Dilemmas of Beginning Teachers of Primary Mathematics

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A large study tracked four primary teachers during their first year of teaching. From their reflections on mathematics teaching, four dilemmas arose that they attempted to manage throughout the year. Discussion with the beginning teachers highlighted issues relating to the noted mismatch between pre-service education, research, and recent recommendations for teaching on the one hand, and on the other hand the realities of classroom practice. Support in the form of a 'fellow worker', amongst other things, is needed to help beginning teachers survive their first year and move towards a less teacher-centred approach to teaching.

Many factors have influenced the directions that mathematics education has been endeavouring to follow in the last decade. These include: new insights from research into how children learn, changing perceptions of what it means to know and do mathematics, the availability of calculators and computer technology, the changing needs of society, and the anticipated needs of the workforce of the twenty-first century. The development of curriculum guidelines to articulate and support new directions has been pervasive in Australia and elsewhere, particularly regarding the move towards outcomes-based education in Australia and the standards of the National Council of Teachers of Mathematics in North America (Australian Education Council, 1991; Australian Education Council, 1994; National Council of Teachers of Mathematics, 1989; National Council of Teachers of Mathematics, 2000). Mathematics is viewed in these documents as more than a collection of facts and skills to be taught in a routine, drill-oriented fashion. Instead, mathematics teaching and learning are focused on engagement of the learner in inquiring, meaning-oriented, challenging, purposeful and relevant activities. Within teacher education programs, similar views are promoted, as indicated by the perspectives adopted in commonly used mathematics education textbooks (e.g., Bobis, Mulligan, Lowrie, & Taplin, 1999; Reys, Suydam, Lindquist, & Smith, 2001). However, *The Discipline Review of Teacher Education in Mathematics and Science* (Department of Education, Employment and Training, 1989) noted that there was a mismatch in many cases between what was taught in teacher education courses and what subsequently evolved in primary school classrooms.

There are a number of reasons why it is that reports, recommendations, guidelines, research, and teacher education practices have not had widespread impact on mathematics classroom pedagogy. Primary amongst these reasons is that teacher education courses do not appear to be effective in changing the traditional beliefs and images about teachers and teaching that students bring to their pre-service education (Calderhead & Robson, 1991; Kagan, 1992; McDaniel, 1991; Weinstein, 1990). For example, within mathematics education, Lerman (1983, 1990) and Thompson (1984) showed that teachers' instructional practices were closely related to their beliefs about mathematics. In addition to the influence of prior beliefs, beginning teachers undergo the transition from university study to fulltime classroom practice with little practical professional experience. They have relatively few weeks of student teaching and often have unrealistic personal performance expectations when they begin fulltime teaching and the associated total responsibility for programming and lesson planning, instruction, motivation, classroom management,

assessment, and reporting to and interacting with parents (Johnson, Ratsoy, Holdaway & Friesen, 1993). Hence, many beginning teachers' preliminary experiences are as a form of 'survival' within the classroom, and in this context there is a constant interplay between situational constraints and individual choices or desires (Zeichner, 1983). The social context or 'cultural milieux' (Taylor, 1996), therefore, exerts considerable influence on day-to-day happenings, interactions, and teaching and curriculum decisions. Further, within this process of 'teacher socialisation' (Zeichner, 1983), the children in the classroom along with the school, other staff members, the community, and society in general can all impact upon a beginning teacher's decisions and pedagogical practices.

These belief, social and contextual factors that the literature reports as influential components of teaching practices, along with the apparent mismatch between teacher education programs and subsequent teaching practices, were the motivation for the study upon which this paper is based. The overall study (Sparrow, 2000) aimed to examine three main things:

- How a range of personal and contextual factors impact upon beginning primary mathematics teachers' pedagogical practices
- How these factors impact upon the beginning primary mathematics teachers' pedagogical beliefs
- The effectiveness of an empowerment model of professional development that incorporates a 'fellow worker' support mechanism

The focus of this paper is upon a key finding that emerged from the larger study while answering the first two research questions – that of *dilemmas* encountered by the beginning teachers. Here, *dilemmas* are defined as "situations which caused the beginning teachers to make a decision between two equally important choices" (Sparrow, 2000, p. 289). The result is a predicament in which "each of the available choices … involves a choice of negative factors as well as positive ones (Katz & Raths, 1992, p. 376). Each choice of action sacrifices possible advantages of the alternative choice of action, and hence, a perfect solution is not possible. Instead, resolving the dilemma is a matter of compromise and ongoing management of the conflicts (Katz & Raths, 1992).

