Mathematics Teacher Education and Development 1999, Vol. 1, 84-93

The Construction of Agency in Mathematics Teacher Education and Development Programs: A Poststructuralist Analysis

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In this paper I question the philosophical adequacy of past and present humanistic notions of agency which frame practice in teacher education and development programs. I look back over the past ten years or so of primary and early childhood teacher education at some initiatives that have been attempted but found wanting with regard to students' acceptance (Schuck, 1996) and eventual competent implementation of innovative teaching approaches (Klein, 1996) in mathematics. I suggest that perhaps a poststructuralist understanding of the discursive constitution of subjectivities may go some way towards explaining this apparent stasis; as well, in teacher education, it may be constitutive of a certain kind of agency for preservice and practising teachers.

Mathematics teacher education and development in Australasia has not been immune to the meteoric rise, and eventual inevitable questioning, of so-called "constructivist" approaches to teaching mathematics. All such approaches are broadly based on a view of knowledge as constructed through active engagement in one's experiential world and this view of knowledge quickly gained favour, at a theoretical and policy level at least, over alternative views of knowledge as facts, skills and so on, to be transmitted. The (often unstated) assumption was that personally constructed knowledge would be more readily applied in the "real world". Along with this view of knowledge, came a new role for the teacher. The teacher was no longer to tell or transmit knowledge, but to act as a facilitator in the student's personal construction of meaning. To this end, the teacher was to "provide the setting, pose the challenges, and offer the support that will encourage mathematical construction" (Davis, Maher & Noddings, 1990, p. 3).

Constructivism officially found its way into teacher education in Australia via the *Discipline Review of Teacher Education in Mathematics and Science* (1989). The pedagogical implications drawn out in this document were that teacher educators should allow preservice teachers to construct their own knowledge through problem solving, exploration, conjecture and invention, through working in groups and learning to communicate mathematically so that they would replicate this approach later in schools. The role of the teacher educator was that of a "partner in the construction of knowledge", rather than that of a "giver of knowledge" (*Discipline Review*, 1989, p. 29). Ellerton and Clements (1989) recommended a similar role for teacher educators working with practising teachers where they would collaboratively plan and develop constructivist school mathematics programs.

At the level of practice, constructivism was embraced by many teacher educators around the world. A few examples come immediately to mind. Taylor (1990) undertook a collaborative research study at a local school where a

mathematics teacher attempted to implement "constructivist" pedagogy. Taylor (1990, p. 2), who relied on "cognitive perturbation" (challenge) to reshape the classroom teacher's concept of his role as teacher, concluded: "This study found that teacher beliefs moderate cognitive perturbation and, subsequently, restrict the nature and scope of teacher conceptual and practical classroom changes". Foss and Kleinsasser (1996) undertook an extensive qualitative analysis of preservice teachers' beliefs and practices relative to mathematics teaching and learning at various points throughout a mathematics methods subject which was taught in a "constructivist" manner. The researchers conclude: "The preservice teachers' beliefs and practices do not change during the methods course and they do not reconceptualise their roles as future elementary teachers" (Foss & Kleinsasser, 1996, p. 441). I, too, have keenly embraced a "constructivist" approach with the preservice teachers in my mathematics methods subjects, and I, too, have noted that although the students learn some useful mathematical concepts that they had not previously understood, they tend to rely on transmission methods of teaching mathematics when in schools and when doing assignments for other lecturers in the teacher education program (Klein, 1996). As made clear by Foss and Kleinsasser (1996), the relationship between knowledge and beliefs and practice is much more complex than previously discussed in the literature; and, I might add, as previously imagined by teacher educators such as myself (Klein, 1997).

From these few studies it is clear that during the 1990s some teacher educators at least put their faith in humanistic discourses which take agency to be an unproblematic feature of rational adult human beings. The underlying expectation was that teachers taught, for example, in a "constructivist" manner, would later implement a similar pedagogical approach in schools (*Discipline Review*, 1989). In the remainder of this paper I argue that poststructuralist theory, in particular the concept of constituted subjectivity developed in large part in contrast to humanistic understandings of the individual agent, may shed some light on why established pedagogies are so resistant to change. It may also be true that this view of the discursive construction of knowledge will provide a firm foundation from which to work for pedagogical and social change.

