How Binary Thinking in School Mathematics Masks and Maintains its Coercive and Conservative Effects: A Poststructuralist Analysis.

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In this paper we contemplate the potential dangers of binary thinking in school mathematics. From a poststructuralist perspective, we suggest that binary thinking insinuates itself into classroom practices and relationships and supports or suppresses students' participation and sense of themselves as competent, numerate persons. As well, binary thinking is conservative in that it blinds educators and researchers, and the students themselves, to the long-term effects of discursive practices that can sometimes result in a 'dumbing down' of the curriculum and make authentic participation on the students' part a pretence.

A group of preservice teachers watched a video of two separate classrooms where upper primary school children were doing mathematics. The students from several classes had been streamed into 'ability' groups and the video showed the 'top' group (Group A) and the second 'bottom' group (Group B) of children. The preservice teacher who made the video presented the tape as evidence that ability grouping advantaged the better students; that these 'good' students, able to do the work set out for them, sat quietly working from the blackboard without interruption while their peers, not capable of completing the set work, inhabited a chaotic space of frequent interruption and a marked lack of attention to the tasks that had been set. Reminiscent of a study that McDermott (1976) had done with reading groups almost three decades previously, the preservice teachers noted that the 'top' students' chances of learning were maximised while the 'poor' students' chances of learning were minimised. As comment and conversation on the video continued, it was clear that the preservice teachers equated 'time on task' with the quality of the learning experience; that is, they took-for-granted that those students who were most 'on task' had 'good' learning experiences while those not on task suffered 'poor' learning experiences. This being the case, the preservice teachers thought that it might be best to avoid ability grouping altogether, though they were not sure how to go about providing 'good' experiences for all students in a classroom where there was a mix of mathematical abilities.

Of particular significance to this paper is that these preservice teachers freely invoked humanist notions of students as essentially capable or not of doing the mathematics and choosing to engage. They took for granted a pre-given, rational and autonomous human subject able (or not) to do the mathematics and keep on task; thus, when they saw 'good' mathematics students engaged in what they read to be a productive learning experience while the 'poorer' students spend very little time on task, they imagined that the level of engagement is a matter of student choice. That is, they imagined that the 'good' students choose to work quietly and consistently and the 'poorer' students choose 'off-task' behaviour. The preservice teachers engaged in binary thinking (good/bad students; learning/not learning; engaged/not engaged) which is acutely attentive to (perceived) student ability or lack of it but blind to teaching/learning processes that also influence what the students are able to learn and their engagement levels. From a poststructuralist perspective, we suggest that binary thinking is dangerous; it coercively and invisibly

influences instructional practice, yet in operation in the classroom it systematically reinvents and sustains itself in the practices it generates.

While mathematics educators and researchers have always been interested in the classroom production of mathematical ideas, patterns and relationships, we build on this foundation to examine also the production of the numerate self; a process whereby students come to know or sense themselves as legitimate participants (or non-participants) in the school mathematics discourse. We imagine that this knowledge of self, constituted in schooling practices, accounts for the "quite negative attitudes" (*A National Statement on Mathematics for Australian Schools*, 1990, p. 31) of many students towards mathematics and the disposition (or not) to further pursue mathematics related subjects and assignments throughout and after school. Because students' futures are made imaginable in the present and so 'real' in the present (Davies, 1994), it is necessary to move beyond 'ability' talk to focus on both the intellectual and social qualities of teaching/learning (discursive) relationships. As the paper unfolds, we contemplate both the epistemological and ontological elements of 'quality' relationships in mathematics education from a poststructuralist perspective. We hope to revisit and further illuminate a point that Kilpatrick and Silver (2000, p. 225) make: "As long as ability is taken as a rock-solid property of the individual…it undermines a commitment to ensuring that all students receive an optimal education in mathematics".

Making the Discourse of School Mathematics Visible

Within the discourse of school mathematics students construct knowledge as they are themselves produced as (in)numerate subjects. School mathematics is a discourse which "provides a set of possible statements about a given area, and organises and gives structure to the manner in which a particular topic, object, process is to be talked about" (Kress, 1985, p. 6). While this conscious and controlling aspect of the operation of school mathematics can be made visible to the eye crafted to see it, the body, emotions and unconscious mind are also constituted through discourse. As Weedon (1987, p. 108) states: "Discourses are more than ways of thinking and producing meaning. They constitute the 'nature' of the body, unconscious and conscious mind and emotional life of the subjects which they seek to govern". Here Weedon (1987) makes reference to the often unconscious and invisible feelings of illness, or elation, that sweep over and through persons engaged in mathematics related tasks and activities. While previously such feelings were thought to be 'owned' by the student, and directly attributable to an inherent (lack of) ability or attitude, a poststructuralist analysis of discursive classroom practices is sensitive to how these feelings are actually produced in classroom interaction, how they could be different, and how they are constitutive of an individual's establishing her/himself as numerate in the social and academic world.

