A SOCIOCULTURAL PERSPECTIVE ON THE FIRST YEAR OF TEACHING SECONDARY MATHEMATICS

Anne Prescott   Michael Cavanagh

The University of Technology, Sydney   Macquarie University

The purpose of this study was to investigate the experiences of a group of four beginning secondary mathematics teachers in their first year of teaching. Each teacher was interviewed individually for approximately 30 minutes in the middle of the school year. The interview responses were analysed in terms of the participants' views of themselves as teachers and the factors which they identified as influencing their classroom practices. The study shows that….

INTRODUCTION

The process of learning to teach is situated in numerous settings including university courses, school-based practicum experiences, and ultimately in the schools where teachers work. In this paper we adopt a sociocultural perspective to investigate the experiences of four beginning secondary mathematics teachers in the early months of their teaching careers. A similar theoretical position has been taken in previous studies of novice secondary mathematics teachers. For example, Ensor (2001) followed a group of seven pre-service teachers from their year-long university course into the first year of teaching and noted the importance of contextualizing learning about teaching, while Goos and Bennison (2006) adopted a community of practice model to investigate the development of an online discussion board for pre-service and beginning teachers. We consider the context of teachers' work to examine the crucial role the school environment plays in shaping how beginning teachers learn their craft through increasing participation in the practices of the teaching profession.

CONTEXT

The present study is part of a larger one which took place over a two-year period. We tracked a group of ten pre-service teachers through their final year of teacher training and interviewed them individually on four separate occasions about their experiences (Cavanagh & Prescott, 2007). We explored how their participation in university studies and the school-based practicum influenced their formation as teachers. In this paper, we report on research which we subsequently undertook with four of the original participants as they commenced full-time work in schools. Our aim was to investigate the beginning teachers' perceptions of themselves as teachers and how

their classroom practices were shaped by interactions with others at the school, especially within the mathematics faculty.

The study took place at a time when a reform-oriented syllabus which specifically promoted the use of problem-solving and mathematical investigations was introduced. Through its Working Mathematically strand, the syllabus described five interrelated student processes: questioning, applying strategies, communicating, reasoning and reflecting. Teachers were encouraged to cover the syllabus content by developing and using a variety of activities that allowed students to engage with the five processes.

SOCIOCULTURAL PERSPECTIVES

Sociocultural perspectives on mathematics education have become increasingly prominent and offer a useful means of analyzing teachers' professional growth (Lerman, 2000). These theories emphasise that learning occurs at specific times in particular locations through one's interactions with others. Sociocultural theories posit that the contexts in which learning takes place are critical because they help to shape the learning that occurs within them (Franke & Kazemi, 2001). Hence the social, historical, cultural and physical learning environments play an integral part in what is learned and how it is learned. Learning is described as a social activity which happens in communities of practice (Wenger, 1998) where people engage in some collective activity or shared enterprise. Learning is said to occur through increasing participation in joint activities aligned to common goals, purposes, means and ends (Lave & Wenger, 1991).

Rather than describe learning as a process of passively receiving new knowledge, sociocultural theorists concentrate on the active involvement of individuals and groups in particular tasks as the means by which learning takes place (e.g., Schön (1983) described the acquisition of professional knowledge as "knowing-in-action"). Learning is seen therefore not as a purely theoretical exercise but rather as participation in specific activities which helps to shape the individual by means of the new insights and skills which are gained. Hence learning is closely connected to "transforming who we are and what we can do" (Wenger, 1998, p. 215).

In sociocultural terms, learning to teach can therefore be understood in terms of increasing participating in the activity of teaching in order to gain insights into the practices of teachers (Adler, 1998). Beginning teachers advance their knowledge and skills in the teaching profession by direct interaction with other teachers in specific tasks which are focused on teaching secondary mathematics. But learning also takes place through less formal processes such as listening to and casually observing one's colleagues as they go about their normal daily routines (Stein & Brown, 1997). Thus learning to teach secondary mathematics can therefore be seen to occur primarily in the company of other mathematics teachers in schools.

Each individual brings a different perspective and level of experience to the task of teaching. Rogoff (1995, p.146) refers to *guided participation* to emphasise the two-

way nature of the interactions of beginning and more experienced teachers and the mutual involvement of each individual in them. At the same time, research suggests that beginning teachers often learn what is valued and practised by their more experienced colleagues (Stein, Silver & Smith, 1998).

