# Do disadvantaged sudents fail mathematics or does mathematics fail disadvantaged students?

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The persistent differential outcomes in mathematics eduation have been cause for considerable research and concern for over 40 years. This paper considers the social context of contemporary mathematics and its implication in the outcomes for disadvanatged students. It is argued that reliance on individualistic models of theory and research need to be considered in conjunction with the social context.

The focus of this year's conference "People, People, People" is both timely and important. For over 40 years, there has been a surmounting body of evidence which documents the differential outcomes for students based on their background – including gender, social class, ethnicity, race, language background, geographic location and other demographic characteristics (Secada, 1992). This differential access and success has been found in mathematics from early childhood through to tertiary education. The differences are explained, theorised and researched from a range of perspectives including arguments of biological determinism through to systemic injustice embedded in the very structures of schooling. Each perspective has different strategies and foci for social justice initiatives. As we move into more conservative times, consternation needs to be expressed with the re-emergence of the New Right and the increasing and tightening control over teachers' work through systemic mechanisms (Apple, 1995) and the lack of focus on social justice.

As we move rapidly towards the new millennium, inordinate changes are occurring with society and schools to the extent where the social fabric of what we have come to know as "our society" is under threat. This has ramifications for schools and education because of its impact on the people integral to these sites. The impact of economic rationalist ideology and the corporatist State has been profound - government undertaken by the managerial elite, technology occupying prime space, privatisation of state authorities, and a focus on efficiency, debts and cuts. This new style of management and government has seen a shift away from "the public good" to a fixation on self interest. This has resulted in high unemployment and increasing poverty - both of which are at unprecedented levels in the post-war era. Working within increasingly conservative regimes and tighter fiscal management practices, issues of social justice and equity are no longer touchstones for reform. However, the increasing gap between rich and poor in conjunction with the diminishing profile of equity and social justice reforms indicates that the economic rationalist ideology has little or no place for real consideration of the educational disadvantage of students excluded from school success.

The demographic characteristics mentioned by Secada (1992) indicate significant portions of our communities differentially affected through the school system. These groups are not singly disadvantaged by schooling, but often endure multiple disadvantage as in the case of young, indigenous women. A factor common to most of these categories is access to money, or more specifically, the lack of money. Huston (1995) goes so far as to argue that income is the best predictor of academic success.

This paper is concerned with the outcomes of students living in poverty as they relate to education and more particularly to mathematics. The rationale for this interest is the increasing numbers of people forced to live in poverty due to the changing economic climate and workplace restructuring brought about through the new style of management. It has been long recognised that students living in poverty are at greater educational risk than their peers from more affluent backgrounds. When there are increasingly more

people forced to live in poverty, then there are important implications and ramifications for educators and for us as mathematics educators given the high status of mathematics within the formal school curriculum and the wider society, along with its role as a social filter. When the corporatist ideology, in conjunction with the economics rationalist ideology, govern reform agendas then there should be even more concern for the education of disadvantaged groups since their voices are marginalised in the debate for access to scarce resources. This is even more so for mathematics educators where numeracy is recognised as a key indicator of school success. This paper is thus an empassioned plea for mathematics educators to consider the present and the future of the *people, people, people* who undertake the (often forced) study of mathematics. It seeks to move beyond psychological approaches to theorising the dialectic of poverty, disadvantage and mathematics education. It seeks to make explicit the social context within mathematics education is intrinsically linked and in so doing, make explicit the constraints within which teaching and learning occur. In so doing, it proposes that there are systemic aspects of mathematics education which must be considered in the future if mathematics education is to take serious the issue of *people, people, people* .

In taking this line of debate, two aspects of poverty must be considered. First is the immediate effect on the individual and educational outcomes. This is the most dominant approach to the issue and is most commonly couched in psychological discourses. Fine (1990, cited in Apple, 1995, p. 343) is critical of such approaches as they have "benevolent consequences...[in which] there are isolatable and identifiable groups of students, who by virtue of some identifiable characteristic are not likely to graduate." These approaches seek to find solutions that focus on the individual students or their families. This approach denies the wider social, or macro, context which supports and maintains structural inequality. These approaches implicitly support and maintain the status quo rather than offer systemic change.

The second approach is what Apple (1995) calls for – the provision of the "best educational experiences we can provide for our children in every curriculum area" alongside "relentless attention to *systemic* power and critique" (Fine, 1993 cited in Apple, 1995, p. 344, emphasis in original). If systemic critique is not undertaken, then the processes through which already disadvantaged students are systematically excluded and marginalised will continue to be masked.

## Poverty, Social Disadvantage and Educational Outcomes

This section is concerned with developing an overview of the issues associated with poverty and education, in particular defining poverty and social disadvantage; drawing on current trends with Australasia and the world; and the effect of poverty in education.

Within the Australian context, "living in poverty" is identified by the economic status of people living below the "Henderson poverty line"[1]. The restrictive lifestyles associated with being poor is not confined to economic resources but also associated with social, psychological and educational disadvantages. There is often a conflation of the terms "poverty" and "disadvantage". For the purposes of this paper, poverty refers to the restricted access to economic resources whereas "disadvantage" encompasses a wider range of indices including fiscal ones.