A poststructuralist analysis of classroom practice is interested in the *quality* of the learning context and teaching/learning engagements that participants are creating for each other. It is interested in what is happening now, because mathematical identities are *in process*, produced in the now and the future and they influence participation in mathematics related discourses now and in the future. In school mathematics, a poststructuralist analysis uses the concepts of subject position, positioning and storylines to make visible how discursive practices support or suppress students' recognition of themselves as innovative, numerate individuals. McDermott (1976), for example, showed how the students he researched were constituted or produced, and how they actively established themselves, as 'good reader' or 'slow reader' within the discursive practices

and uses of language in the classroom. In the 'slow' reading group the students had to bid for turns as the teacher believed they should not be embarrassed by being expected to read passages they might find too difficult. It was during this bidding process that the students lost direction; they lost their place, relied on the teacher's help and her signalling that they had been chosen to read. When the teacher left the group they engaged in 'anarchy' which could be read as a strategy to bring her back on task as their support (Davies, 1994). What McDermott (1976) makes visible here is the productivity of the interactive teaching/learning process whereby the teacher positions the students as 'in need of help' and 'not to be embarrassed', and the students actively take up this positioning as learners in need of the teacher's constant support and supervision. Through discursive interactive processes such as these the 'slow readers' are daily (re)constituted while their teacher's identity as a caring and supportive educator is sustained.

The Coercive Force of Binary Thought

What one 'sees' in classrooms is strongly influenced by one's interpretive lens (which, from a poststructuralist position, is constituted or crafted through participation in multiple discourses throughout life). The preservice teachers, coming from a humanist view of learners as essentially rational and autonomous, saw the 'good' group of students quietly working from the blackboard and textbook and they spoke unreservedly of the 'good' learning experiences these students enjoyed. To the preservice teachers, the students in classroom 'A' seemed to know what to do and how it was to be done. These students settled into a routine of averting eyes to the board, writing in text or pad, to again looking at the board. This routine was rarely interrupted except for occasional 'rubbing out' and a furtive glance to see what the person next door was doing. No student walked around, and very few words were spoken, except by the teacher who roamed around the room clarifying what had to be done. To the preservice teachers this learning environment looked to be very productive; they noted how the students made the rational choice of getting the work done, as they occasionally paused only for a moment to consult the teacher to make sure they were on the right track.

From a poststructuralist perspective, the 'good' students are not essentially so, but are so constituted through how they are positioned in the classroom. The subject position 'good' at mathematics is made available to them, and they are coercively enticed to take up this positioning and enact it in classroom activities (discursive practices). In teaching/learning interactions the students are respected and valued for their knowledge and ability to perform, they are expected to work hard, covering a lot of work and not straying from the task. These students are given 'harder' work than the others and they are expected to be able to do it. If they can not, the teacher steps in as guide and mentor. Co-incidentally, of course, the teacher is able to establish himself as the creator of a productive learning experience for his students. As McDermott (1976) states:

> A teacher cannot maintain the positioning of a teacher without the help of students…people are each other's contexts in that they form an environment for each other about the reality of that environment for each other and offer feedback to each other. (pp. 94-5)

The students and teacher position each other as competent in carrying out the tasks demanded of them. In poststructuralist terms, the teacher is able to achieve himself as a legitimate or 'good' teacher as the students similarly achieve themselves as competent in the discourse of school mathematics (as it is constructed in this classroom).

In classroom ‘B’ the ‘poorer’ students were not nearly so engaged. Although the set tasks were similar but cast at a lower level to those in classroom ‘A’, the students were not focused on them. The students in this classroom actively took up the subject position offered to them, that of ‘poor’ at mathematics. Although the preservice teacher who made the video stressed the classroom teacher’s strong commitment to these children and to their active engagement in learning mathematics, attention to task (on the part of teacher and students) was not at all evident. The students found any and every excuse not to do the mathematics; they walked around the room, two of them wrestled on the floor at the front of the room, one girl sat the whole lesson with her hand up bidding for attention. While the teacher sat with a couple of students throughout the duration of the video and ignored the others, ‘rubbing out’, chatting, re-arranging tidy boxes and colouring in took up a significant amount of the students’ time. The preservice teachers were concerned that the students were choosing not to do the mathematics (that they were not making a rational choice to get on with it) and they spoke of ‘avoidance’ tendencies exhibited by the students. While the preservice teachers took a deficit (humanist) view of the students’ ability and consequent lack of attention to the mathematical tasks, a poststructuralist concern for how students are positioned and constituted as ‘not able’ in teaching/learning engagements provides an alternative reading.

