

# Preservice Work Within Schools: Teaching Knowledge in Production

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The principal purpose of this paper is to critique concepts of 'content knowledge' and its 'pedagogical application' as they are currently fashioned in the field of mathematics education. Drawing upon work which is primarily philosophical in character, I propose a view of teaching based on my empirical study with preservice teachers in schools. In the first instance I introduce theoretical ideas and suggest how they might function in the process of data analysis. Second, I use these ideas to analyse instances of teaching knowledge in production. Finally, I argue for a conceptualisation of pedagogical content knowledge which recognises the reciprocal constitution of knowledge and subjective experience.

Preservice mathematics teacher education has always been a pivotal agent in the transformation of the mathematics knowledge base of contemporary society. The notion of the preservice mathematics teacher as instrumental to national development and security is premised on the rational actor who will teach better when he or she knows more. This commonsense idea is so embedded in past and contemporary forms of mathematics education that numerous efforts to improve education through policy, research, and practice have all been constructed around a "deficit model" (Askew *et al.*, 1997; Brown *et al.*, 1998) of teachers' knowledge. In particular, the influential work of Shulman and his associates at Stanford University (e.g., Shulman, 1986, 1987; Grossman, *et al.*, 1989) is organised around "improving teachers' own subject knowledge" (Poulson, 2001, p. 43) as a means for better pedagogical practice and, ultimately, for improved social conditions.

Brown and her colleagues (e.g., Brown *et al.*, 1998; Askew *et al.*, 1997) have serious reservations regarding the applicability of the deficit model of pedagogical content knowledge for primary school mathematics teachers. They argue: "[S]ome teachers of younger children have real problems over subject knowledge, but it is not clear how much this affects their effectiveness" (Askew *et al.*, 1997, p. 59). In their recent studies of 90 numeracy teachers these researchers recommend that a reasonable sense of what needs to be taught, together with a skill at communicating and linking this to other aspects for children, might be preferential to a deep understanding of content knowledge. Similarly, Poulson (2001, p. 460) reports that a study by Calderhead (1998) found that content knowledge factored in less significantly on preservice teachers' planning and teaching than did their observations of supervising teachers. Poulson (*ibid.*) notes: "even when students had sound knowledge, they did not draw upon it in their planning and teaching, but preferred to copy and adapt ideas suggested by their supervising teacher/mentor" (p. 46) or which they had sourced elsewhere.

In this paper I look at aspects of classroom practice which contribute to the creation of pedagogical knowledge in the primary school mathematics classroom. My particular focus is centred on the experiences of preservice teachers and is directed at the specific times during the preservice programme when the course offered within the tertiary institution is given a context in schools. My analysis begins with a critical reconsideration of the continuity between knowledge and effective practice. In response to seemingly conflicting

evidence and unresolved dilemmas which presented in a similar study undertaken by the author the previous year (Walshaw & Savell, 2001), in this replication study I have found it more useful to understand the construction of teacher identity as continually mobile and never taken-for-granted. Approaching teacher identity in this way demanded an acknowledgment of the tentative and shifting balance between theory and classroom experience, and the recurring tension between curriculum and the emergent personal relationships and meanings within the classroom.

In the first section I introduce poststructuralist ideas on knowledge and subjectivity. I draw on these to explore their significance for the construction of an alternative conceptual model for assessing the role of content knowledge in the identity formation of preservice mathematics teachers. In the second section I explore conditions and circumstances for preservice teachers within the context of school work. I focus on one question: what does it mean to engage in pedagogical work during the teaching practicum? Finally I draw upon the empirical data to reveal the discursive practices at play in the process of becoming a mathematics teacher. From the analysis I argue that, rather than exalting content knowledge, we need to look closely at embodied relations and the unconscious to see how these relations exhibit a power differential in teacher/student relations and how they inform, shape and interrupt the possibility of a theory of pedagogy based on linear models of content knowledge application.

### A Framework for the Formation of Teacher Identity

A preoccupation with conditions and circumstances in the formation of identity is given theoretical expression in poststructuralist theory. Central to the poststructuralist argument is an understanding that knowledge is a production, created by cognitive agents within practices and positions of differing power and privilege. In this theorising questions about knowers, their identities and their relative locations of knowing are all integral to analyses of the production of knowledge. These ideas allow one to move from a discussion of identity in the context of the classroom as a cultural phenomenon of the psychological self, towards a conceptualisation of multiple conceptions of subjectivity located within the discourses and practices of the classroom. The starting point is that subjectivities are produced within a range of organisational and institutional discourses and practices. Integral to the construction of subjectivity and identity formation, is an *a priori* set of rules of formation which enables certain thoughts and practices of preservice teachers to be entertained at one time and constrained at another time. As structuring principles, discursive practices govern beliefs and practices in such a way as to produce a certain network of material and embodied relations; they are both determined by and constitutive of the power relations that permeate institutional and organisational processes and structures.