Australian statistics indicate that there is an increasing number of people (and children) living in poverty. Briggs (1994) argues that one in eight Australian children are living in poverty. These figures are repeated in other parts of the Western the world (Hamburg, 1993; Huston, 1995; Morra, 1994). Hill and Veale (1995, p.9), using information from the Brotherhood of St Lawrence, state that "Australia [and] the United States had the highest poverty rate when measured against other comparable OECD countries." Such statistics indicate that the issue of poverty and social disadvantage cannot and should not be ignored. Significant numbers of students are forced to live in

[1]This is an arbitrary line brought about as a consequence of the Henderson Commission of Enquiry into Poverty, 1975-76. At the time of writing this paper, it was around $12,000.

conditions which are implicated in their positioning as learners of mathematics. Of those most affected by poverty are sole parent families (McInnes, 1996). Within the Australian context, indigenous Australians are disproportionately represented within any measure of educational disadvantage. For example, outcomes from the Year 2 Diagnostic Net and the Year 6 tests (Education Queensland, 1997) have shown that indigenous Australian students are identified as performing significantly poorer than their peers in all areas of numeracy and literacy measured.

The effects of poverty on educational disadvantage is well documented. Poverty effects the educational achievements of students so much so that Connell, White and Johnston (1990) have argued that the increasing levels of poverty are reflected in the increasing levels of educational disadvantage.

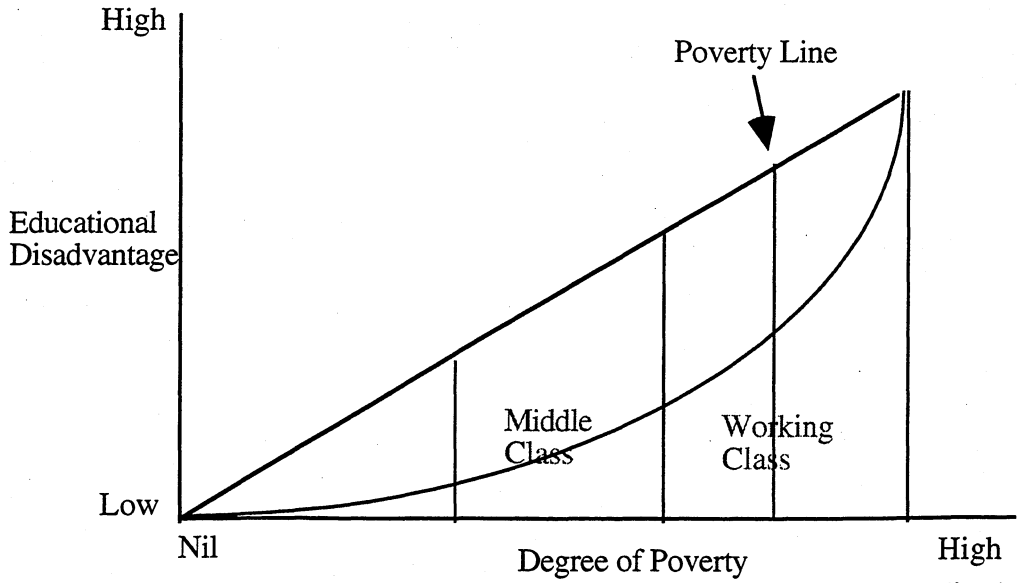


Fig 1: Representation of class relations relative to poverty and educational disadvantage
Source: (Smith, 1993)

Knapp, Adelmann, Needels, Zucker, McCollum, Turnbull, et al., (1991) argue that students at the greatest risk of educational failure are those from low-income backgrounds who disproportionately represent ethnic minorities and NESB/ESL families.
The ways in which poverty manifests itself in educational disadvantage includes:

- spasmodic attention spans due to lack of food (Smith, 1993)
- psychological health - eg depression (Smith, 1993)
- low levels of literacy and numeracy (Smith, 1993)
- teachers having lower expectation of these students (Knapp, et al., 1991; State Board of Education, 1992)
- truancy and poor attendance (Smith, 1993)
- preschool participation in much lower than for their more affluent peers - 35% of poor children in comparison with 60% of high income families (Morra, 1994)
- low retention and completion rates (Smith, 1993; Lamb, 1992)(Teese, Davies, Charlton, & Ploesel, 1995)
- students from lower-status backgrounds were only half as likely to enrol in HSC [senior] group 1 mathematics, physics and chemistry than other students (State Board of Education, 1992; (Sturman, Sharpley, & Polesel, 1992).
- students from lower-social status backgrounds had greater enrolments in technical and applied courses along with economic and business courses than their peers.(State Board of Education, 1992)(Teese, et al., 1995)(Sturman, et al., 1992)
- Poverty is compounded by other factors - such as immigrant families, rural families, linguistically isolated (NESB) families (Knapp, et al., 1991, Morra, 1994) ) (Lamb, 1991)

- under-representation of parents in school activities, (Connell, Ashendon, Kessler, & Dowsett, 1982, Smith , 1993)

***The Dialectic of Poverty and Education***

There is an inter-relationship between poverty and education whereby poverty has some effect on education and education has some effect on poverty (Petrie, 1990). If, this is the case, then schools and mathematics have a role in the production and maintenance of poverty, but also can be involved in the solution of poverty.

