

## ENGAGING PEDAGOGIES IN EARLY MATHEMATICS EDUCATION: FOSTERING AUTONOMY OR THE CRUELEST REGULATION?

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The argument I present in this paper revolves around different interpretations of just what an ‘engaging pedagogy’ in mathematics education is, and the potential effects on learners and their learning of mathematics. As a teacher educator, I have become increasingly aware that preservice teachers, especially those intending to teach in the early years of schooling, are often drawn to overly naïve notions of ‘having fun’ as the sole criterion of engagement, with all sorts of serious implications for their future teaching of mathematics. I use the poststructuralist notion of the intersecting forces of power/knowledge/desire to analyse some of the preservice teachers’ conversations and submitted pieces of work to argue that these prospective teachers actively strive to *protect* their pupils (and themselves?) from the mathematics. While teacher ‘desire’ is rarely spoken of or indeed researched in mathematics education, I argue that we ignore it at our peril; it can move mountains or it can silently and imperceptibly ensure that everything in mathematics education remains just as regulated and unchanging as it has always been.

It is my impression that young children are quite fascinated by mathematical ideas and have an easy and energetic way of working with numbers and spatial concepts when they come to school (Askew and William, 1995; Hughes, 1986). Indeed, young children are able to solve simple problems and count purposefully with few mistakes (Lambert, 2000). Over time, though, this fascination fades and these very same students are not backward in asserting that they no longer like mathematics, or the learning of it. How is it that so many students come to lack engagement with mathematical ideas and ways of thinking, feel anxious in mathematical investigation and remain more or less ignorant of the powerful thinking that ensues from a firm grasp and appreciation of the patterns and logical relationships that structure the disciplinary field?

This is not an easy question to answer, though it is an important one. It is important because it is at the core of ecological, social and economic sustainability. No longer is it adequate to have school leavers who can merely pass tests; sustainability demands that all persons have developed a creative mathematical energy that enables them to act in generative and innovative ways, to ‘think outside the square’ and be confident and competent enough to action that thinking. To this end, new pedagogies and learning environments are advocated (Queensland Studies Authority, 2006) that focus on learning mathematics through real life situations, investigation and play. It is anticipated that the focus on young persons as capable and creative initiators of learning, problem solving and the communication of ideas will not only challenge and support them in constructing mathematical knowledge, but also operate in ways that maintain and extend interest and confident engagement in mathematical tasks and investigations in, and after, schooling. While the suggested new pedagogies have a firm grounding in extended, rigorous research, I wonder about their implementation and maintenance in schools. My concerns stem from the fact that the mooted changes do not merely tinker at the periphery of one’s established teaching practice, but qualitatively change teaching-learning relationships to emphasise the active and productive role of pupils (even very young pupils) as initiators of learning and creators of knowledge. From my work with prospective teachers

of mathematics in the early years, I have begun to sense that the mooted changes, to do with changing power relationships between teacher and student, might be more difficult to realise in practice than anticipated.

The policy documents, of course, speak to humanist educators, rational, autonomous teachers who are expected to appreciate the importance of the new inquiry-based, or investigative ways of teaching and learning, and will supposedly be able and willing to implement these new ways-of-being a teacher in the early years of education. However, it has been my experience that many prospective teachers hold on tenuously to notions of what is engaging that, I suspect, have a conservative influence over their classroom practice. At school they were subjected to discursive practices that led to a constituted *knowing* (Lather, 1991) about how mathematics should be taught and learned. Through relations of power, the social world of the classroom inscribed itself on them, establishing teacher and text as dominant and themselves as learners as support or subsidiary to the smooth operation of the school mathematics discourse. Although in contemporary terms the coupling of the controlling teacher and the subservient learner would not be seen to operate in the students' best interests, preservice teachers have taken up these relative positionings as their own, and see them as highly desirable (Davies and Gannon, 2005). The preservice teachers' professional, embodied sense of how mathematics education is done are intrusions from past school days, yet they "defend them and desire their maintenance" (Davies & Gannon, 2002, p. 319).