When we apply poststructuralist ideas to a study of the 'making' of teachers during the practicum and to an investigation of how pedagogical knowledge is produced by institutional processes and practices we first need to understand the teacher as an historical and culturally specific entity who does not establish his or her materiality with a fixed prediscursive essence. Britzman (1997) and Davies (2000) both speak of this presupposition as the discursive constitution of pedagogical subjectivity. Their poststructuralist language sits uneasily for those of us trained in a tradition where an ontology of sameness casts individuals as autonomous, sovereign and interchangeable. Nevertheless, this move from autonomous individual to discursive subjectivity is a productive means to talk about and investigate the practices and construction of the

identity of preservice teachers in school sites, since, firstly, it opens up new possibilities for teacher education. Secondly, it offers a more complex and layered notion of the teacher. Thirdly, such a move allows us to engage the historically specific relationship between preservice pedagogical practice and forms of social control and possibility. And lastly, an understanding of shifting subjectivity suggests an understanding of pedagogical practice and agency as an active yet never-completed process of enculturation.

### Methodological Issues

Fundamental to this study is the discursive constitution of subjectivity. More specifically the subjective is regarded as constituting the meaning of student teacher experience – both in terms of where the experience comes from and how it relates to concrete social practices. Relocating the project of preservice teaching within the context of schools for this way of thinking shifts the focus from empirical observations to a broader form of inquiry – one informed by the close relationship between identity, power and knowledge. The issue is less of making linear connections between content knowledge and practice than of showing whose experiences and what knowledges come to count or are dismissed during the process of establishing pedagogic authority.

All 72 students enrolled in the second year compulsory mathematics course at the university in attendance on the day the questionnaire was administered were invited to participate in the study. All of the students agreed to participate. During the three weeks in which they were out in schools during the third (of four) school terms, they worked closely with one classroom teacher (the associate), endeavouring to build a professional partnership together within a supportive environment formed by links with the university and the school.

### The Discursive Production of Teaching Practice

Preservice teachers in this study had engaged with a complex knot of course-related practices and knowledges which together produced the possibility and effectivity of classroom teaching in New Zealand primary schools. Ensor (2001) refers to the symbolic and material resources mapped out in the university course as a “privileged teaching repertoire” (p. 299). Through explicit engagements with the official curriculum statement and its theoretical representations of development, cognition, pedagogy, assessment and the learner, they had also learned what counts as evidential content and process and the kinds of questions central to the field. They knew what particular pedagogic modes are legitimated and the types of resources and classroom arrangements deemed central to knowledge facilitation. By producing the terms of school mathematics and thus the parameters of school mathematical practice, the course had created an identification for these preservice teachers. However, like practitioners in other domains of professional practice, prospective teachers are confronted with learning ‘discursive codes of practice’. As they move from the university course into the school they enter a different network of political and social discursive practices. The identity positions and politics which these discourses offer provide access to a differential engagement and positioning in relation to the regime of ‘knowledgeable’ practice operating in schools.

The student teachers in this study soon learned that, irrespective of school size, mathematics was routinely taught in the morning (82% of the schools). A third (30%) of the students saw mathematics taught on a daily basis, and only a relatively small number (15%) reported that mathematics took place less than four times per week. Students

quickly learned how long each lesson would be programmed, given that the scheduled length of time was consistent from one day to the next. However the expected duration varied considerably from one classroom to another. Whilst the median time spent on mathematics during the school week was three hours twelve minutes, one student came to expect five hours regularly each week. Another student soon came to appreciate that mathematics would be sacrificed on school concert practice days. Mathematics in this particular classroom lasted only ten minutes on both of two days of the possible fifteen.

In practices of administration like these the production of mathematical knowledge is normalised. Precisely because these practices fix limits, controlling the 'time' around which pedagogical reality might take place, they determine to some extent what is able to count as mathematics. Not only is the status and production of mathematical knowledge implicated in school administration practices but so too are specific forms of knowledge production. Mathematics teachers in schools invest in particular discursive codes of mathematics pedagogy which foreground particular processes and practices, shaping how teachers should plan and enact practices in the classroom. These discursive codes based on theoretical decisions are not always made explicit to the novice, yet to the associate teacher they constitute a closely scripted first strategy of how the teacher's work is to be constructed.

Theoretical decisions about learning have important implications for the ways in which pedagogical relations can be conceptualised and enacted. In creating particular modes of activity, ways of being and interpersonal relationships, such decision making governs the production of knowledge, legitimising and excluding particular forms and events. This is an important point because it suggests that knowledge, including practitioners' knowledge, is implicated not only in the practices of administration and normalisation, but also in the production of forms of sociality.

