the ethical response-ability add to this discussion? Ethical response-ability places the primacy of ethical considerations in the teacher-student encounter. There are two dangers in this encounter that erodes ethical response-ability of the teacher and hence of the student. First, to deal with the students as individuals with no regard for their gender, ethnicity or socioeconomic background – factors that are demonstrably related to student achievement in mathematics - is to relate to an "abstract" student. Not only is this a recipe for failure – it also is dehumanizing and is unethical as argued by Neyland (2004) above. Similarly, the other extreme of seeing a student *only* as being of a particular gender, ethnicity or social status is equally counterproductive. This stereotyping also limits the possibility of an authentic encounter with the *other*. An ethical encounter attempts to be open to any possibility that exposes itself and responds to *other*'s needs and aspirations rather than in a stereotypical fashion. In supporting the students' response-ability a teacher can provide the opportunity to develop the high intellectual quality to the maximum of the students' needs and capacities. This is consistent with Vithal and Skovsmose's (1997) argument that a focus on the background of the student can obscure and hinder a focus on the *foreground* that sees possibilities as to what the student can be rather than a focus on where they have come from.

SUMMARY

Although the mathematics education literature during the past fifty years has taken a "social turn" by adopting a variety of sociocultural perspectives, there is a noted absence of discussion of *ethics* as it relates to the discipline. This absence is paralleled by a lack of consideration of the topic in general education and philosophy in our Western culture. This paper argues that ethical responsibility provides moral foundations for concerns about social justice. Ethics relates to the face to face encounter with the other that precedes concepts and reflection. Reconceptualising ethical responsibility for the other as its etymological meaning of response-ability, we have considered its implications to mathematics education.

We argue that the aim of mathematics education in this perspective is to support student response-ability as members of society. This support must necessarily go beyond the provision of mathematics that is needed for a minority of jobs and economic development to include mathematics that is needed by the majority of students and adults as active citizens of an increasingly mathematised society. School mathematics should support students' response-ability not only to *read* the world but also to *transform* the world. From this ethical perspective, in order for mathematics to contribute to the response-ability of the student as citizen, it should attempt to engage the student in meaningful and authentic "real world" problems and activities that not only develop the mathematical capability but also develop an understanding of the social world and contribute to its transformation whenever possible.

Similarly, a focus on socially just pedagogy supports the social response-ability of the teacher to meet the response-ability of the student. A socially just pedagogy does not sacrifice quality in the name of equity nor does it sacrifice equity in its pursuit of quality. Although these implications are consistent with the critical mathematics education movement, they highlight the role of pedagogy that attempts to balance concerns about quality and equity in the discipline.

In conclusion, this ethical stance, rather than being a normative criterion which dictates a particular line of action in different situations, establishes a means to reflect on action and policy towards the achievement of more equitable access to high quality mathematics education

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