Politics, Power, Action Research and The Social Constructivist Curriculum

Jim Neyland

Mathematics Education, Wellington College of Education

PO Box 17310 Karori, Wellington, New Zealand

19 April 1994

0. Abstract

Action Research programmes need to have a political dimension involving an examination of dominant ideologies in education. One such ideology, the Technocratic/Bureaucratic ideology, is having a marked affect on teaching practice in mathematics classrooms. It is producing an increase in technique-oriented, behaviourist, approaches to pedagogy, and teacher beliefs and values are adapting to those more consistent with this ideology. Teachers need to be empowered to analyse their practice, beliefs and values against a range of alternatives. One of these needs to be the dominant ideology and the practices which spring from it. Another needs to be an approach to teaching which sharply contrasts with the dominant ideology. The point of entry for these analyses is the language and 'currency' teachers are most familiar with: classroom approaches and teaching activities. The goals of the analysis are planned change in teacher practice, a strengthening of the belief and value system which surrounds this practice, and the deliberate adaptation and subversion of the dominant ideology.

1. Introduction

This paper argues that (i) mathematics teaching is being adversely affected by an educational ideology imposed from outside; (ii) criticism of this ideology by academics is insufficient to significantly affect teacher perceptions; (iii) teachers need to be empowered to do their own analysis of their classroom practice and the beliefs and values expressed by it; (iv) teachers need to be able to analyse their current situation against a range of alternatives; and (v) the vehicle, the language and concepts, which initiate this analysis needs to be classroom curriculum approaches. I propose a model for helping teachers to analyse the beliefs and values which have been imposed on mathematics education. This model uses classroom curriculum approaches as the point of entry and is designed to enable teachers to undertake a self analysis as part of an action research project,

and more importantly, to adapt and subvert the restrictions imposed by the dominant ideology to more educational ends.

1.1 Politics and Power

Skilbeck (1976) used the term 'The Technocratic/Bureaucratic Ideology' to describe an idealised (not an ideal) set of beliefs and values along lines similar to the following. Schools are like pieces of machinery which produce outputs with certain standards. The outputs are students who have achieved outcomes at specified levels of achievement. The machine is adjusted by defining these outcomes, levels and standards. Teachers have unwanted interests in education and need controlling. They are components of the machine and must be 'set' to produce the required outputs. Teachers are further controlled by ensuring that there is a close link between the achievement of the outputs and remuneration. Educational costs are reduced and quality is maintained by ensuring schools compete for students and therefore for funding. Schools are required to decide how they are going to produce the required outputs and prove that they are in fact doing so. Curriculum development within this ethos is based on the definition of outcomes, standards and methods of national testing. This set of beliefs and values about education and schooling, and others similar to them, have been widely condemned by educationalists (e.g., Smyth, 1989). But, they continue to have an impact on mathematics education. In a growing number of countries this approach to education (perhaps in a slightly watered-down form) is being imposed on schools by government and quasi government organisations. Two of the down-stream effects are worrying.

Firstly, teachers seem to be increasingly accepting that this approach to education is the only approach. The mechanism for this change in belief and values shouldn't be described as conversion; it is more like absorption. Some of these teachers would be horrified to find out how their language, practice and increasingly their beliefs and values are changing to correspond to the imposed view. Secondly, classroom environments are changing. I see increasing movement towards outcome driven, neo-behaviourist, approaches to pedagogy, and an increasing distortion of assessment practices towards those which aim solely at assessing and recording the achievement of objectives. I call this combined effect the 'magnet effect' of the Technocratic/Bureaucratic ideology -- teachers beliefs and practices eventually become drawn into those of the dominant ideology. Teachers need to learn to subvert the anti-educational components of the dominant

ideology, and to write policy statements for their schools which protect good teaching practice.