Mathematics Education as a Discourse

A poststructuralist view of knowledge holds that as long as we live we are positioned within discourses and are actively involved in learning. "Discourses", states Burman (1994, p. 2) "are socially organised frameworks of meaning that define categories and specify domains of what can be said and done". There is no moment or place where we can remove ourselves from the influences of the social world and the vast array of discourses it comprises. In place of a humanistic, unitary individual, poststructuralism posits a multiple, changing, cultural/gendered/ethnic embodied self with a constituted subjectivity or identity which in turn influences the discourses within which one acts (Davies, 1996).

This notion of constituted subjectivity is particularly relevant to teacher education as it causes us to delve more deeply than we may have in the past

regarding the possibilities for teacher agency and change. It means that the preservice teachers, and we ourselves, are not unitary, rational and autonomous individuals freely able to choose new ways of viewing and doing mathematics at whim. We have all lived, been positioned in various ways, in multiple discourses which are constitutive of, and themselves constituted by, our uses of language and practices. What this means is that "truths" which we have lived and are visceral, part of us, are extremely difficult to interrupt. In teacher education and development programs this view of the discursive construction of the individual (as "subjectivity") is particularly relevant in three ways: (a) with regard to the preservice and practising teachers who have experienced traditional practices in school mathematics for twelve years or so; (b) with regard to teacher educators caught up in the "game of truth" (Foucault, cited in Bernauer & Rasmussen, 1987) of teacher education and development who may unknowingly act to galvanise traditional student/teacher relationships and storylines; and (c) with regard to implications for the future design of teacher education and development programs.

Students' Constituted Subjectivities

Teachers and students who come into our programs have all been to school and have constituted knowledges of what mathematics is, and how teaching mathematics is done. If we can accept the notion of constituted subjectivity, we can understand that this is not solely a cognitive knowing but it comprises conscious and unconscious aspects of experiences and feelings. Our students come to us with constituted predispositions to teach (and learn) in certain ways; these particular ways feel "right" and pleasurable and are difficult to change. A preservice teacher (cited in Tillema & Knol, 1997, p. 31) demonstrates the fixity of knowledge as part of her subjectivity constituted through previous discourses:

> My own experiences are important to me, no matter what I learn here. They are the ones that have left a deep mark. I remember a very nice female teacher who treated us to sweets when we learned a lesson well and a male teacher who could tell exciting stories in history class. I would like to be that way; it gives you a comfortable feeling to try to be that way because you know it worked out so well when you were there.

Schuck (1996) reports on the pressures exerted on teacher educators by preservice teachers who want to be taught "real" mathematics as they had experienced it at school. While the teacher educator strove to involve the students in new conceptions of what mathematical knowledge might be, the students resisted attempts because they did not see this as "real" mathematics. Thus, while these students learned mathematical facts, algorithms and concepts and how to solve mathematical problems in school, they had also learned how mathematics teaching should be done. This knowledge has become part of them and it is not always accessible at a cognitive level. Fay (1987, p. 210) states: "It is as if their traditions were inscribed in their bodies, and are so much a part of them that they cannot be removed any more than their skin can be removed". It could be argued that these "traditions" are not constitutive of competent and agentic teachers of the new millenium who will need new understandings of mathematical knowledge and new understandings of the authority relations in classrooms if they are to engender the investigative and inquiry approaches to teaching considered necessary for

lifelong learners in these new times (*A National Statement on Mathematics for Australian Schools*, 1990). For the most part, the students entering teacher education programs do not have the mathematical (Loewenberg Ball, 1990) nor pedagogical knowledges necessary to teach in an investigative way, or "against the grain" as it were. The mathematics they have learned at school is in many cases that which nowadays can be more efficiently done by machines and their restricted grasp of mathematical ideas and relationships, together with the ways they have been positioned in classrooms, make it difficult for them to engender the construction of knowledges considered relevant to the twenty-first century (Australian Education Council, 1990; Department of Employment, Education & Training, 1989). Many preservice and practising teachers have not experienced conjecture, exploration and inquiry as important elements of knowing mathematics as an intellectual and social practice.