Connell, et al. (1982) argue that the core of the problem of poverty and education is the schooling system rather than the character or culture of the poor themselves. Through practices such as public and state schooling; high and low status knowledge; pervasive and competitive assessment systems; streaming; and so forth, the schooling system helps to perpetuate inequalities through the ideologies embedded within those practices. Simultaneously, there are clearly practices which have been implemented which aim to transform schooling so that the role in maintaining social disadvantages are minimised. Bourdieu (with Passeron, 1977) in his earlier work has noted that the schooling system favours and valorises particular forms and ways of knowing through various subtle and coercive means. Through these processes and practices, particular cultural and social systems have more legitimacy than others to the end whereby students from the middle- and upper-classes are more likely to be successful in school than their working-class peers.

Within the contemporary context the issue of poverty is difficult to research because of the ethical dilemma of accessing the background of students. However, through processes which use national statistics, the Ross Index provides an indicator of combined disadvantage This statistic is used to identify schools which are serving a disadvantaged community and support for that school is made available through the Disadvantaged Schools Program[2]. When comparisons are made between the outcomes of statewide testing practices (Education Queensland, 1997) it is quite clear that as a group, students attending DSP schools did not perform as well as their peers from non-DSP schools in the areas of numeracy and literacy. These figures are indicative of group performance rather than individual so that it is not possible to extrapolate about individuals.

## A Review of the Literature

An extensive review of the literature in the domain indicates three main trends. The first is concerned with the identification of variables of "at-risk" students. This literature tends to draw on extensive databases of statistics and identifies a number of factors which are seen as significant in the educational outcomes of disadvantaged students. This literature identifies the family structure as significant, and of particular reference is the status of the mother. Most often the causal links drawn from such studies are the single parent family (most frequently the deficit person is identified as the mother), poor educational levels of the primary caregiver (again the mother), and other factors such as drugs, early parenthood (again single mothers) or stereotypical views of "poor" families/communities. For example, Morra (1994) argues that the environments in which poor children grow up involve more homelessness, street violence, illegal drugs, and young, single-parent families. She states that in these families there had been a 46% increase in single-parent families and a 20% increase in families where neither parent had completed (US) high school standards. Within the Australian context , Hill and Veale (1995, p. 9-10) argue a similar position. These family characteristics at often described of as "at-risk" indicators. The more that a student has of these indicators then the more "at-risk" the student is of failing school. Such identifies engender the description of certain families characterised by single parent, welfare, drug or substance abuse, early parenting, where the mother has

[2] The Disadvantaged Schools Program (DSP) was the touchstone of the educationla reform of te Whitlam government. It is the longest running social justice program in the world and has srvived many incoming governements in spite of the numeraous changes to structure and funding.

little formal education, the family is living below the poverty line, the first language spoken in the home is not English, unmarried mother at time of the child's birth, the family is a single-parent structure (Zill, Collins, West, & Hausken, 1995). This general claim is supported by Tunstall (1995) who also raises the issue of race, particularly in the case of the Black Americans and their over-representation in poverty.

The second main theme in the literature are intervention programs. These programs vary from school (or even classroom) to national initiatives. Within this literature, the key initiatives are the Disadvantaged School Program (DSP) in Australia, and the Head Start Program in the United States. The latter has currently been revitalised in recent years due to the increasing issues associated with educational outcomes of significant proportions of the American population. In contrast the DSP has been one of the longest serving compensatory programs in the world and has been in operation since the 1970s. Both programs aim to provide additional educative experiences for students in the expectation that this will have long terms effects for the participating students.

The third theme which needs to be discussed in the very limited, but very specific, literature on mathematics and poverty found in the mainstream mathematics education literature. One of the more pervasive myths in education is that students from disadvantaged backgrounds have (presumed) deficiencies in basic and relevant skills due to their impoverished backgrounds. Until they make up the differences with their more affluent peers, then advanced skills should be postponed until the students are "ready". Typically mathematics programs in these schools are focused on the basics and adopt a rote-and-drill pedagogy (Silver & Lane, 1991). Knapp, Shields and Turnbull (1992) similarly note the curriculum for children living in poverty is guided by principles which emphasise basic skills, sequential curricula and rigid control over delivery. Knapp, et al. (1991) found that in poor classrooms, classroom practice tends to conform with general practices across the US where there is an emphasis on arithmetic computation, pedagogy usually involves teacher presentation followed by seated work and the curriculum is defined by the textbook. These rigid approaches support and foster a myth that poor students should be exposed to curricula where academically challenging work is delayed until a mastery of basic facts has been achieved.