1.2 Curriculum Categories

If teachers are to be presented with a framework of categories which they can use to identify their own beliefs, values and practices, what sort of framework will be most suitable? The choices would seem to include: A framework of educational ideologies, such as Skilbeck's (1976), or more simply, Lawton's (1983); a framework of ideologies of mathematics education, such as Ernest's (1991); a framework of learning theories in mathematics education, such as Resnick and Ford's (1981); or a framework of curriculum approaches to mathematics teaching. The question is which of the options produces the best point of entry for teachers? I believe that a framework of curriculum approaches, although more complex and difficult to describe, is the one which best links with the intuitions of the culture of teachers. Such a framework uses the complex of integrated concepts and perceptions which teachers routinely use in the classroom as the point of entry. It recognises that teachers have a unique feel for classroom activities, and for the student work and dialogue which arises as a result.

So what is a curriculum category? It is a loose amalgam of a number of features, with one or two being dominant. It is not a neat, systematic, arrangement, just as the nature of teaching and learning is not neat and systematic. Each category in the framework needs to be sufficiently distinct from others, and each needs to have one or two features which give it a focus.

2. Modified Keitel Classification

The framework of curriculum approaches I am going to propose will use Keitel's classification, outlined in Howson, Keitel and Kilpatrick (1981), Howson (1983) and Bishop (1988), as its basis. I will modify it to make it slightly more idealised than the one Keitel originally designed.

2.1 New Maths

The New Maths curriculum had its origins in mathematics itself and showed little concern for pedagogical matters. It arose as a natural extension of the formalist and logicist (absolutist) philosophies of mathematics which had dominance at the time it was developed. This approach links most closely with Skilbeck's Classical Humanist ideology.

2.2 Behaviourist

This category has origins in educational psychology and favours a mechanistic approach to teaching. In a secondary form it appears as mastery learning. Standards based assessment with levels of achievement is often described in precise 'output' terms, and is therefore also behaviourist in form. Behaviourism was originally designed in part to transform education from a labour intensive process to a capital intensive one and for this reason, and the emphasis on outputs, it is closely linked to the Technocratic/Bureaucratic ideology.

2.3 Structuralist

This model has origins in both mathematics and cognitive development theories in psychology, and arose out of the work of genetic epistemologists who were examining the process of concept formation. The best known proponent of this approach within mathematics education is Dienes who built on the work of Bruner who was interested in both the processes and concepts which underpinned the discipline concerned. Dienes, however, focused more on the unifying concepts. I will use this latter feature as the distinctive approach in this category and leave the consideration of processes to other categories. This category is most closely linked to Skilbeck's Progressive ideology.

2.4 Formative

This approach has origins in developmental psychology and focuses on the natural structures of personal development. This approach is closely aligned to the Progressive ideology.

2.5 Integrated Environmentalist

This approach is based on the attempt to teach mathematics in contexts integrated with other subjects and the environment. This concept of integration is stronger than mere applications or context based learning. The approach is multi-disciplinary. Subject barriers are down-played, knowledge is seen as an integrated web. The approach to mathematics is fallibilist, and the approach links with that of Skilbeck's Reconstructivist ideology.

I propose, now, to extend the above framework of five categories to include three more. I need, in each case, to explain its unifying features, to justify the need for a new category, and to show

that it is sufficiently distinct from the other categories. The three categories I propose to add are (1) The Problem Solving approach, (2) The Cultural approach, and (3) The Social Constructivist approach.

3. Problem Solving Approach

The Problem Solving approach views problem solving (or the strategies for doing it) as an important structure within mathematics; in fact, one that makes many of the procedures taught in other approaches, redundant. Typically, these strategies, such as 'solve a simpler problem first', 'work backwards', and 'try extreme cases', are taught as a series of techniques which are then used within a range of content areas to solve problems. Despite the fact that there is an emphasis on mathematical processes within this approach, the underlying view of mathematical knowledge is more absolutist than fallibilist. The problem solving strategies simply enable the students to solve traditional mathematical problems (standard applications, and so on) using generic approaches. The emphasis on 'many ways of doing mathematics' does have a slightly fallibilist flavour.

