

Numeracy Intervention: Is It Working in Primary Schools?

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In this paper, I explore the effectiveness of numeracy intervention within Australian primary schools. As a mathematics educator and researcher my central concern is that millions of dollars are being spent in this area, but are we seeing the benefits of it for students in primary school? Unlike most of the work being done in the area which is founded in psychological literature, I am undertaking a sociological analysis of numeracy intervention. In presenting this paper, I raise a number of dilemmas associated with this type of approach to understanding the pitfalls of interventions.

In recent years, there have been a number of numeracy intervention programs developed by educators who are responding to concerns about the teaching and learning of mathematics in the primary years of schooling. These programs include, *The Year 2 Diagnostic Net* in Queensland; *Count Me In Too* in New South Wales; *Early Numeracy Project* in Victoria; and *First Steps in Numeracy* in Western Australia. In this paper I am focusing on *The Year 2 Diagnostic Net* and *Count Me In Too*. The assumption here is that all of these programs are transformative. By this I mean the programs are designed to enhance the mathematical learning of students who are experiencing difficulties in numeracy. Similarly, these students will benefit from a highly structured approach to learning mathematics. This raises particular issues and dilemmas in so far as implementation of numeracy intervention programs are concerned.

All of the intervention strategies currently being used in Australian schools have been founded within psychological frameworks and hence are underpinned by different assumptions than the ones in this paper. The research that I am proposing to undertake represents a different way of viewing, interpreting and understanding intervention to establish whether intervention practices are transformative or produce the relations of reproduction. In this paper, I can do no more than clarify some of the issues and dilemmas and raise some questions associated with a larger study of numeracy intervention in Australian Primary Schools that I am embarking on. These dilemmas are posed as a conclusion to this paper to develop further discussion and future direction for my study project.

Numeracy Intervention

Numeracy intervention is seen to encompass a range of strategies and is not just confined to group withdrawal or one-to-one programs. It is seen to be the process whereby an educator undertakes some form of assessment of students and then develops strategies to redress the learning errors/difficulties as deemed appropriate to enhance learning. Whereas many teachers assume that intervention involves withdrawal or individual programs with the focus on the student so that he or she can learn strategies to solve mathematical tasks, it should be more encompassing so that the teacher examines his or her own classroom practice and seeks to change it in order to maximise student learning. It is this overall assumption that is critical to establishing if intervention programs are transformative and support student learning in the short and long term or if they are

mechanisms which act to further marginalise or exclude the very students they are meant to help.

Theoretical Assumptions of Intervention Programs

Adopting a sociological position in this paper raises a number of theoretical assumptions about intervention programs that need interpreting. In this section I will identify and develop a discussion of those assumptions suitable for the scope of this paper and explore how these affect the implementation of numeracy intervention programs.

In research, theories are used as frameworks to guide the area of study. In the case of most numeracy intervention programs there is the underlying assumption of a theoretical association between research based practices and those of schools, therefore, schools should not experience difficulties with implementing and sustaining intervention programs to improve student outcomes. As a maths educator and researcher trying to implement a numeracy intervention program, there are significant differences between the two sites and these differences affect any reforms implemented into schools. Ernest's (1998) exploration of personal and public knowledge is useful to interpreting this assumption. Ernest distinguishes school and research mathematics as constituting "different discursive practices and different sites or contexts for the production (reproduction) of mathematical knowledge" (p. 247). As far as school mathematics and in particular numeracy intervention programs are concerned, the learning of existing knowledge through short-term tasks and the acquisition of skills and new knowledge are set by the teacher. However, the research aspects of mathematics and in particular numeracy intervention is set by a group of researchers who create new knowledge in the long-term by posing or selecting problems associated with numeracy intervention. There are numerous differences between the two sites that cannot be explored in this paper. The dilemma is that the theoretical frameworks that guide numeracy intervention programs at the research site are very different to those that inform the practices of schools. It is because of this difference that I am seeing that intervention programs may in fact not be as transformative as what they are perceived to be.