### *Limitations of the Dominant Trends in Research*

The trends noted above are seen to be restricted in their potential for success for students living in poverty. The literature which identifies "at-risk" factors focuses on individual characteristics and intervention is of a compensatory mode and founded on deficits models. The entering behaviour, skills, knowledge of the students are seen to be restricted and in need of some form/s of compensation. Models of these intervention strategies are programs such as the Head Start Program (US) and The Disadvantaged Schools Program (Aust). These programs, while having different foci, have as their central tenets programs and practices which seek to redress the deficits that students have when they enter the formal school context. As has been noted with the Head Start Program, the success of these initiatives are limited. The limitations are at the level of accessing students who are in need of intervention along with the limited long term effects. These programs focus on the individual and do not address wider social and cultural impediments to the participation and success of students living in poverty. Where intervention is at the level of the individual - whether this is student, classroom, or school, long term success is restricted as the wider structural and systemic aspects of schools and society.

In the remainder of this paper, I draw on some of the key factors which impact on the teaching of mathematics in primary schools. These factors similarly impact on secondary and tertiary levels of teaching. The comments are drawn from teacher interviews which were open-ended interviews focused on the teaching of mathematics in schools and classrooms in identified "disadvantaged" schools. The data draw on comments which focus on the individual and social aspects of teaching in these schools. It will be argued that teaching in these contexts is flawed and often compounds the disadvantage of already

disadvantaged students. It is possible that some educators may see these social context as divorced from mathematics. However, teaching mathematics does not occur in a vacuum and this social context is inextricably bound to mathematics. The central thesis that is developed in the following sections is that schools and mathematics contribute to the disproportionate outcomes of education. By considering the social context within which teaching of mathematics occurs, then we are in a better position to implement systemic change which may have a more profound effect on the social justice outcomes of education.

## Systemic Approaches to Mathematical Disadvantage

### *Cultural Constraints*

Students come to school with identifiable cultural attributes. When there is a congruency between the patterns of school and home, then students are more likely to be successful in the formal school context. Conversely, when there are differences, then success (and even participation) is more elusive. In the most obvious examples, Maori and Indigenous Australians enter the formal school context having been raised in a family and social setting which values and embodies particular ways of knowing and seeing the world. When they enter the formal school context, their cultural knowledge and behaviours are dissimilar to those of the school context. Similar arguments can be made for working-class students and any other social or cultural groups whose culture is dissimilar to that of the school. For students whose culture is different from that of the school, then significant more effort will be necessary if that student is to be constructed as "successful" within formal schooling. There is a significant body of research in mathematics education which documents the cultural biases in the mathematics curriculum. These biases effectively work to marginalise students in their study of mathematics, that is, they are cultural impediments to learning. Kemmis, working from Habermas, uses three key identifiers which are useful for observing and theorising cultural conditions - the patterns of language, work and power.

Bourdieu's notions of cultural capital are similarly useful in theorising the lack of participation and success of students from poor and disadvantaged families. Within this theoretical framework, students enter the school context with certain knowledges, practices and an ethos towards school. For those students whose knowledge, language, experiences are similar to those valorised within the school context, they are more likely to be successful the participation and outcomes of schooling. Students who come from poor and impoverished backgrounds are less likely to be familiar with the patterns of language, work and power within the classroom and the school. This has been shown on numerous occasions - for example, Walkerdine's analysis of binary opposition terms (such as more and less) indicates that students from more affluent, middle-class families have a familiarity with both signifiers whereas students from poor, working-class families have familiarity with "more". This very subtle difference in background experiences will clearly have some effect on the positioning and learning of students in the mathematics classroom. For those students for whom the patterns of language work and power of school are congruent with familial backgrounds, then success is more likely, thus making culture a form of capital which effects educational outcomes.

Teachers are often aware of the cultural differences in entering students. They recognise that there is a significant amount of work to be done with poor and disadvantaged students to bring them to a level which is similar to that of their more affluent middle-class peers.

> *These children come to school unable to read or even knowing their colours. The parents don't even have the money to buy books. Even if they did, they would not know the difference between a "good" book and a "bad" book.*

This comment indicates not only an awareness of the differences in the knowledge and skills that students bring to the formal school context, but also an implicit recognition of cultural capital effecting the life chances of students. In this context, Marg recognises that not only do the students lack the literacy and pre-numeracy skills of their middle-class peers, but the problem is more than just a deficit. It is that the parents do not have the cultural awareness of what are seen as valuable cultural icons for improving educational outcomes in their students. She also comments

> *The parents are keen for their children to do well at school, but they have no idea on how to help them. They would not know how to help them with homework or even what to do with helping them with reading.*

This comment indicates that the problem is more than just lack of knowledge and basic skills, but more endemic. The students and their families have little idea of what formal schooling values and hence have little idea of how to improve the educational outcomes of their children.

The lack of knowledge that students have upon entering the school context necessitates that teachers will spend significant time teaching fundamental skills. In contrast, their more affluent peers will be encountering curriculum beyond this level and therefore be more "advanced" than their poor peers. While some of this teaching and learning may be focuses on fundamental knowledge associated with the mathematics curriculum, a significant amount of time is also dedicated to the teaching of social skills.