Is this approach distinct from the other approaches mentioned? It is very similar to the Structuralist approach, but I characterised that approach as being mainly concerned with the structures based on content. This approach is based around a process structure. As with Structuralism, the educational ideology most closely associated with this approach is Progressivism.

4. Cultural Approach

I believe that there is sufficient interest in some circles for an approach to mathematics teaching which can be used by minority cultural groups within the education system. Some of these groups are asserting their cultural identity and seeking to improve the achievement of their members by establishing firm links between their culture and mathematics. One approach is to acknowledge that all cultural groups have developed their own approach to mathematics and that western mathematics is only one such manifestation (and even this has been enriched by a variety of other cultures). This approach views mathematics as a universal activity in which each cultural group participates. Bishop (1988) suggests that this universal activity can be thought of as comprising six groups of activities: counting, locating, measuring, designing, playing, and explaining. Accordingly, the cultural group in question identifies the ways it performs these activities within its culture and

uses this as the basis for an extended understanding of these activities, eventually encompassing traditional school mathematics. This approach views mathematics as a social product and accordingly has a fallibilist conception of mathematics. The Cultural approach has emancipatory aims and so ties in with the Reconstructionist ideology.

Is this approach distinct from other approaches? Once again their are similarities to the Structuralist approach with the structures being the universal activities. Some of these universal activities are process based and some are content based. Structuralism, as defined above has a content focus for structure. The embodiments are likely to be contextual and integrated with other areas of knowledge, thus having similarities with the Integrated Environmentalist approach. But the universal activities provide a structure not usually associated with this approach. I suggest that there are sufficient distinctive features associated with this approach, and sufficient interest in it as a style of education, to justify having a separate category for it.

5. Social Constructivist Approach

There is a growing body of literature supporting the view that mathematics teaching is a sense-making activity that is socially constructed and socially transmitted through a process which has been called enculturation (Bishop, 1988; Schoenfeld, 1992) and socialisation (Resnick, 1989). This strand of thought has a base in an area of cognitive psychology which sees cognition as a social phenomenon, and another in social constructivist and quasi-empirical approaches to the development of mathematical knowledge. The group of students is thought of as a fledgling mathematical community which is being enculturated into the expert mathematical community. The teacher has the responsibility of aiding this process of enculturation. Enculturation involves learning all the ways the expert community operates; the way mathematicians see things; the way ideas are explored; the processes of generating, justifying and validating knowledge; the mathematical values, such as rationalism, objectivism, control, progress, openness and mystery (see Bishop, 1988) held by it; the way it uses criticism-aimed-at-consensus; the way knowledge has a taken-as-shared quality. Each new generation of students reinvents mathematical knowledge afresh, albeit guided by their teachers. They reflect on their mathematical experiences. They form their own structures for the discipline using their own interpretations of the existing ones as part of their reference frame. They examine the value base, and learn about the way mathematical ideas have

emerged in the past. They take on the perspectives of the mathematical community, but do it with a measure of understanding about the place of mathematics in society. To this extent the approach is consistent with the Reconstructionist ideology.

Is this approach distinct from the other approaches? The approach has similarities with the Structuralist, Integrated Environmentalist, Problem Solving and Cultural approaches, but there are sufficient differences from each of these to warrant treating the Social Constructivist approach as a valid alternative. The process of enculturation is similar to the process of forming structures in the Structuralist, Problem Solving and Cultural approaches. However the process of enculturation is more far reaching (involving a combination of processes, ideas, values, and perspectives) than any of these approaches taken on their own. The 'learner forms his or her own structures' approach used in the Integrated Environmentalist approach has some similarities with 'remaking the structures of the passing generation', but the Social Constructivist approach is much more based around the discipline of mathematics, and its dynamic interaction with the community of mathematicians, than the multi-disciplinary Integrated Environmentalism.