The purpose of the present study was to investigate the perceptions of beginning teachers about their classroom practice. We were particularly interested in the extent to which the first-year teachers were able to implement the Working Mathematically strand of the new syllabus and the factors which they identified as influencing their classroom practices.

METHOD

Our original study focused on ten pre-service teachers as they undertook a one-year Graduate Diploma of Education program taught by the authors in two universities and comprising units in mathematics education curriculum, teaching methodology and supervised professional experience. Those who obtained full-time employment in the same city as the university were invited to take part in the second phase of the research which is reported here. Four of these teachers agreed to participate and each one was interviewed using a semi-structured protocol for approximately 30 minutes half-way through their first year of teaching. The interviews were audio-taped and transcribed.

Analysis of the data began with a thorough reading of the transcripts during which patterns in the responses for each individual participant were identified. The ideas which emerged from each transcript were categorised into themes for each participant. These were then cross-checked against the other transcripts so that a set of common themes began to emerge. These were classified according to whether they related to issues of self-perception, working mathematically, or classroom practices. The findings are summarised in the following sections.

RESULTS

From a sociocultural perspective, a teacher's professional identity is closely related to the ways in which each one participates in the activity of teaching in association with colleagues (Wenger, 1998). Identity is not fixed but rather evolves in response to the school environment and particularly in how teachers perceive the reactions of co-workers, pupils, parents, and so on. Moreover, each teacher's view of him or herself acts as a prism through which future interactions are perceived and through which learning about teaching occurs. It also provides a basis for making decisions in the classroom as lessons progress. All of the participants in our study spoke about how they quickly became aware of "school politics" and the accepted classroom practices of fellow teachers, which were invariably quite traditional and not really in the spirit of the new syllabus. However, despite their desire to follow a working mathematically approach, the beginning teachers conformed to the traditional practices of their colleagues.

SELF-PERCEPTIONS

Many studies (e.g., Adams & Krockover, 1998; Kardos & Johnson, 2007) have found that beginning teachers find their first year of teaching stressful, hectic, chaotic, a roller coaster ride, and emotionally draining as they find themselves in a situation where they move from one 'crisis' to the next and our beginning teachers were no exception.

It was so easy for the beginning teacher to obsess about the relatively small number of difficult students they dealt with and lose sight of their achievements.

> Low points. Every day, one out of 60 kids doesn't do it. Or, you know, has been rude or whatever and I was concentrating more on that one person than the whole lot. It took me a while to sort of think: You know, there were 60 today and just one was out of whack. But it was very draining.

Relating to other teachers

When new teachers are expected to be independent from the start, as opposed to being sheltered as novices, they find the experience a solitary one where they mostly plan and teach alone (Kardos & Johnson, 2007). Beginning teachers aim to fit in so they make sure they 'toe the line' by conforming to the status quo. To this end they find it hard to ask for help because they do not want to appear to be floundering and besides, the other teachers all look so busy. Alongside this feeling of trying to be independent, is the view of many experienced teachers that beginning teachers must learn from their own mistakes and too much help is not good for their survival in the long term. The beginning teachers, however, were looking for support.

> I guess one thing would be good if the mentor came in and observed my lessons … Not necessarily to grade me but to say I can see some difficulties, here are some things you can do.

WORKING MATHEMATICALLY

The emphasis in the new syllabus is Working Mathematically (indeed it can be seen as central to the whole syllabus) but that requires a less textbook oriented approach to teaching mathematics and the emphasis in the university course supports this – but the schools are much more textbook oriented. The problem is that beginning teachers also see 'fitting in' as conforming to the style of teaching exhibited by their more experienced colleagues. This is generally textbook based so working mathematically becomes problematic for beginning teachers.

The beginning teachers recognised the need for a balance between the traditional textbook approach and the working mathematically approach to mathematics teaching but were also sure they were not yet getting the balance right. There is an unresolved tension in that the beginning teachers see the value of working mathematically but perceive it as taking longer and creating classroom management issues. They say they will postpone working mathematically until they feel more confident in the classroom.

> I know [less able students] need [working mathematically] the most but I just fear that if I do this that they won't listen or they'll muck up.

> Once I establish a good relationship and ... good communications with them ... then I'll be popping up interesting questions.