In this paper I use feminist poststructuralist concepts of power/knowledge/desire not to analyse the preservice teachers' constructions of gender, but their constructions of what constitutes an engaging pedagogy in mathematics education. I examine their 'performance' of themselves as early years educators reproduced in assessment pieces and conversation. I argue that their constituted sense of themselves as 'teacher' and their pupils as learners of mathematics, run counter to those espoused in recent policy documents, and are likely to have a detrimental effect on classroom practice. While the epistemological dimension of professional development as a mathematics educator is always important, and well documented in research, a poststructuralist analysis adds an ontological aspect that has something to offer about *how* it is that (novice) teachers come to interact in certain ways with pupils in classrooms.

### Poststructuralism

Within poststructuralism language is recognised as "the common factor in the analysis of social organisation, social meanings, power and individual consciousness" (Weedon, 1987, p. 21). The uses of language that I cite in this paper do not reflect social reality but constitute what it taken to be real. Discourses, it is said:

are ways of constituting knowledge, together with the social practices, forms of subjectivity and power relations which inhere in such knowledges and the relations between them. 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" (Weedon, 1987, p. 108).

In poststructuralist analyses of practice then, the previously assumed rational, autonomous novice teacher gives way to one responding to the play of desire and the unconscious, constituted within discourses throughout her/his life. Of relevance to this research is the notion that the preservice teachers' positioning within the discursive fields of child care, child development, behaviour management and mathematics (to name but a few) seems to prejudice, in some ways, their achievement of themselves as the generative teachers of mathematics proposed in policy documents. Within these humanist discourses relationships of power circulate to render particular ways of being a teacher (and adult) desirable. However, it may be, as I suggest in this paper, that the preservice teachers' previously (and currently) constituted interactional patterns can prejudice their pupils' learning of mathematics, and their achievement or sense of themselves as capable and competent learners.

The data that I present in this analysis do not stand as *evidence* of some truth about preservice

teachers and their teaching of mathematics. Rather these data reveal processes of subjectification at work. Through an analysis of the data, I as researcher, have access to the constitutive effects of the discursive practices through which the prospective teachers are now establishing themselves as teachers of mathematics. These data reveal just some of the many ways-of-being a teacher that are spoken and written into existence in this one particular context, early years' mathematics education within a teacher education program. My own collection and analysis of data also reveal processes of subjectification at work; a particular interest in poststructuralist analyses of practice are born of intersections of power/knowledge/desire out of which have grown this socially constructed approach to educational research.

### Prospective Teachers Establish Themselves as Teachers of Mathematics

Mathematics education in the early years is firmly grounded in theories (Queensland Studies Authority, 2006) that foreground pupils' personal construction of meaning through active engagement in investigative learning processes. In the teacher education program, prospective teachers gradually come to a sound understanding of the concept of investigative inquiry in the early years of education. This understanding is enhanced by inquiry based participation in tutorials where preservice teachers work together to construct concepts of how young children might actively and concretely represent mathematical ideas as they engage in learning mathematics as a social practice. Thinking and reasoning mathematically is highlighted, as it is through these processes that pupils are seen to build robust understanding, leading to competent and confident application in out of school contexts. In each of these sites (university and school) an engaging pedagogy is theoretically one that makes spaces for learners to construct their own meaning and sense of mathematics (and the teaching of it) through active and generative participation. However, as I hope to demonstrate in this analysis, this construction of what is engaging does not always translate into the novice teachers' practice. A poststructuralist lens makes visible how past discourses tend to fashion the prospective teachers' desire for interactional patterns in direct contrast to those proposed above. In following sections of the paper I examine briefly some of the preservice teachers' responses in (a) a poster heralding the positives of inquiry-based or investigative knowledge construction in mathematics, in (b) planning investigative tasks and in (c) critical analyses of classroom practice.

#### *The Poster*

The preservice teachers were asked to plan an A3 poster for a parent/teacher night at a school where an inquiry-based (or play based) approach to teaching mathematics was to be used. Their task as teacher was to convince parents and guardians that this new approach has a lot to recommend it. Using limited text and small photos and icons they were to depict the types of tasks pupils would be engaged in, the talk and tools or resources that would comprise the learning environment. Criteria for assessment (each marked 0-5) included:

- Demonstrated knowledge and comprehension of the proposed changes in the teaching and learning of mathematics;
- Clear indication of what these changes mean for classroom practice;
- Clear indication of the effects these proposed changes will have on learners and learning, and
- Presentation

The submitted posters were big and bold in presentation demonstrating for the most part very effective use of colour and various technologies. Pupils sitting in groups and the use of calculators and computers were commonly represented, as was the proclamation "Maths is fun!" most often in large letters. The abundance of smiling children and teachers might very well present a compelling and convincing argument to interested parents! However, there was something missing from many of the posters: the mathematics. In very few posters was there mention of thinking and reasoning as key to mathematical tasks, and pupil initiated talk focusing on the mathematics (rather than a procedure to get a correct answer). Tools or resources were of the

manufactured variety and there seemed to be little recognition of those resources brought to the learning of mathematics by the students themselves; their past experiences and their inherent interest and motivation.