6. How does the Social Constructivist approach resist the 'magnetic effect' of the Technocratic/Bureaucratic ideology?

Firstly, the Social Constructivist approach is inconsistent with the outputs, technique-oriented, behaviourist approaches. The Social Constructivist approach makes full use of all the developments in computer technology. Computers can use most of the techniques formerly taught using behaviourist approaches. Accordingly, more attention is put onto the aspects of mathematics which do not fit under the 'technique' umbrella; behaviourist approaches are not much use for teaching these higher order skills. Behavioural approaches are anti-mathematical, emphasising 'rule following' rather than 'rule learning'. The Social Constructivist approach emphasises mathematics as 'a way of seeing the world', and 'a way of knowing', rather than 'a way of doing' and 'a series of techniques'. Bishop (1988) proposes that the values of rationalism, openness and progress need more attention in a Social Constructivist curriculum and that the values of objectivism, mystery and control are over represented in current practice. The former values do not lead themselves to outcome approaches. Passing on of the values of a culture is an interactive, interpersonal process involving the use of humanistic and organismic rather than mechanistic approaches. Enculturation

focuses on shaping ideas and meanings not on behaviours and techniques.

Secondly, the Behaviourist approach inhibits the achievement of Social Constructivist goals. Within the Social Constructivist approach different points of view, errors and misconceptions become a focus for discussion and resolution. But with behaviourist techniques skills are taught in sequence with little attempt to search for, or explore, misconceptions. Behaviourist approaches encourage the students to learn that mathematics is a 'one way' subject - the teacher's way; that mathematics is a series of facts and skills; that answers and methods will be provided by the teacher; that mathematics is handed down by experts; that one should always have a ready method of solution for any problem; that learning mathematics involves mostly memorisation; and that doing mathematics involves a lot of practice in rule-following. These are contrary to the aims of the enculturation process.

Thirdly, the aims of the Social Constructivist approach cannot be met in output terms. Teachers, under pressure of time constraints, often give priority to the objectives which will be tested and leave out other goals, even though many of these other goals, e.g., metacognitive goals (such as learning to plan a problem solving activity) would lead to more effective learning. The developments of number sense, a feeling for reasoning under uncertainty, a predilection to quantify, mathematical values, mathematical perspectives, and metacognitive approaches, all inherent in the Social Constructivist approach, are not linear processes with well defined steps which pass through easily identified levels and are easy to assess.

7. Conclusion

I believe there is an urgent need to address the impact the impact of the Technocratic/Bureaucratic ideology. Teachers need our support. Perhaps the Social Constructivist teaching approaches will eventually be described as outputs and gradually become drawn into the behaviourist magnet? In this case I will propose finding another more resistant approach. My deeper worry is that the Technocratic/Bureaucratic ideology is more than just another set of beliefs and values; that it is more like a paradigm shift? In this case the strategy proposed above will be ineffective.

Agenda for Action (1980), NCTM

Bishop, A (1988) *Mathematical Enculturation* Kluwer Academic Publishers.

Howson, A (1983) *Curriculum Development and Curriculum Research* NFER-NELSON

Lawton, D (1983) *Curriculum Studies and Educational Planning* Hodder and Stoughton.

Polya, G (1945) *How to Solve it* Princeton, NJ: Princeton University Press

Resnick, L and Ford, W (1981) *The Psychology of mathematics For Instruction*, Lawrence Erlbaum, Hillsdale: N.J.

Resnick, L (1989) Teaching Mathematics as an Ill-Structured Discipline, In Charles, R and Silver, E (eds) *The Teaching and Assessing of Mathematical Problem Solving* NCTM.

Schoenfeld, A (1992) Learning to Think Mathematically: Problem Solving, Metacognition, and Sense Making in Mathematics, In Grouws, D (ed) *Handbook of Research on Mathematics Teaching and Learning* Macmillan: NY.

Skilbeck, M (1976) Ideologies and Values; Unit 3 of Course E203 *Curriculum Design and Development* Milton Keynes, Open University.

Smyth, J (1989) A Critical Pedagogy of Classroom Practice: Education Reform at the Chalkface *Delta*, 41, Massey University NZ