Just as the students in classroom ‘A’ actively rise to the challenge and achieve themselves as the ‘good’ students, those in classroom ‘B’ achieve themselves as those marginalised from and not competent in the discourse. Discursive practices, such as unsupervised blackboard and textbook work, the teacher’s sitting with his back to most of the class and allowing them to leave their desks and walk around the room, intersect to position the students and teacher as participants in an alternative discursive rendition of school mathematics. The students here do not have the knowledge or skills of the students in the other class, nor are these made available to them. They are positioned in their learning as marginal participants in a discourse known as ‘school mathematics’ though the discursive practices do not strongly support their learning of mathematics. Perhaps the teacher has been constituted through discourses that subscribe to the storyline that less ‘capable’ students should not be challenged or made to do something they do not want to do; so they are allowed to work on their own, but without direction or support. In this way, the students may sense that the activities are just too hard for them or not all that important, so they switch off and find something else to do. The teacher, for example, reinforces the notion that the most important thing is just that they ‘cover’ or complete the work, not that they understand it; he says “those who have not finished 1 and 2, just leave them and go on to 3 and 4”. It would be extremely difficult for these students to establish themselves as ‘good’ at mathematics and able to use mathematics in powerful ways in this classroom!

Discourses, says Foucault, form the objects of which they speak (Scheurich, 1997). Here the ‘good’ and ‘bad’ mathematics students are formed within the discursive practices of their classrooms. Similar (humanist) storylines about good/bad, motivated/unmotivated students permeate the teaching/learning practices and interactions in each classroom and are (re)constitutive of teachers and students. It is interesting though that the teachers are read by the preservice teachers to be ‘good’ and ‘supportive’ even though the students in classroom ‘A’ work quietly from set texts with little input at all from the teacher, and those in classroom ‘B’ do little or no mathematics. That teachers can be seen to be doing good and productive teaching when it is permeated by such low levels of intellectual challenge and rigour and productive participation is worrying for the future of mathematics education; it contributes to the continuation of teaching-mathematics-as-usual and to the

many disenchanted and disenfranchised students who hate mathematics and wouldn't do it even if they could (Willoughby, 2000).

How Binary Thought Acts Conservatively in Mathematics Education

From a poststructuralist position we have argued above that it is not that the students are essentially 'good' or 'bad' at mathematics. Rather, it is that they find themselves in discursive spaces where they are positioned as legitimate participants or marginal or incompetent or not making the right sort of effort (Davies & Hunt, 1994). In a discourse such as school mathematics students are *subjected to* discursive practices (such as teacher explanations, doing 'tables' and long division operations, sitting in desks in rows or groups completing worksheets) and simultaneously made into speaking, acting *subjects* who can participate in more or less powerful ways in the discourse. To be powerful, students must be able to speak and write the constituted 'truths' and practices of the discourse (epistemological), and have a sense of themselves as able to go beyond established knowledge and practices to forge new (to the student) understandings and representations (ontological). In school mathematics, then, it is necessary for students not only to know the procedures, skills and facts of mathematics but to be positioned in such a way that they are able to 'fly alone', to construct new knowledge, to investigate and problem solve in/for the full appreciation of the power of mathematical ideas, patterns and relationships. However, in many classrooms, as in 'A' above, a teacher coming from humanist understandings of individuals takes autonomous and productive engagement for granted, at least for those 'good' at mathematics, and does little to nourish the depth and breadth of the epistemological (knowing that/knowing how) and ontological (being/becoming) quality of the educational experience. Similarly in classroom 'B' the students are seen to be choosing not to behave rationally and autonomously, and they must wear the blame for a total lack of any form of recognisable mathematical activity in the classroom. In this way, binary thinking and labelling or classifying students as 'good' or 'bad' is conservative; no matter what, 'good' students choose to be seen as competent in terms of the dominant discourse and 'poor' students make poor choices. There is little recognition of the fact that children said to lack ability in mathematics "merely lack the appropriate opportunities to learn" (Kilpatrick & Silver, 2000, p. 225).