Teacher Educators' Subjectivities

Teacher educators, too, have been positioned within and constituted through humanistic discourses – because of their *constitution* or subjectivities. They may not interrupt but maintain teaching-relationships-as-usual which "feel right" though they position learners as ultimately dependent on authoritative and all-knowing others. Constituted through humanistic beliefs in agency, they are often oblivious to the power relationships operating in their practices (whether working with preservice teachers or in collaborative partnerships with practising teachers). Teacher educators tend to assume (as I have done over many years) that in taking themselves up as "constructivist" practitioners they are modelling for students a safe and supportive environment where regulation and oppression are left outside. Indeed, nothing could be further from the truth. What they continue to do is to orchestrate a discursive regime, a "game of truth" (Foucault, cited in Bernauer & Rasmussen, 1987) in which teacher/student power relations are perpetuated as the students knew them at school. Because of who we are, and the social structures in which we work, none of us could be considered autonomous, but always constitutive of, and constituted by, the discursive plays. For example, the students insist we "tell" them how to teach well and I myself, wanting to be constituted as a responsible and "good" teacher, defer to their dictates (Klein, 1997; Schuck, 1996). The students, on their part, can research and be as critically reflective as they like, but in the end they must come up with pedagogical views that the lecturer can recognise as "truth" in the teacher education and development discourse. One of my students in 1995 wrote of how she was positioned within my interpretation of a "constructivist" mathematics methods subject:

> Although we were told to 'construct our own meaning', to interpret the question in any way we could, and that there was no right answer or one way to do anything, we knew that at the end of it all you would still give us a mark. There might not have been a right or wrong way of doing something, but as marks/grades show, there are better ways and worse ways of doing things. The university classroom is not the place to take risks where marks are concerned. We are told we are not supposed to guess what's in the teacher's head, but rather construct our own meaning. However, we know that there is something in the teacher's head, and that

> it determines how right or wrong our answer is, depending on how far our answer/folio correlates with, or deviates from the teacher's expectations. You, the teacher, know what you want. Working autonomously is thus difficult and frightening – and I'm white and middle class!!! Constructivism, was for me, disempowering.

A related concern is that "constructivist" practice, because it is based on psychological understandings of a unitary, rational, humanistic individual able to choose to be autonomous and competent, allows the teacher/educator to classify students who are not "keeping up" and move on with her teaching (see Zevenbergen, 1996). In my journal entries over several years I found (Klein, 1996; 1997) that this was my practice: I classified the students in binary pairs reflective/pragmatic, autonomous/dependent, honest/dishonest and competent/anxious where problems arose. In this way any difficulties were constructed as individual aberrations, something beyond my control, something that the students themselves would need to rectify. Thus, I was able to continue to teach in ways that I found pleasurable, without considering how my practice might be made more enabling for those students experiencing difficulties. Although my teaching might readily be seen to be quite engaging (see student evaluations of the subject; Klein, 1996) there is no real indication that traditional power relationships between teacher and taught had been interrupted. In teacher education, notions of teacher authority are reproduced, with the emphasis on authority as sole access to authorship of ideas, actions, speaking, writing and being heard. I begin the following section on teacher agency by reflecting on what might constitute alternative new metaphors and images for teaching and learning in the next millenium: in schools and in teacher education.

Making a New Start for New Times in Teacher Education

Before we can begin to think about which areas of study must be emphasised in teacher education programs, we need to think very carefully about the kinds of learning experiences that might be most appropriate and beneficial for school children. Few doubt that our world is a world of rapid and constant change, where no student can hope to learn all the mathematical knowledge that exists today, let alone that which will exist by tomorrow. *A National Statement on Mathematics for Australian Schools* (1990) recognises that changes in society and advances in technology will greatly influence what will be considered fundamental to school mathematics given the ever-changing nature of life and work in the next century. Whereas in the past being "numerate" referred to one's ability to recall and apply mathematical facts, skills, procedures and formulae, this will no longer suffice. Students at school today will need new forms of knowledge to support them as numerate participants in this ever changing world. Of course, they will need the mathematical knowledge, but equally importantly they will need a constituted positive knowledge of themselves as competent participants in mathematics as a social practice. The Australian Association of Mathematics Teachers (1996, p. 4) states: "It is the responsibility of all teachers of mathematics...to expand students' horizons, confirm their confidence in their own learning and ensure their willingness to continue to learn and use mathematics".