The assumption underpinning intervention programs is that students who are assessed as experiencing mathematical difficulties will be supported to improve in their mathematical learning. The concern is that as teachers are developing the skills associated with intervention programs they may well be, as Townsend (1997) argues in his study of restructuring the curriculum, lessening the very curriculum they are trying to improve because of a narrow focus on the priorities of intervention programs. This results in the intervention program informing the teaching and learning of mathematics and not the syllabus. Similarly, the impact of increased workloads for teachers through the implementation of intervention programs is less likely to improve student learning. As intervention programs are implemented in schools and "recontextualised" (Bernstein, 1990) by teachers for the students who are seen as lacking in mathematical ability, reflection on their own teaching practices within the classroom is reduced. The concern here is that the intervention programs designed by researchers to support student learning are simplified and condensed so that only certain aspects are maintained to suit the teacher, not the students, who are experiencing difficulties in mathematics. Significant to this concern is that parents are asked to work as volunteers in supporting those students who are seen to be lacking in mathematical ability. If this is the case schools are putting those students who are at most risk of mathematical failure with their least qualified adults but

who seem comforted by the illusion that students are being supported in improving their mathematics ability.

Second, there is the assumption that implementation of intervention programs will skill teachers, despite limited funding for initial inservicing and subsequent support. This raises the concern of whether teachers are being skilled or deskilled in the use of the program. Arguably, any curriculum deliberation needs time, something that is not always readily available to teachers because of the “intensification” (Apple, 1999) of their workload. Rather, deliberation may well be pushed aside as ready made mathematics curricula are sold to schools to remedy the symptoms of mathematical failure among students without consideration of what really is causing the failure in the first place. The difficulty with reforms is that they are seen to skill teachers in numeracy intervention to bring about success for students regardless of how diluted they may become with problematic results.

With any reform and subsequent implementation, funding is an issue for schools. The assumption that there is funding available to support implementation of reforms is a concern, when in fact this is not always seen to be the case. Rather, funding may be made available to implement reform, but marginalised the following year because of other pressing budgetary concerns. This raises the issue of continuity of reform for those teachers who are new teachers or have come from interstate. Furthermore, ongoing support for all teachers is reduced considerably. The reality is that a teacher who is passionate about the reform is the one who gives the time to support other teachers.

With all of these assumptions there is the overriding concern that the language used by experts persuades teachers into believing that implementation of reforms will prevent students from slipping through the system. Arguably, the dominant ideology behind these reforms is that they are transformative and designed to help students. When in fact

the supposedly neutral language of an institution, even though it rests upon highly speculative data and may be applied without actually being appropriate, provides a framework that legitimates control of major aspects of an individual’s or group’s behaviour (Apple, 1990, p. 144).

The language of intervention programs focuses attention on its sophistication and premise of helping to support teaching and learning and not on the ethical results. McLaren (1998) states this further by arguing that psychologising student failure is part of the hidden curriculum that relieves teachers from engaging in deliberation of teaching practices. The reforms practices are made to appear to be responsive to ways of dealing with students, when in fact the reforms may well act as devices by which schools slot students into categories and further marginalise or exclude them.

Assumptions About Cultural and Social Reproduction and Transformation

From the sociological literature, schools are seen to be sites for social and cultural reproduction and transformation. Schools act to produce the relations of reproduction, but at the same time are seen to bring about transformation. In so far as numeracy intervention is concerned, questions need to be asked as to whether the practice is transformative or actually contributes to further marginalisation or exclusion of students. Arguably, the dominant ideology behind these reforms is that they are transformative and bring about changes in pedagogic practice and student learning. The authors and the implementers believe that the reforms will have a positive effect on students and enhance their numeracy performance. In so doing improve their overall performance and their sustained

mathematical understandings. However, serious questions need to be posed as to the real effectiveness of intervention reforms.

There are a number of assumptions that undermine the effectiveness of intervention programs. In fact from a sociological position, intervention programs are seen to further marginalise students through the process of tracking students into ability groups (McLaren, 1998). Tracking assumes that schools play a part in meritocratic selection and allocation based on ability. In fact, however, tracking fosters the illusion of meritocratic competition while in reality functioning as a “ranking” system that legitimates differences based on race, gender, and social power and locks students into positions of limited opportunity. Tracking thus perpetuates social class inequalities through selection and allocation procedures (McLaren, 1998).