> *There is a lot of work that has to get done with the children just to bring them to a level which works in the classroom. I have to teach basic things like colours and shapes before we can even start sorting activities. Their social skills also need a lot of work. They don't know how to behave in a classroom so I have to spend a lot of frustrating hours just working on these sorts of things.*

The social skills which are valued in the classroom occupy a significant amount of teacher time in the lower primary years. This is, in part, due to the perceived need that students assume the valued patterns of interaction and work of formal schooling - the hidden curriculum. This can be seen to be the imposition of a middle-class cultural system. In raw terms, it essentially means that the teaching of such skills takes even more time away from the teaching of (basic) mathematics and therefore further advancing the educational experiences (and outcomes) of their affluent, middle-class peers.

## Structural Constraints

### *Resources - Technological, Practical and Human*

The current infatuation with post modernity and education has brought to the fore recognition of the power of technology and the subsequent impact on classrooms (see for example, (Green & Bigum, 1992)). Some support for the information technology is well documented while others raise concerns that technology is fast becoming the new social filter - the ever increasing gap between rich and poor, and the subsequent differential outcomes.

A survey of the literature alerts us to the impact of technology on the teaching of mathematics. At the primary school, it is quite apparent that computers and CD-ROMs are having a substantive effect on teaching and learning practices. Similarly, at the secondary level, the impact of graphic calculators is very apparent. As I have argued elsewhere (Zevenbergen, 1996) the use of graphic calculators at the senior level need to reconcile the differences between those who have access to them and those who do not. Assessment at

this level must ensure equitable access to such technology before it is can be reified through assessment practices (see Jones & McCrae, 1996).

Technology is not creating the master plan for schools and education insofar as advancement for all, but rather, reifying already apparent differences. Students who have access to technology will be more advantaged than their peers who do not have similar access. This applies to whatever level of technology is considered. Whether this is computers, the World Wide Web, software or even at the level of calculators, the difference between those who have access and those who do not, is largely determined by economic capital. Students who are able to access such are resources are clearly advantaged over those who do not. One only has to consider the implications of access to graphic calculators at the senior levels or even the familiarity of calculators at the primary level. When this is considered within the context of the World Wide Web where students can advertise or access sites which will help them with open-ended tasks, it is clear that students who have the financial resources to enable them to purchase hard- and software designed for these tasks will be far more likely to succeed in mathematical assessment than their not-so-financially-endowed peers.

### *"Non-electronic" Resources*

At a different level, access to technology, where technology is consider within a broader framework to include both electronic and non-electronic equipment, there are considerable aspects of differential treatment again. For example, it is quite common for the more affluent schools to have access to considerably more resources than their less-affluent peers. The difference in access to resources impacts on the programs, and by implication their quality, that can be offered within a school context. Students who do not have access to basic mathematics equipment, such as MAB block, unifix, pop stick, and so forth, are disadvantaged in the modes of learning and working valued in contemporary mathematics education.

> *This new school was a real shock, there is so little equipment around. I thought it must have been locked away in a central store, but my teaching partner told me that this school did not have much in the way of resources. My last school had more resources in one classroom than this school has across the whole school. It is clear that this is because of the socio-economic status of the parents. At my last school we could charge a levy of $40 per student. Where there are 60 students in the double classroom, then we had a lot to spend on resources. At this school, the parents have trouble giving their kids lunch, let alone $40 for a levy. We have to do with the bit that the Dept gives us. It means that it is even hard to find money for photocopying.*

The comments made by this teacher are most applicable at the classroom level of implementing mathematics. In contrast, schools with healthy budgets, particularly elite independent schools, are more likely to have access to greater resources and more flexibility in gaining resources depending on the immediate programs being implemented. This is in stark contrast to schools where there is a lack of access to finances and resources. Denise was commenting on the chronic lack of resources. She was planning a lesson on measurement, but the few tape measures that the school had were being used in the upper school.

> *When I found out I could not have tape measures, I had to make my own using blackline masters. The students will be able to do some measuring, but the measures were not as good as tape measures. They would break easily but it was the best I could do. I had to spend almost a lesson teaching the kids to be careful with them so that they would last longer.*

The constraints placed on teachers in providing for quality teaching in mathematics is strongly linked in the economic resources available to the schools and teachers. While teachers are very resourceful, the extra work created in attempts to make resources intensifies the workload of these teachers. Even when teachers are resourceful, there are great pressures on teachers insofar as basic resources including photocopying, art supplies and so forth, all of which impact on their capacity to create effective learning environments for their students. This compounds the disadvantages already faced by disadvantaged students.

Where schools are able to access special funds, such as DSP funding, there is potential for building up substantive resources. However, the need for mathematics resources must be identified in the budget submission - which in itself takes a substantial amount of extra teacher time. Where schools have allocated money for the purchase of mathematics resources, then without adequate professional development (some) teachers may not know how to use them appropriately and their value is diminished or even lost. One of the major criticisms of DSP was that many of the programs were the initiatives of particular staff members and when these staff member/s left the school, the programs were lost.