Education Queensland (1999, p. 19) stresses the importance of a shift in emphasis from content to process driven learning: "Teachers need to be able to help students to learn to learn. Students must develop the enthusiasm and skills to become lifelong learners, to become independent workers and learners, and to become effective users of technology". If we are willing to accept the premise that subjectivities are (re)constituted through involvement in discourses such as school mathematics, we would imagine that the classroom processes would need to be affirming of the students' past experiences and constructed mathematical knowledge, and supportive of personal sense-making through exploration and inquiry. Thus, if students are to exit our schools as numerate individuals constituted as lifelong learners, the processes of learning need to be engaging (there is a resonance with students' prior mathematical constructions and constituted *subjectivities*) and they need to be enabling (students are *positioned* in ways that authorise them to construct and speak mathematical knowledges in ways that are personally meaningful and sensible). It is my view that in the recent past we have perhaps managed to make learning more engaging for students; a problem remains though in that classroom activities and practices are often not enabling because students are not authorised to construct and speak/write mathematical knowledges in ways that are personally meaningful and sensible. *A National Statement on Mathematics for Australian Schools* (1990, p. 31) makes the following troubling assertion: "There is considerable evidence to suggest that children come to school enthusiastic and eager to learn mathematics and that a great deal leave school with quite negative attitudes". Unfortunately, such students are readily recognisable in our teacher education programs! Given the enormous problems that must be faced, what steps might be taken to facilitate the constitution of life-long learners in schools and universities?

If teachers are to teach in ways that genuinely foster the construction of numerate behaviours in students, then they will need to find ways to step outside the bounds of existing discourses and find *new ways of being* with/in the discourse of mathematics. A form of agency may be realised when teachers recognise the constitutive power of discourse and how teaching interactions position learners in ways that can authorise and empower, or alienate and prevent them from acting in powerful ways. Davies (1994, p. 82) states:

> Poststructuralist theory provides a set of analytic tools that make it possible to examine teaching as usual and its constitutive effects. As well, it opens up the opportunity, in thinking quite differently about what we do, to develop a new set of practices that disrupt old authorities and certainties, that rid us of stereotypical thinking, and open up the possibility of creating something new.

The analytic tools of subjectivity and positioning might be used in teacher education to introduce the notion that we are all constituted through discourse, coerced by it, and yet "made into speaking subjects who can begin to disrupt and move beyond coercive patterns we do not want" (Davies, 1994, p. 82).

A first step may be to have students recall their past experiences of learning mathematics in school. In telling their stories they could be encouraged to share how they were positioned within the discourse and to what extent they were able to establish themselves as numerate beings. In recognising the constructed nature of

subjectivity they could be encouraged to think about how classroom practices were sometimes supportive of their mathematical and personal development, and sometimes not. Davies (1996, p. 146) states:

> Each person comes to see the multiple ways they are positioned and the ways in which they are constituted first through one discourse and then another. Each person...takes up a knowledge of their own specificity, their embodiment as this person with this specific cultural/gendered/ethnic history, but also with political awareness recognising they are always constituted and always constitutive of others.

Perhaps an added feature of the teacher education and development program needs to be a concentrated focus on contemporary schooling practices to make visible how the uses of language and the activities therein position students in varying ways. If teachers are to teach in ways that genuinely support students in communities of inquiry, in ways that engage and enable, they will need to recraft their eyes to recognise how teaching-as-usual militates against personal sense-making and exploration: to see how filling in worksheets, being heard number facts, doing irrelevant problems with one correct answer, streaming, practising algorithms and formulae, position the students as always unknowing and the teacher and text as sole authority. Furthermore, because these classroom practices are all premised on the regulatory establishment and maintenance of constructed binaries of right/wrong answers and competent/incompetent students they effectively undermine any genuine attempt at exploration or discovery on the students' part.

A difficult final step would be to have the students do the intellectual and skill-based work necessary to conceptualise and implement uses of language and practices of teaching mathematics that are genuinely abling for as many students as possible. It is important for teachers to realise that their students can be authorised to speak and construct knowledges without their having to lose personal power – it is not a zero sum game. Teachers usually have much more mathematical knowledge than their students, and in teacher education we are no doubt better informed of pedagogical issues, but this does not mean that we know everything; learners, too, have lived experiences and previously constructed knowledges that need to be authorised if the activities and practices of the classroom are to be genuinely engaging and enabling.