Many schools are poorly resourced and rely solely on textbooks – one school used the textbook rather than the syllabus as its programming document making anything but a textbook oriented approach much harder. Because the beginning teachers were on probation, they felt they had to keep a tight rein on their students and they felt that a textbook oriented style of mathematic teaching made this easier.

> If you don't finish your register then you might get spoken to at the end of the year

In addition, the beginning teachers were also aware that their students were not used to a working mathematically approach so classroom management issues were more likely to arise in those lessons. They were fearful of trying something new in case it did not work.

> You're on probation and you've got a teaching certificate to get so you don't want to be taking too many risks. The teachers often walk past my classroom so you want to keep the class reasonably quiet.

The beginning teachers recognised their lack of experience in choosing examples that covered the syllabus and were pitched at an appropriate level for their students. Textbooks were therefore seen as a reliable classroom resource.

> I have the support of the textbooks so I'll be focussing on my ability to explain things, try and keep the right level, use the right words etc.

Only one of the beginning teachers was happy with the possibility to undertake working mathematically in the classroom. During the practicum he had not been allowed to prepare less textbook oriented lessons but now had support from the school and the freedom of his own classes and was enjoying the experience. The support had come from the availability of resources and from a variety of people, including a mentor, the head of department and the principal.

> I guess I had a number of philosophical differences with my supervising teacher; just, totally different approach. So I was finally able to do what I wanted to do. I didn't have to worry so much, you know, I could, if I wanted to do a lesson and have a discussion for the most of, you know, most of it or whatever then that was my decision to do, and I didn't feel like I was having to please somebody else.

Despite the encouragement of his mentors, this beginning teacher was still using the more traditional approach because he saw this as more closely conforming to the culture of the school.

CLASSROOM PRACTICES

The beginning teachers wanted to be effective in the classroom and saw this as being able to deal with classroom management issues, and being a good communicator so

that explanations are clear. They saw their discipline issues as emanating from their inability to cater for the range of abilities in their classes. This also included being able to take into account the specific different needs of different classes and the amount of work they should be covering in each lesson. The full teaching load made lesson preparation and reflection a luxury rather than an essential of good teaching practice so time management skills were vital.

Examination pressures

Even though the beginning teachers acknowledged that the textbook approach was not necessarily the best way to learn, they felt pressure to keep up with parallel classes so that their students covered all the material required for examinations.

> You've got to try to teach the material so that they can have some opportunity to do well in the exam … I'm trying to push them through the work so at least they've seen it. … So long as you've taught it, that's OK. But whether they've learned it or not is immaterial.

It was not a case of making sure the students understood the work, rather it was a case of 'covering' the material in class so you could sign off the register. The beginning teachers also knew that the examination questions were usually procedural and that they would be unlikely to test conceptual understanding (despite Working Mathematically being central to the syllabus).

In addition, the beginning teachers felt pressure from students who did not see the value of working mathematically. The students' experience of mathematics lessons was almost exclusively instrumentalist and the working mathematically approach required greater effort on their part but many just wanted to know how to do the examination questions. The resistance from students discouraged the beginning teachers from pursuing that style of lesson, and those who tried and felt their lesson was poor were fearful of trying again.

> They said why are we doing this? We don't need this. They rebelled.

Time constraints

A common complaint expressed by the beginning teachers was the inordinate amount of time required on activities they regarded as not central to the work of a teacher. They wanted to spend more time preparing quality lessons, but were consumed by administrative matters and extra-curricular tasks such as playground duty. Classroom management problems also meant that many hours were needed to follow up recalcitrant students.

> I've got about eighteen lessons a week but in addition to that I've got things like sports… so that's time I can't use for anything else. I've got assembly … pastoral care, those kind of other things.

Classroom management issues also included dealing with students who needed extra help. The inability to deal with the various levels of ability in the classroom meant that lunchtimes were used for helping students to catch up with their work and to improve understanding.

I see a lot of students benefiting from individual attention which I can't give them during a normal lesson and I tell them 'Look you have to come for a lunchtime because I want to cover this area in detail with you'.

Where there was a lack of resources in the school, there was also a feeling of having to 'reinvent the wheel' in creating worksheets and developing classroom activities. When time was at a premium, as was often the case, the beginning teachers felt they relied too much on the textbook but they saw no other option. Observations of experienced colleagues who seemed to be able to prepare lessons at will, served to emphasise the time pressures experienced by the beginning teachers.