While there are many readings that could follow on from the data above, a poststructuralist analysis recognises in the posters the preservice teachers' constructions of an engaging pedagogy and learning environment in mathematics. The preservice teachers desire a safe and happy learning space for the children in their care, full of fun and active participation. While one reading (from a humanist perspective) might suggest that the preservice teachers allow the active engagement and 'fun' to elide the mathematics because they don't feel confident with mathematical knowledge themselves, a poststructuralist reading makes a further contribution that has additional professional development implications. Lack of attention to the mathematics may also have to do with the preservice teachers' constituted subjectivity and their subject positions within the intersecting discourses of mathematics and education. While they may have a sense of themselves as nurturing and caring adults, well positioned within the educational discourses of child care and development, this positioning may not extend to the discourse of mathematics. It may be that their emotions and unconscious mind draw them away from participation in a discourse within which they felt, and continue to feel, so powerless. Even if they could 'catch up' on the mathematics, this catching up process can not be separate from a lingering sense of alienation and frustration constituted in previous encounters with mathematics.

#### *Mathematical Inquiry and Investigation*

The preservice teachers were also asked to plan and suggest assessment techniques for some investigative, play based mathematical tasks. They had to identify the key mathematical concepts under construction and link to the appropriate syllabus outcomes. An important part of this assessment piece was that they provide indications of where and/or how pupils might be engaged in inquiry based processes of thinking, reasoning and working mathematically.

While in the poster the learning of mathematics was 'dressed up' with colourful presentation, stickers, glitter and, in one case, the attachment of buttons, the attention to cosmetic appeal was also evident in lesson plans. In this case though, attention focused on the mathematics itself. Common themes popped up throughout the planning, each mentioned in an attempt to make the mathematics more palatable to pupils. First, there was reference to making the mathematics 'relevant' and 'real world' to ensure learner engagement. Proposed tasks here centred on telling the time, participation in classroom based shopping activities and calculation. Often the tasks were presented on attractively drawn worksheets, depicting space ships (for example) with numbers to be added printed on them. Second, an added art component seemed to be one way of ensuring engagement. One student stated: "This activity has an art component, so the children will probably be engaged". Rewards were seen to be efficient in ensuring engagement, with, in one case, Easter eggs handed out for plane shapes correctly identified. More common was colouring in as reward for early completion of an activity.

Again, there are as many readings of these data as there are mathematics educators and researchers; however, a poststructuralist lens makes visible the issue of power relationships. The preservice teachers are constructing themselves as teachers who can make everything relevant and engaging for their pupils. Within intersections of power/knowledge/desire they are holding on like grim death to a subject position that feels so right to them. A problem arises, though, in that the learners' subject positions may well be compromised. Using Lather's (1991) notion of constituted *knowing* constructed through discursive practices, we can imagine that young learners may (a) *come to know* mathematics as something that is *not* inherently relevant and engaging (since it has to be dressed up to appeal) ; and (b) they may construct the sense that they themselves have to be nurtured and supported through it. This positioning of young learners is in contrast to policy documents such as the Early Years' Curriculum Guidelines (2006, p. 8) which state: "Children are strong, rich and capable. All children have preparedness, potential, curiosity, and interest in constructing their learning, negotiating with everything their environment brings to them" (Lella Gandini).

### *Critical Analyses of Learning*

A weekly event in the preservice teachers' program is the analysis and discussion of various examples of teaching mathematics. Together we examine interactional patterns to talk about those we see as particularly mathematically productive, and/or productive in the sense that pupils are given the opportunity to recognise themselves as capable and competent learners. I sometimes use short excerpts from the Department for Education and Employment's (DfEE, 1995) implementation of the national numeracy strategy in the United Kingdom. These are thought provoking examples because although the mathematics is clearly visible, there is little opportunity for pupils to engage with it in ways that value their initiative and independent thought. A variety of rubrics are used to analyse these interactions (including those the preservice teachers have constructed themselves), in an effort to convince them that different educators and researchers are looking for different things in teaching-learning interaction.