A further issue impacting on the potential to deliver qulaity mathematics programs within the primary school is the issue of human resources. Most schools are staffed on a per capita basis whereby standard formulae are used. Some flexibility is possible within the school so that schools have some degree of autonomy on staffing ratios and specialist teachers. For example, it is often possible for higher classroom ratios to allow for specialist teachers. Alternatively, programs can be established within special projects, such as DSP funding arrangements:

> *We are hoping to get DSP subsidiary funding. If that comes through then we have decided that we will employ some extra teachers for intervention. They will take the children identified as having learning difficulties to a specialist area and work on them intensively.*

This process will allow students who have been identified as needing extra time and effort in the areas of numeracy (and literacy) in an attempt to redress their deficits. Such programs, while in rhetoric represent an altruism aimed at improving the educational outcomes for disadvantaged students, they are heavily reliant on extra funding sources. As we move into tighter economic times, tighter fiscal control as noted at the beginning of this paper, then the long term survival of such programs is dubious.

Of further note is the relationship that disadvantaged schools have with their parents and community. As has been noted by numerous researchers and alluded to in an early section of this paper, parents from economically disadvantaged, working-class families are less likely to work with their schools in spite of recognising the value of schooling. This links with notions of cultural capital and cultural incongruency noted previously. What this means for delivering quality mathematics programs is a restricted pool of adequate (human) resources from which teacher s can draw. Not only are parents less likely to participate in school activities, when they do, they are less likely to have the skills and knowledge to help the teachers and students than their middle-class, more affluent peers. Many teachers commented on their lack of contact with parents and the consequent impact on the programs which can be developed.

> *I will spend these holidays making maths games for the kids to take home with their readers. They will be able to play these with their families. It might make them do something mathematical and I hope it will get the parents to see things as being maths, not just the homework sheets with lots of sums to do.*

> *[Researcher asks: Why don't you get a group of parents to come in help you make them? That way they might take more care of them as well as make it easier for you.]*
> *They would not come in. I have got lots of parents who just drop the kids a the gate and you never see them. Also, if they did help, I would have to spend a lot of time explaining to them what has to be done. I think it would be quicker to do it myself.*

This interaction indicates the difficulty experienced by teachers working in this environment and the impact it has on the development and implementation of quality mathematics programs such as those described by Silver and Lane (1996).

***Assessment***

There has been widespread implementation of standardised testing in most Western countries. Within the Australian context, tests have been developed and implemented by the various state authorities which vary in form and years of implementation across the states and territories. Recently (March 1997) State Ministers of Education agreed to hold standard tests across the nation making Australia comparable with other Western countries. The principle of such tests have been widely contested (see for example, (Ellerton & Clements, 1994; Apple, 1992). For teachers working with students from disadvantaged backgrounds, this has substantive implications. Where funding for intervention is attached to such testing, there is pressure on teachers to ensure that they make "accurate" assessments of their students.

Of particular importance for teachers working in areas of social and economic disadvantage, is the recognition that if a significant amount of time is being devoted in testing. In the first instance, teachers must devote some time to preparation for the tests. Second, and perhaps more significantly, it has been shown from the outcomes of statewide assessment, that students from poor and disadvantaged backgrounds are disproportionately represented in the cohorts identified as needing intervention. This finding suggests that, particularly in the case of diagnostic tests, it is reasonable to assume that teachers working in schools serving this client group will be spending significantly more time testing than teaching. This process even further disadvantages this group of students.

> *I'm so glad that all of this Year 2 validation is over with. I have spent the last four weeks guessing where my kids are, then working with activities so that they can be "tested" with the Net[3]. I have had to do activities which orientate the kids to the work on the Net. Now that I have gone through validating where they are against the continua, I can now teach again.*

Others have complained that they spent an inordinate amount of time preparing their students with the background knowledge needed to do the tests, but the content of the tests was not seen to be in line with syllabus documents so that for these teachers, the implementation of the tests actually meant that their students were being denied access to perceived important knowledge.

Tests, such as the Net, are mechanisms by which the State is able to control teachers' work. Teachers felt compelled to be 100% certain that where they mapped a student was accurate. This was, in part, due to the potential litigation which may occur if they "mis-diagnosed" a student. However, it is worthy to note, that interviewed teachers also commented that their original "hunches" or diagnoses of students were accurate when

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[3]The "Net" is a term used in Queensland to refer to a state-wide intitiative aimed at the early years of schooling Its intention is to identify children at risk in the areas of numeravy and literacy. Students "cuaght int eh Net" will recieve extra fudnign for intervention at the school level. Its full title is "The Diagnotics Net" and is structured around student outcome statements. Teachers must map individual studetns against stated outcomes. Students who are not able to perform scertain tasks will receive this "extra" funding.

compared against the final reports submitted. Ball (1996), using case studies, tracked the implementation of the Net and showed not only the proletarianisation of teachers work, but also the intensification of their work. In this light, Apple's concerns about the proletarianisation of teachers' work are accurate. Teachers are concerned about their professional "intuitive" judgements of students' mathematical performance - their professional judgements have been subjugated to more technocratic aims and processes.