As well as a lack of time to prepare, there was virtually no time to reflect on lessons just taught. As a result the beginning teachers did not feel they were making sufficient progress in becoming effective in the classroom – mistakes were repeated more often than they would have liked.

I often don't have time to reflect on what worked and what didn't. I do sometimes but not half as much as I would like to … it's basically trying to survive to the next lesson.

CONCLUSION

We sought to examine how the school environment can influence beginning teachers' self-perceptions and classroom practice, particularly in the context of a reform oriented syllabus that emphasised mathematical problem solving. Our analysis indicated that the culture of the school and the practices of more experienced teachers have a powerful impact in the development of beginning teachers. In particular, the new teachers wanted to be seen as effective in the classroom by their colleagues and their students. Therefore, they emulated their peers and adopted what they perceived as the safer option of relying on the textbook.

This study indicates that beginning teachers could benefit from fewer extra-curricular activities and a lighter teaching load. A more structured system of mentoring rather the present ad hoc practice would provide an avenue of support and a forum for professional development. Mentoring could include an opportunity to share a class so the beginning teacher could participate in and reflect on good teaching practices within the culture of the school.

While each beginning teacher recognised that they had not yet adopted the Working Mathematically strand of the syllabus, they all indicated a desire to align their teaching practice more closely to it. Whether these beginning teachers actually achieve this goal or become entrenched in the current system is a matter for further research..

REFERENCES

Adams, P.E., & Krockover, G.H. (1998). Concerns and perceptions of beginning secondary science and mathematics teachers. *Science Teacher Education, 81*(1), 29-50.

Adler, J. (1998). Lights and limits: Recontextualising Lave and Wenger to theorise knowledge of teaching and of learning school mathematics. In A. Watson (Ed.), *Situated cognition and the learning of mathematics* (pp. 161-177). Oxford: Centre for Mathematics Education Research.

Cavanagh & Prescott 2007

Ensor, P. (2001). From preservice mathematics teacher education to beginning teaching: A study in recontextualizing. *Journal for Research in Mathematics Education, 32*, 296-320.

Franke, M. L., & Kazemi, E. (2001). Teaching as learning within a community of practice: Characterizing generative growth. In T. Wood, B. Scott Nelson & J. Warfield (Eds.), *Beyond classical pedagogy: Teaching elementary school mathematics: The nature of facilitative change* (pp. 47-74). New Jersey: Lawrence Erlbaum.

Goos, M., & Bennison, A. (2006). An online community of practice for pre-service and beginning teachers of secondary mathematics. In J. Novotná, H. Moraová, M. Krátká & N. Stehlíková (Eds.), *Proceedings of the 30th conference of the International Group for the Psychology of Mathematics Education* (Vol.3, pp. 209-216).

Kardos, S.M. & Johnson, S.M. (2007). On their own and presumed expert: New teachers' experience with their colleagues. *Teachers' College Record, 109*(9) www.gse.harvard.edu/~ngt/papers.htm. Last accessed 11/1/2008.

Lave, J., & Wenger, E. (1991). Situated learning: Legitimate peripheral participation. Cambridge, MA: Cambridge University press.

Lerman, S. (2000). The social turn in mathematics education research. In J. Boaler (Ed.), *Multiple perspectives on mathematics teaching and learning* (pp. 19-44). Westport, CT: Ablex.

Rogoff, B. (1995). Observing sociocultural activity on three planes: Participatory appropriation, guided participation, and apprenticeship. In J. Wertsch, P. del Río & A. Alvarez (Eds.), *Sociocultural studies of mind* (pp. 139-164). Cambridge: Cambridge University Press.

Schön, D. (1983). The reflective practitioner: How professionals think in action. New York: Basic Books.

Stein, M., & Brown, C. (1997). Teacher learning in a social context: Integrating collaborative and institutional processes with the study of teacher change. In E. Fennema & B. Scott Nelson (Eds.), *Mathematics teachers in transition* (pp. 155-192). New Jersey: Lawrence Erlbaum.

Stein, M., Silver, E., & Smith, M. (1998). Mathematics reform and teacher development: A community of practice perspective. In J. Greeno & S. Goldman (Eds.), *Thinking practices in mathematics and science learning* (pp. 17-52). New Jersey: Lawrence Erlbaum.

Wenger, E. (1998). *Communities of practice: Learning, meaning and identity.* Cambridge, MA: Cambridge University Press.