I often find the discussions in these sessions confronting. At an intellectual level of course the preservice teachers usually have no trouble identifying those instructional practices that are productive and those that are not (they can reproduce the hegemonic discourse). The problem arises (for me) in that they do not operate only on an intellectual level. Even when they have identified a teaching episode devoid of mathematical challenge, thought and learner initiative, embodied desire enters the discussion and the preservice teachers contend: "I know what you want me to say, but I want to *be* just like that teacher. She is so in control and sure of herself. The pupils are having fun". Some of these intending teachers at least desire a regulatory regime where intersections of power/knowledge/desire afford them the subject position as teacher they seek. I suppose the reason I find these discussions confronting is that intersections of power/knowledge/desire do not afford me the subject position I seek; as author of discursive practices out of which are born new educators able and willing to interact in new ways with pupils in teaching and learning mathematics.

### Implications for Teacher Education

However, I am optimistic that there may be a small window of opportunity for teacher education to accomplish something quite different from what has been attempted in the past. Subjectivities and professional practice are not set in stone, and are amenable to influence by all manner of discursive practices. New mathematics educators are produced in social spaces where power and knowledge circulate unpredictably and where identities are always tenuous, in process, vulnerable (Davies & Gannon, 2005). As Butler (1997, p. 14) suggests:

As a subject of power (where 'of' connotes both 'belonging to' and 'wielding'), the subject eclipses the conditions of its own emergence; it eclipses power with power...the subject emerges both as the effect of a prior power and as the condition of possibility for a radically conditioned form of agency.

A first step in teacher education might be epistemologically founded and ensure that novice teachers have something of consequence to teach in mathematics. However, one has to be careful about how this is done; it is important not to dredge up old feelings of dread and despair. Perhaps it would be helpful to position the preservice teachers as teachers-in-process (rather than as students having to come up with the answers tutors want) and have them collaboratively investigate play based, investigative activities that could be used to have their pupils construct key mathematical ideas; for example, those of patterning, equality, number sense, partitioning, spatial and number relationships. In this way, they would be able to actively take up the subject position of teacher, and produce activities (and subjectivities) supportive of their achievement of themselves as competent teachers. A second task, the most important and difficult, would be to have the novice teachers recognise the productive power of pedagogic interactions and relationships. They need to be able to recognise what is happening to their pupils when they molly-coddle and pamper them. They should come to sense the importance of actually teaching some rigorous mathematics and realise that if they do not do so, their pupils will never achieve the subject position in the discourse of mathematics that is their right. Perhaps the preservice teachers could begin to sense the constitutive force of discourses such as mathematics education by recognising their own constitution as

potential teachers as historically specific and socially regulated, and thus able to be called into question (Davies & Gannon, 2005). They could ponder and share how particular ways of being a teacher of mathematics are convincing and compelling, and others not. As they become aware of the constitutive force of previous and current discourses, and strive to become recognisable (to themselves and others) as teachers of mathematics, they may sense the vulnerability of learners denied an energetic and active presence in learning mathematics.

### Conclusion

It was Ball (1988, p. 40) who first drew to my notice the fact that "...lack of attention to what teachers bring with them to learning to teach mathematics may help to account for why teacher education is often such a weak intervention – why teachers, in spite of courses and workshops, are most likely to teach math just as they were taught". However, while I agree with the sentiment, poststructuralist proclivities do not allow me to imagine that new instructional practices will evolve from cognitive (re)constructions or 'unlearning' old patterns as Ball (1988) suggests. Rather, it may be that new teaching-learning patterns can only grow out of an embodied sense that new ways of interacting with students are desirable, founded on new appreciations of learners and the learning of mathematics. In teacher education some sort of intervention is needed that "plugs into the economy of desire" (Venn, 2002, p. 66) and recognises that novice teachers will interact in investigative, inquiry-based ways with their pupils in classrooms only when they have established an embodied sense that this is how mathematics education *must* be done.

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