In classroom 'A' the teacher is produced (and produces himself) as the master, and the students are his apprentices. Discursive practices, such as completing pages of the textbooks and copying off the blackboard take on the didactic posture of traditional teaching (where the teacher and text are authorities, and students listen, copy and learn). From a poststructuralist perspective, such practices are epistemologically and ontologically unproductive as deep understanding is compromised and students do not get to establish themselves as competent in the "chaotic processes of exploring, defending, and arguing their own approaches" and ways of making sense of the mathematics (Forman & Steen, 2000). The students take on the subject position of needy recipients of knowledge; this positioning, with that somewhat contradictory positioning of 'good' at mathematics, is constitutive of their mathematical identity *in process* and will influence how they feel about mathematics as a field of inquiry and whether or not they continue to use and learn mathematics after school. However, it may be that the subject position 'good' at mathematics is such a privileged positioning that it will get them through, for as Paechter (1998) states:

> Mathematics provides a fantasy of power and control which, although at least on one level chimerical, is part of a discourse in which those seen as having 'mastery' of it are given a real (in

> the sense of exercisable) power, arising from its possession, rather than from the knowledge directly. (p. 65)

Whether or not this is the case for all those students deemed 'good' at mathematics, it will be worrying if they end up in careers such as teaching where having covered the work and 'getting through' will not be enough!

In classroom 'B' there is little or no mathematics being learned or taught. A discourse of mathematics *education* is not in operation. An alternative discourse, of a particularised understanding of social responsibility or care has overwritten mathematics education and the students struggle to establish themselves as active participants within the confused discursive spaces. Although they sit with textbooks in front of them, and they and their teacher see themselves as engaged in a mathematics lesson, little that could be recognised as mathematical knowledge or skills is in evidence, and the students have little or no opportunity to recognise themselves as active, engaged learners. The preservice teachers observe that the children in classroom 'B' are choosing to avoid the mathematics, not to engage and put in the effort. However, discursive practices that position them as invisible as numerate subjects can only court a lack of engagement.

While one could argue that at least there was some mathematics done in classroom 'B' by the students who sat with the teacher, and humanists could say that the context was supportive and some of the children at least had fun, poststructuralists decry the discursive practices that produce these students as 'not able', 'non participants' and 'not making enough effort'. The teacher makes no effort to teach the knowledge that they have to know, the knowledge that will be a first step towards establishing themselves as competent in the discourse. There is no opportunity to speak what they do know, to ask questions about what they do not know or probe the depths of their understanding and that of their peers. There is no opportunity for these students to have a sense of themselves as creative, numerate persons. It could be argued that they endure a discourse that affords them more harm than good; they are given no opportunity to learn the mathematics and establish themselves as competent, yet this lack is seen to be a matter of personal deficit and lack of effort.

Conclusion

From a poststructuralist perspective 'good' and 'bad' students are not born but invented; invented in a multiplicity of discursive practices that coercively mould and shape them over time. This, we have argued, has important implications for mathematics education. While mathematics educators and researchers have always been interested in 'quality' learning experiences, most often this has referred to quality in cognitive constructions, made possible through in-depth engagement in thinking processes such as conjecture, generalisation, estimation and so on. Such cognitive growth is indeed important, though embodied, engaged participation on the students' part can be sacrificed at its altar. In this paper we have suggested that streaming students into ability groups can coercively and conservatively affect practice in mathematics education. We invoke the poststructuralist notion that students' identities as mathematically able are discursively produced, influenced as much by how they are positioned as learners as by their cognitive growth. Quality learning experiences involve students in not only constructing the mathematics, but in also finding the discursive spaces to recognise themselves as competent and confident mathematicians, as equal partners in the initiation and construction of intellectual and social knowledges in the classroom.

We find the possibility that mathematics educators and researchers might come to think and speak from multiple positions within discourses such as mathematics education exciting. As Davies (1994) states:

> While consistency and total coherence are pleasurable and satisfying, they involve a large degree of selective perception and ignorance: we need to live with contradictory discourses because we live in a profoundly contradictory world with multiple and contradictory positions and discourses which go to make up that world. (p. 35)

This is no more true than in mathematics education where psychological and sociological perspectives already inform practice and poststructuralist viewpoints are beginning to make a contribution. The poststructuralist contribution is to disrupt the mind/body binary; to recognise not only the intellectual but also the constitutive powers of discourses such as school mathematics. The freedom we enjoy to deconstruct the taken-for-granted of binary thinking in mathematics education, though on the one hand unsettling, is also important, as Luke (2003, p. 59) suggests: "not just to the sustainability of educational theory, but to the task of continually remaking and transforming everyday practice".

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