Elaborating further on this epistemological vantage point, student teachers believed that their associate teachers used "Mathematics in the New Zealand Curriculum", the official mathematics curriculum statement for New Zealand schools, more often for planning (78%) than any other resource. They volunteered that planning was also guided by commercially produced teachers' guides supporting the New Zealand curriculum (60%), worksheets and notes from previous years (55%) and textbooks (50%). The Internet (6%) was perceived to be the least used planning resource.

Students were asked to consider what particular pedagogical relations and practice were actualised in the classroom. Classes were routinely grouped according to ability. Intra-class ability grouping took place in 64% of all classes seen. Not only was ability grouping observed within the class; inter-class streaming/setting arrangements typified an additional 11%. The remaining 25% of classes were ungrouped. In both these latter two arrangements the children were invariably older, and were taught as a whole class, with teacher exposition and children's practice of skills and concepts scheduled for the bulk of the lesson time. In normalising 'who shares the space' in which pedagogy is to take place, these arrangements determine what qualifies in the classroom as learning reality.

Student teachers' observations of a typical lesson for the classes which were organised according to ability grouping reveal that a relationship is orchestrated between mathematics, the teacher, and the child in which the teacher is to maintain prior knowledge, introduce new concepts for the day, make links with prior knowledge, provide explanations, model, pose questions for the children, supply work and activities to enable practice of these ideas, and finally reflect on the work. In this logic the teacher moves reflexively from writing on the board, to observing, to talk, and to questioning, grounding

understanding through the process of children's activity and written work. Like many educational texts, the typical lesson structures pedagogical arrangements for school work, establishing a set of institutional and social relations for the teacher and learner in the classroom. In this account the teacher is situated with a particular view of pedagogy, predisposed to reading the classroom world of mathematics from a particular epistemological vantage point.

Students were asked to choose from a list of classroom activities the types of approaches associate teachers engaged in their classes. The three most commonly identified activities (seen by 82% of the respondents) were: teacher talk and exposition; children listening; and children doing worksheets. Students were also asked to apportion time to each teaching approach. Teacher talk and exposition with children listening consumed 29% of classroom time, whilst students spent 37% of classroom time working on prepared worksheets. Constituting around 50% of class time, cooperative and group activities were the most lengthy activities. Children using equipment also took up a high proportion (44%) of class time in those classes where observed. There was wide variation in the feedback which teachers give their pupils. 20% of the students reported that they never saw the teacher give any formal feedback to the children. Most commonly seen was an oral assessment or correction of an individual (seen by 58% of the students), followed by an oral assessment or correction given to the whole class (seen by 50% of the students). Teachers written comments provided more formal assessment in 43% of classrooms, with ticks and crosses from the teacher a common practice in 41%. Peer assessment or correction was seen in 28% of the classes. Children marked and corrected their own work from written answers in 32% of the classes.

### Affirmative Practice and Conflicting Meanings

The preservice teachers in the study, like all teachers, have an understanding of the kind of place they would like their own classrooms to be: the rules and norms they would like to establish for their own conduct and that of the children; the placement of furniture and children's access to resources; and the type of 'feeling' evident in the classroom. In this section we look at making connections between the students' impressions of how teaching practice met their expectations. To avoid repetition only a selection of responses is given.

*Well structured programme. Timed clearly. Well planned in advance.*

*[I was interested to see] the use of concrete materials to indicate how to solve the problem.*

*The programme was very well run and children progressed throughout the unit.*

*[I was interested to see] that concepts were put into real, relevant contexts and that children were able to experience these.*

*HANDS ON! Children did enjoy the practical activities.*

*I enjoyed teaching maths with the equipment.*

*Teacher integrated maths into the morning roll call, as children counted how many children were at school, how many boys/girls, the difference between the number of*

*boys/girls etc. Teacher always asked 'how did you work that out?' and got children to explain their working out.*

*Maths was taught well, with enthusiasm and interest.*

*I found the school had great resources.*

*Math was very much made relevant and hands on for the children who experienced a lot of different activities, e.g., popcorn (mass/weight), cooking recipes, different food containers.*

*Group work went well as children are closer in ability.*

*Of interest was the way many children in my class supported each other in their work, or were willing to tutor each other.*

The students' observations here reveal that the practices and positionings made possible for teachers through the university course cohere with actual classroom practice. The world of school mathematics which classroom practice offers, sits comfortably with personal meanings. Such alliances make for smooth partnerships for second-year students unsure of their own ability in producing effective classroom learning environments. 47% of all the students in the study voiced their uncertainties and concerns at the beginning of the practicum. A sense of their tentativeness can be gleaned from the following:

*Worried about doing maths in the classroom.*

*Bit uncomfortable – Wanted more in-depth knowledge of how to get it across.*

*Nervous. Very nervous about teaching mathematics. Often find I get confused myself.*

*Scared of teaching maths!*

*A bit unsure.*

*Unfamiliar with routines.*

*I was familiar with the resources and activities but I had no idea how to run the maths lessons.*

Knowledge about teaching mathematics is produced by social interaction and as such, is steeped with power and social positioning, and subject to negotiation, consent and circumstance. The working of power in the preservice/associate teacher relation is delicate and seemingly intangible, yet its networks can determine the very texture of teaching and its possibilities. More importantly, subtleties within the networks of power can shape and misshape loves of and passions for teaching mathematics, particularly those feeling vulnerable and lacking in confidence.

*My associate was very well organised and supportive. She shared all her plans and resources with me. She provided quality feedback with positive ideas for me to improve on.*

*It was amazing to watch her in action. She definitely loves to teach and maths has a very high profile in her class.*

What I am at pains to do here is *not* to suggest that there is any straightforward casual link between the determining structures (associate's practice) and the action of individuals (preservice teaching practice). Rather, teaching mathematics is *relational* for the preservice teacher. By that I mean that the preservice teacher is simultaneously inscribed within and refashions classroom existence in relation to others, engaging with, negotiating and contesting the cultural logics of the associate's practice.

*It was a bit difficult to get my Associate to help me with my Maths planning. She LOVED Maths – it was really her thing. She motivated the kids and they all seemed quite happy about it – which was strange. I suppose she naturally assumed I had the same knowledge.*

*I was forced to follow her methods of teaching in maths as that is what she had planned and wanted maintained. I am confident in maths but was given little opportunity to express my confidence. Could not go outside the square.*

In the teaching practicum, each move that the novice and associate teacher make in the relationship is situated within institutional arrangements that in many ways push them both to engage in particular discursive practices. Discursive practices in schools are powerful and it is precisely because they shape the construction of teacher's work that any attempt at practice which is not compliant must contend with a set of discursive impediments. In the above excerpts we engage with the observations of students in the process of trying to construct their teacher identity when the discursive practices in schools are at odds with their own personal theories. The identity papers the students had acquired through the course are challenged by and can scarcely be validated by the discursive practices upheld by the associate teacher. In those examples it is not possible to separate the preservice teachers' identity from the contradictory material and discursive practices which seek to regulate their pedagogical practice.

*I have found that my strength in Maths increased with teaching it. The [course] had a lot more consequences with the way I viewed maths and viewed how children would receive my teaching. I now know that maths teaching requires many different approaches to find the answer to any problem. I basically had to follow my Associate's methods and then adjust them to my own approach.*

Teaching mathematics in primary school comprises close and complex relationships of power and knowledge, in which the spoken and the unspoken becomes intricately linked both to the production of knowledge and to the subjectivity of teachers. This calls for an understanding of the subjectivity of the student teacher as itself continually reshaped by the changing designations students employ to understand themselves - those designations which significant others assign to them and the spaces they all share.

## Conclusion

This paper has explored the question of what it means to engage in pedagogical work in New Zealand primary schools. Taking a different approach to the project of mapping preservice teaching practice in schools, it seeks to draw attention to a set of issues which

commonly have remained outside the scope of standard epistemological analyses of teacher education. These taken-for-granted epistemologies have framed investigations linking classroom practice with content knowledge, and the deficiencies which these studies have reported have spawned new proposals and policies in teacher education. Within this conventional paradigm there is no place to consider the preservice teacher in any terms other than in a model of normality/pathology.

Drawing on the insights of poststructuralism, I have looked closely at discourse in action in the classroom for an examination and a critical reading of engagements of what is best named *teaching knowledge in production*. In this paper I have pointed to a theoretical and empirical direction for an analysis of mathematics teacher education which begins from a recognition of the politics of knowledge and their reciprocally constituted effects on subjectivity. In this theorising preservice teacher identity is fractured and fragmented, and the classroom is a site of political struggle over the real and its meanings. The concept of teacher identity then is best thought of as complex and multiple, developed in response to other identities which are sometimes held in opposition. Teaching experience then becomes much more than an issue of content knowledge and technical skills; it is, above all, a source of (micro) political engagement. Developing a sense of pedagogical and professional norms grows out of a history of response to local discursive classroom codes and wider educational discourses and practices, all of which interrupt, derail and elide the best intentions of the student teacher; all of which signal changes in the cognitive structures which constitute the preservice teacher's desire for the pedagogical.

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