The widespread use of IQ testing and ability grouping by schools is viewed as meritocratic, since both are used as a means of sorting students into specialised programs where they are seen to be receiving the best possible education. McLaren (1998) cites Oakes’ study (1985) to illustrate this further by stating that students who are at the bottom of the social hierarchy adjust their aspirations downwards because of tracking. These students may well be unaware that schools are treating them unjustly, teaching them low-status knowledge and socialising them for an unequal society. Thus, producing the relations of social and cultural reproduction.

The tracking of students by educators and schools is a serious concern, as is the “intensification” (Apple, 1999) of teachers’ work. As teachers try to improve their teaching practices with new methods, they are combining this with the demands the education system requires them to do. They may well suspect little about reforms, and continue on their own devotion with good intentions. The concern here is whether teachers realise they contribute to the maintenance of the dominant ideology behind the reform, that is, seeing the reform as transformative. Similarly, as teachers support limited or partial understanding of reforms they unknowingly sustain the existing system which is full of traditions that act to dominate education (Apple, 1990, McLaren, 1998). As education systems demand improved teaching practices, the assumption is that teachers are taking shortcuts and achieving only day-to-day tasks. Hence, serious deliberations about educational practice rarely eventuate, instead a reliance on the expert to tell them how and what to teach develops, rather than trusting their own expertise. As teaching and curricula are controlled by experts, more has to be accomplished (Apple, 1990, McLaren, 1998). New responsibilities are added on top of existing demands. Arguably, it is through deliberation and critique of educational practice that dominant ideologies begin to be questioned. For it is the practices, expectations and understandings that often go unquestioned, that continue to sustain schools. The fact that these practices are difficult to deal with and question means that teachers must begin to articulate the unarticulated assumptions that seem to lead education and more importantly reforms (Apple, 1990).

The intentions of reforms may well be transformative and for the good of the student, however do they really transform, and if so, what is the duration of the transformation? For it is through deliberation and critique of educational practice, which bring about change, that teachers need to begin to question and rebuild their practices.

Ameliorative Reforms

According to Apple (1990), one of the key difficulties with questioning the assumptions behind reforms is that they are cleverly articulated in a way that they are believable and are supported by valid scholarship with support documents. Effectively, what appears to be

humanitarian is adopted by altruistic educators immersed in looking after the interests of the very students they come into contact with each day and may not question the reforms. My concern is that the reforms are implemented to meet the needs of students with little consideration of the long-term effects to the students as they progress through their schooling. All too often, these programs harm the students they are meant to help and cloud over more serious issues related to teaching practice rather than contributing to the educators ability to face them honestly.

According to Apple (1990), educators may think their work is neutral and does not take a political stance. The reality is that education which is driven by economic outcomes acts as a powerful agent of social and cultural reproduction. The reforms that are implemented into schools are already a choice from a body of individuals who act to serve those in power. Arguably, the language used in these reforms is grounded in psychology and hence project the message of the expert who has a genuine interest in the educational problems of the student. Similarly, this language is adopted by educators who are seen to be humanitarian (Apple, 1990, McLaren, 1998) when in fact the language is used as a mechanism by which schools engage in sorting students into preordained social and educational categories. In so doing, these reforms Apple (1990) argues, may well divert attention away from examining the inadequacies of education in schools that cause the necessity of using this language in the first place.

Overview of Intervention Strategies

In the next section I am going to discuss the two numeracy intervention programs that are the focus of this paper. They are *The Year 2 Diagnostic Net* and *Count Me In Too*.

The Year 2 Diagnostic Net

The Year 2 Diagnostic Net was designed to assist teachers with the process of monitoring and reporting on children's numeracy development in the early years of schooling in Queensland. As teachers use the net they identify those students who are experiencing difficulties in numeracy and develop appropriate learning programs for those students. The net involves a series of processes whereby teachers are required to observe and map all children's progress using developmental continua for numeracy. This provides a framework of key indicators of a student's numeracy development across the early years of schooling. Students are seen to be in a particular phase of numeracy development if they achieve all the key indicators of that phase (Queensland School Curriculum Office).