What I am suggesting for teacher education is that students be exposed to, and potentially partly constituted through, an alternative discourse of what teaching and learning mathematics might be. The alternative discourse attempts to interrupt the humanistic view of the learner as freely able to choose to be competent, with that of an individual always positioned within discourse, including classroom activities and practices. There is also an attempt to interrupt the taken-for-granted "supportive" context of learning mathematics and the supposed unproblematic efficacy of "active engagement" or "problem solving" by making students aware of the power relationships and positioning that constitute all learning encounters. However, it is not immediately clear how the students' previous constitution as able or not at mathematics will affect their engagement in this discourse and/or eventual realisation of themselves as agents of change.

Agency for Teachers

I have argued throughout this paper that agency is not easily won – it involves recognising how subjectivities are variously constituted through discourse and taking the steps to interrupt discourses that function in oppressive ways. Davies (1991, p. 51) states: "Agency is never freedom from discursive constitution of self but the capacity to recognise that constitution and to resist, subvert and change the discourses themselves through which one is being constituted". The question arises, though, as to which of the preservice and practising teachers will find the new discourse of critique enaging, and will it be sufficiently enabling for teachers working within institutional structures and resources? It may be that those who see themselves as "good" at mathematics have investments in teaching mathematics as they were taught and will not wish to engage with the discursive deconstruction. As Davies (1996, p. 210) suggests, some may resist "because the old discourses are still more convincing and desirable to them and can readily be used to destabilise the new, or because the new can readily be reworked to become the old, since any new discourse is always overlaid on the old, and does not replace it". However, those positioned in school as "poor" at mathematics may be relieved to be able to shift some of the blame for their performance to how they were positioned in classrooms, and may more readily engage in deconstruction of teaching-mathematics-as-usual. Pedagogically, though, an added problem may arise where these students do not know the mathematics, the "truths" of the discipline well enough to be readily recognisable as competent, so necessary for those who would consider themselves, or have others consider them, able teachers of mathematics.

Conclusion

As the world around us changes, as every day there seems to be a new technological device for knowledge-workers of these new times, as social and cultural diversity becomes recognised and celebrated, it becomes clear that there can never be one pedagogy, one method of teaching mathematics that will be appropriate for all learners in all contexts. If we want children in schools to be constituted as life-long learners, we must realise that they serve out their apprenticeship for this in schools and universities. It is incumbent upon educators in these new times to give them the space and support to learn how to learn – teaching and learning becomes a continuing conversation which will be more or less abling for individual students.

In teacher education, too, we attempt to engage preservice and practising teachers as lifelong learners and reflective practitioners in a continuing conversation helping them recognise the constitutive power of language and classroom activities. Aware that there is no easy answer to the question of teacher agency, I have included an appendix to this paper which is an overview of how I attempt to facilitate the construction of mathematical and pedagogical knowledges that I consider essential for agentic teachers of mathematics in the new millenium. The efficacy of this and all attempts at teacher agency will be a matter of historical inquiry, for as Kappeler (cited in Lather, 1992, p. 95) cautions "The point is not a set of answers, but making possible a different practice".

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Appendix: Rationale

Table 1
Preservice Teachers Need:

What	Why	How
To recognise mathematics as a discourse constitutive of *subjectivity*: - comprising power relations - comprising mathematical patterns and relationships, as well as facts, skills and concepts.	If preservice teachers are to teach in investigative ways, they need to know and experience a different mathematics. They must come to know conjecture, exploration and inquiry as important elements of knowing mathematics as a social and intellectual practice.	Throughout the subject mathematics is constructed as both a social and intellectual practice. In tutorials students undertake investigations and itemise: - the maths constructed - social (self) knowledge constructed (subjectivity).
To be able to recognise how classroom interactions *position* learners; how they can be *engaging* and *enabling*.	If preservice teachers are to move away from a sole reliance on worksheets, texts and transmission methods of teaching, they must be able to recognise how these technologies can alienate some learners and limit their chances of constructing powerful and useful mathematical ideas and relationships.	University lectures and tutorials are used to have students reflect on and articulate how power relations exist in all teaching interactions. Classroom scenarios provide another avenue for analysis. Preservice teachers are encouraged to think about how these encounters could be more engaging and enabling for learners.
To develop the skills of setting up, maintaining and evaluating a classroom culture of mathematical inquiry (rather than transmission of facts, skills etc).	As well as the knowledges above, preservice teachers need new skills: - choosing and planning tasks, - keeping the conversation alive and equitable, - evaluating effect of these on student learning.	Ideas are developed in the lectures. Students are encouraged to try out these suggested practices and skills with young children where possible.