***Changing Nature of Teachers' Work***

There is considerable recognition of the students in contemporary society. Some authors, such as Green and Bigum (1993) and Smith and Curtin (1995) have gone so far as to argue that students are "aliens" in today's classroom. Their focus is in the impact of technology on the way in which students think and behave. The emphasis on behaviour management programs suggest a crisis in student behaviour. These changes are also apparent in the high applications for stress-related leave. The romantic notion of "good old days" where students would "sit up and shut up and get on with their work" are no longer the environment where teachers' work. The issues associated with "problem children" are seen to be more common in disadvantaged schools. Many explanations are offered for this ranging from the poor background of the children and their families, to the imposition of middle-class culture (of teachers and the schools) onto working-class students.

The issue of behaviour management is particularly evident in mathematics classrooms where there has been an emphasis - rightly or wrongly - on structured, individualistic learning. I would suspect that very few mathematics educators would support this pedagogy, however, the reality is that it is a very common approach in primary and even more so, in secondary classrooms.

The documented evidence which shows that demographics of the typical classroom teacher is one who is approaching mid-40s. There are very few young teachers in education. For most teachers, this would mean that their initial teacher training was undertaken in the 70s where mathematics teacher education emphasised behaviourist modes of teaching and learning. Furthermore, it is also evident that a significant amount of teachers do not undertake professional development, suggesting that these teachers are not up-to-date with contemporary modes of teaching mathematics.

For teachers working in classrooms where there is a cultural difference between the teacher/school and the students, where the teacher still works within a traditional mode of teaching, then the teaching of mathematics is unlikely to be catering for the needs and interests of the client students.

> *The school is changing in its demographics. Once we were known as a very good school but that is changing now. There are a lot of people who still come to the school because of its past reputation, but they don't know how bad things are going. We are now a B1[4] rating for DSP funding. As a new teacher, it is really frustrating to come out of Uni with all these great ideas on how to deal with classrooms. We learned all this stuff about group work, activities , problem solving, constructivism and that at uni, but when you get into the classroom teachers just laugh at you - particularly those who have been out for a long time. You look at their teaching, and you see the children sitting in rows, doing maths sheets. They are quiet and the teachers think they're learning. A lot of the teachers are just really cruel to kids to keep them in their places. They have no idea of what the needs of these kids are, but they are seen as good teachers because the kids are quiet and they are sitting doing their work. I think it is really a case that the kids are scared of*

[4] Schools are rated for funding based on the Ross Index as noted previously. Schools with an "A" rating are those which will receive finding. B ratings do not automatically receive fnding, but will put into a pool and any remaining dfunding will be distributed accoridng to submision evaluaions. Within this context, a B1 rating is the next "best" rating for funding.

> *their teachers. How can they learn maths like that. The teachers have no idea of how to teach these kids. It was not an issue 20 years ago, but it is now.*

New graduates may be more aware of the changing needs of schools and students, more up to date with contemporary methods of teachings mathematics, but their representation in schools is comparatively limited. There is a recognition that the rote-and-drill methods which focus on basic skills is a dominant approach adopted by teachers working with students from disadvantaged backgrounds. Silver and Lane (1991, p.3) argue that:

> a program of repetitive drill and practice on basic computation which has characterized middle-school mathematics education for many American students and which has relegated disproportionate numbers of poor students to the remedial track, thereby blocking their access to most socially acceptable paths to status and success. (Silver & Lane, 1991) pp.3-4)

Knapp, et al.'s (1992) work indicates that quality practice with poor students needs to focus on meaning and understanding where skills are embedded in a meaningful context and where there are explicit links made between the school and outside-school contexts. Silver and Lane (1991) also note that in the context of teaching students from disadvantaged backgrounds, some consideration must be made of the reading comprehension abilities, writing abilities and general familiarity of the task contexts in order to develop an appropriate teaching and learning environment. It would appear from Amanda's comments that such practices are not common in classrooms, particularly among the cohorts of teachers who have been in the teaching profession for some time.

***Intervention Practices***

As has been noted earlier, the clientele attending schools is changing. The literature indicates more students come from non-nuclear families, more children live in poverty; and more students come from dysfunctional families. Such labels are problematic and should not be accepted without some question. What can be seen as "acceptable" is that there are issues confronting teachers which are different from those of the past. The changing society is evident in the emergence of labels such as at-risk students, behaviour adjustment, behaviour management, effective teaching environments, ADD students, ADHD students, and so forth. The immensity of such labels indicates that the (supposed) emergence of a range of behaviours not evident in earlier times. Again, such labels should be treated with caution since they focus on the individual rather than systemic issues. However, what they do indicate is the need for teachers to apply labels to behaviours (and in some cases, children) which previously were not apparent in society. The state's attempts to address these problems is evident in the range of programs and services aimed at supporting teachers and students.