The developmental continua for number are used to develop Individual Student Profiles for students in Years 1, 2, and 3. The profiles provide a continual observational framework for monitoring student progress from one year to the next and from one school to another. Teachers are required to validate observations of students who need additional support through specifically designed assessment tasks.

The developmental continua are a source of information for teachers and parents about the numeracy development of children.

Count Me In Too

The central focus of *Count Me In Too* (Department of Education and Training, 2000) is to assist classroom teachers with improving their knowledge of how students learn mathematics with the focus on the strategies that students use to solve mathematical problems. Through inservicing, *Count Me In Too* aims to skill teachers in how to assess

students' current levels of thinking in number and then use this information as a guide to further instruction in the classroom using a Learning Framework in Number. The Learning Framework in Number was developed by Wright (1996). The theoretical base underpinning this program is the notion constructivism. Key characteristics of this program are that the students have to think hard to solve challenging arithmetical problems which are focused at the cutting edge of their knowledge. Similarly, as teachers observe students, they are continually micro adjusting their teaching to build on a student's current knowledge of solving arithmetical problems (Department of Education and Training, 2000).

Underlying Assumptions and Key Differences of Each Intervention

The underlying assumption of *The Year 2 Diagnostic Net* is that through a coordinated approach all teachers will map students numeracy development using developmental continua and identify those students who require numeracy support. The net is seen to promote the effective teaching and learning of early numeracy by developing learning programs that address student's diverse learning needs.

The underlying assumptions of *Count Me In Too* (Department of Education and Training, 2000) are that teachers will broaden their knowledge of how students learn mathematics by focusing on the strategies that students use to solve arithmetical and counting tasks. The belief is that it is very important for teachers to observe and take account of children's knowledge and strategies. Similarly, teachers need to spend time to become familiar with the learning framework and establish learning teams for the successful implementation of the project.

There are several key differences between the two intervention programs. *The Year 2 Diagnostic Net* does not have a strong theoretical underpinning whereas *Count Me In Too* has a strong theoretical underpinning, that of constructivism.

The Year 2 Diagnostic Net was designed in four months in 1996 by an extensive team of educators. *Count Me In Too* has, as its basis, research spanning fifteen years and has undergone modifications as deemed necessary to suit the changing needs of teaching and learning.

The Year 2 Diagnostic Net focuses on identifying those students in Years 1, 2 and 3 who are experiencing difficulties in numeracy and provides a framework for developing appropriate learning programs for those students. *Count Me In Too* focuses on developing effective classroom practice by assisting teachers from Kindergarten to Year 4 with how students learn mathematics with a strong emphasis on the strategies used to solve mathematical tasks using a learning framework to guide instruction.

The Year 2 Diagnostic Net provides a framework for students who need learning support. *Count Me In Too* provides an explicit framework of students' strategies showing increasing levels of sophistication.

The Year 2 Diagnostic Net has parent reports and parent information brochures whereas, *Count Me In Too* does not have an emphasis on reporting to parents.

Both intervention programs require significant amounts of recording. *The Year 2 Diagnostic Net* is a developmental continua where students are mapped throughout their early years of schooling. This requires a consistency on the part of teachers to regularly record their observations of student progress. *Count Me In Too* uses an initial assessment of student mathematical knowledge and strategies. This is used to inform further instruction. A second assessment is done later to establish progress and further direction

for instruction. These reforms seem to add to an already intensified teacher workload and may lead to short cuts and a serious lack of curriculum deliberation about the reforms.

Discussion

From a sociological perspective, these reforms are ameliorative. By this I mean that they are seen to bring about transformations for teaching and learning in mathematics. This supports the dominant ideology underlying the reform. However, these reforms also act as agents of the production of cultural and social reproduction in so far as students are tracked through their early years of schooling and grouped according to their ability in mathematics. The concern here is that often these students stay with the same group of students from one year to the next without experiencing the mathematics in other class groups. Similarly, these same students may well be taught by parents who are seen to take on the role of intervener. The concern here is the parents' lack of training and lack of depth of mathematics. This raises the issue of how and why parents become involved in intervention programs in the first place.

The reality of education and schooling is that funding allocations for schools is subject to change from year to year. This means that funding for the implementation of a reform may be provided but withdrawn in subsequent years. Therefore, the continuity of the reform is subject to a filtering process whereby teachers take out of it what matches with their ideologies of mathematics education and parents take on the role of intervener, rather than the teacher. In a similar vein, teachers who are new to teaching or have come from other states are briefed about the reform and are expected to continue maintaining it with limited or partial understanding. This results in the reform being used as a piecemeal approach to intervention that results in minimal transformations for student success.

Dilemmas for the Research

This research has serious implications for schools seeking to implement any mathematical reform. For it is through critique and deliberation of reform that will guide the improved teaching and learning of mathematics. As this is a pending research project many questions are still unanswered and it is in this direction that I am going to take the paper. These questions create dilemmas for the project and constitute the remaining sections of this paper.

Dilemma 1. The overall of intervention should I focus on the two named interventions or one or four? What are the disadvantages of one as opposed to the two or four? If I focus on just one will I gain a good depth of information about it and how transformative its implementation has been? Similarly, if I focus on two or four am I gaining a lot of rich data that I could possibly find if I focused on one?

Dilemma 2. The role of the intervener, should I focus on the role of parents versus dilution of reforms? If I focus on the role of the intervener, in this case the parents, will I have ready access to parents to gather information and will the information be what I need for the study? Similarly, should I focus on funding and dilution of reform and how and why schools place those students who need learning support with their most unqualified?

Dilemma 3. What intervention should I focus on, numeracy or numeracy and literacy? Over the last fifteen years there has been a considerable amount of funding for literacy intervention but are these programs transformative in the short term or the long term?

Dilemma 4. Should I focus on the intensification of a teacher's workload and dilution of reforms? Could the intensification of a teacher's workload be the reason why reforms are not implemented and maintained the way they should be and hence causing the dilution of the reform? The data collection would provide a rich source of information about teacher's work and reforms. Is this something new?

Dilemma 5. Should I focus on new teachers and how they take on reforms? If I focus on this will I gather data pertaining to the issues for new teachers as they embark on their teaching career and having been a tertiary students for several years?

Dilemma 6. Research and intervention: Should I focus on the role of the researcher and his or her practices and how they align with the practices of schools? This could provide me with an understanding of the basis of research for reforms and who the reforms are really for?

Dilemma of Method

How do I do it and what are the issues that I will be confronted with, with each of these dilemmas? If I focus on just one dilemma, my data will be gathered mainly from the foci of that dilemma. However, will it be possible to focus on just one dilemma? It may not be and hence the need to access a variety of sources for information. From a sociological perspective, if I take a critical approach to my research I will be interacting with educators, researchers and parents to analyse and interpret their actions and situations with teaching and learning in mathematics and the implementation of reforms. This will assist me to interpret and explain their intentions and who and what informs their teaching. In finding this information, I envisage bringing about change with reforms and how they are implemented and maintained in schools.

Reference

- Apple, M. W. (1990). *Ideology and curriculum*. New York, NY: Routledge.
- Apple, M. W. (1999). *Power, meaning and identity: Essays in critical educational studies*. New York, NY: Peter Lang Publishing, Inc.
- Bernstein, B. (1990). *The structuring of pedagogic discourse Class, codes and control; v. 4*. London, UK: Routledge.
- Department of Education and Training NSW. (2000). *Count Me In Too*. Curriculum Support Directorate.
- Ernest, P. (1998). The culture of the mathematics classroom and the relations between personal and public knowledge: An epistemological perspective. In Seeger, F., Voigt, J., and Waschescio, U. (Eds.), *The culture of mathematics classroom* (pp. 245-268) Cambridge, UK: Cambridge University Press.
- Queensland School Curriculum Office. (1996). *The Year 2 Diagnostic Net Handbook for Schools*. Queensland School Curriculum Office.
- McLaren, P. (1998). *Life in schools: An introduction to critical pedagogy in the foundations of education*. (3rd ed.). Los Angeles, CA: Longman.
- Oakes, J. (1985). *Keeping track: How schools structure inequality*. New Haven, CN: Yale University Press.
- Townsend, T. (1997). Afterword: Problems and possibilities for tomorrow's schools. In T. Townsend (Ed.), *Restructuring and quality: Issues for tomorrow's schools* (pp. 215-227). London, UK: Routledge.