There is a considerable correspondence between behavioural issues and the familial background of the students where there is a strong link between the perceived "bad" behaviour of students from disadvantaged backgrounds. As previously discussed, this may be due to cultural differences between the school/classroom/teacher and the students rather than some biological basis. What is of importance to this paper is the impact this has on the learning outcomes in mathematics. Because of the perceived "problems" in classrooms, the state implements particular programs and offers various forms of support to teachers to help "deal" with the problems. Intervention at this level can be in the forms of teacher support, special aid teachers or even special programs. Such interventions may be classroom based or involve withdrawal of the student/s from the classroom.

In conjuction with the school-based initiatives, students identified as "at-risk" are often subject to other interventions from the state. Where students come from familial circumstances which have been identified through jurisdictional processes, particular external bodies also may be involved in some forms of intervention. Such initiatives

involve state authorities such as family services or police. In many cases, the implementation of state authority programs may be based at the school so as to cause minimal disruption to the students' lives. This may appear to be a worthwhile practice, but given the immensity of the number of students involved in such interventions, then this can cause considerable disruption to classroom life and effectively the educative experiences of the students.

> *I have been asked to work with teachers to help them with their maths teaching, but I have gone into classrooms and I am amazed at what goes on. I was once in a classroom where I thought I'd spend a couple of hours with the teacher to work on her maths planning. She's planned a maths lesson so that I could see what she was doing and that we'd have time to look, see and evaluate. What ended up happening was that I had to see a procession "support" come through that room so that in the end she only had about 30 mins of maths. Some of the people included police, family services, teacher supports, and so on. It really made me think that this is one of the reasons why she is having trouble delivering her maths, and also why the kids were having difficulties learning the stuff. Until that is changed then there is not much hope for her or the children.*

The disruption to teaching mathematics is noted in this comment and is further discussed by Ball (1996). Quite clearly, the amount and range of services needed to cater for the emerging 'problems' of contemporary classrooms restricts the capacity to cover content. This reinforces the comments made by teachers of the emerging classroom context.

## Social Justice and Equity: Research Implications

In light of the comments raised in and through this paper, it is clear that there are many issues confronting mathematics educators. Many of the big issues can not be addressed by considering the individual. Psychological discourses, with their focus on the individual, assume that the problem with exclusion and marginalisation is an issue which can be addressed by focussing attention at the level of the individual. Such initiatives are only "bandaid" solutions. No longer can we keep patching up problems. It is time to address to systemic inequality. Clements and Ellerton, in numerous writings have been urging the mathematics education community to rise to the challenge. The national agendas of state (as in the case of Australia) and federal (as in the case of New Zealand) politics needs to be challenged. In considering how poverty and social disadvantage can be addressed, it is essential to consider the context in which teaching and learning mathematics is occurring and how this impacts on the cognitive aspects of learning. Learning and the act of teaching do not occur in a social vacuum. Teachers are a product of the society in which they are raised, the teacher education facility which trained them, the schools and sectors in which they work, all of which impact on their thinking and practice of teaching. As teachers' work becomes more intense and proletarianised, they need to be made aware of the conservative agendas impacting on their work and the learning outcomes of their students. A greater understanding of the processes through which issues of equity and social justices are realised in and through teachers' work needs to be undertaken in order for a more complete picture of how mathematics education contributes to the construction of social disadvantage can be developed. The recognition of the social context within which mathematics education is essential to this new emerging era of research. This changing contexts of schools is borne out in the comment below:

> *As teachers today we can longer think about just teaching [mathematics] content we have to think about managing the class. Things like inclusion have changed teaching so much that it is not like it was 20 years ago. The*

> *teachers who have been in since then still think it is OK to teach with the children lined up in rows in doing worksheets. They rule through terror but I wonder how much the children learn. Or even what they learn. We have to change teaching to meet the needs of the children that come to our schools these days. When a lot of these children come from really sad homes, schools have to think about this and work with their students.*

As mathematics educators, we need to begin to consider the changing contexts of schools and the impact this has on teaching and learning of mathematics. This context can vary from the level of the classroom through to more macro issues of systems, policies and politics. These variables invariably influence the work of teachers and researchers.

> *As one teacher I can only make a small change to the lives of my students, but as a collective, teachers can make a substantial difference to the life outcomes of our students. Teachers need to know how the system helps to exclude students and how we as teachers are part of that process. Until we know and can accept that role, then we will not be able to change much. At the moment it is just finger-in-the-dyke stuff.*

Returning to comments earlier in this paper, it was noted that there has been more than 40 years of recognition, research and reforms in differential outcomes in mathematics education. In spite of this body of work, there still remains differential outcomes in this area. As one of the most hegemonic subjects offered within the school curriculum I urge the askance of the question which is the title of this paper - do disadvantaged students fail mathematics or does mathematics fail disadvantaged students? By considering the latter question we may begin to reconceptualise our work and make headway into the differential access and success in mathematics. Within a broader conceptualisation of mathematics education where the social context is mutually constitutive and inextricably bound to the learning of mathematics, then a critique of the systemic constraints to differential outcomes can be undertaken.

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