The dilemmas noted by Katz and Raths (1992) were related to teacher education in general, not specifically to beginning teachers or mathematics teaching in the primary school. Hence this research is of significance in reporting on some of the challenging decisions faced by beginning primary mathematics teachers, the related choices they make, and how the foci or nature of their dilemmas change as they develop professionally.

Method

Since its aim was to understand the nature of a learning environment and the ways beginning teachers interacted with it, this study was designed as a naturalistic, interpretive inquiry. The research did "not attempt to manipulate the research setting", (Patton, 1990, p. 39), but rather, to elucidate the internal dynamics of relationships and situations. Hence, qualitative methods, with their capacity to emphasise contexts, meanings, and individuals' interpretations, were adopted.

More specifically, the research involved case studies of four beginning primary teachers with the researcher in the role of 'participant-as-observer' (Gold, 1969). The beginning teachers were volunteers for the research and they all had recently completed a one-year Graduate Diploma in Education in Western Australia after prior completion of a three-year Bachelor's degree. The sample consisted of two males and two females. This

was not typical of the overall enrolment in the diploma course, where generally males are in the minority. However, proximity to the university and the need for the researcher to visit the teachers on a regular basis governed selection of participants. The two males were mature-aged students, with backgrounds as a plumber (Harry) and a short time as a secondary teacher (Gaz). The two females (Stephanie and Tiffany) entered their education diploma immediately following an initial degree, which had itself immediately followed secondary school.

Data were collected from interviews, teacher and researcher journals, group meetings, and classroom observations. Interview transcripts were the initial data analysed, with the other data sources used to substantiate and expand themes identified in the interview data. Hence, data analyses proceeded inductively, with NUD*IST as a data handling tool (Qualitative Solutions & Research, 1997). Initial nodes for use in NUD*IST were selected from factors identified from the literature as relevant influences upon pedagogy.

Findings

During their first year of teaching the teachers in this study faced a number of dilemmas that could be categorised within the following four dichotomies:

- Personal beliefs about teaching versus what others recommend for teaching
- Selecting and using teaching strategies that focus upon developing learners' understandings versus development of performance
- Risk taking by trying different teaching strategies versus playing safe and maintaining the traditional or status quo
- Concentrating on the less able students versus accommodating the diverse range of students within a class

Each of these dilemmas is outlined in the upcoming sections and explicated along with examples from the situations and related interviews. They are discussed separately, yet are in fact related in complex ways that reflect the complexity of teaching situations. Changes throughout the year in the way the teachers handled the dilemmas are also noted, showing how the inherent conflicts in dilemmas are often managed in differing ways as teachers develop professionally.

Beliefs Versus Recommendations for Teaching

In their recently completed teacher education program, all the teachers had been exposed to a range of ideas and pedagogical practices that could be said to fit within a constructivist learning perspective. While these ideas were not necessarily in opposition to their personal beliefs about mathematics teaching and learning, they were sufficiently different to cause conflicts. This was particularly true when their beliefs about school contexts and expectations were considered, along with what they perceived as 'allowed' by the school or the children themselves.

For example, Stephanie and Tiffany, in their first week in schools, confronted a dilemma about teaching related to constructivist learning practices. They were conscious of how others thought they should teach, or more explicitly, of what their university studies had promoted as the way to teach primary school mathematics. They wished to incorporate talk, concrete materials, and group work into mathematics lessons, yet they initially felt constrained by what the school context allowed. In this case it was what they perceived to be the expectations of colleagues or the children themselves. Stephanie tried to 'fit in' by

copying what she saw another teacher do, for example using daily individual speed maths sheets, and she thereby chose not to risk the possible noise and activity of more open-ended or hands-on lessons. At the same time, she expressed concern that the students would either not behave, or would not be able to learn in a less structured environment because they would not be "sure of exactly what they are supposed to be doing". Similarly, since Tiffany felt constrained by the children themselves, with their behaviour, she chose initially to adopt a traditional approach to mathematics teaching:

> I attempted some hands-on exploratory learning activities and if I look past the behavioural problems, I guess some children did get something out of them. It is the behaviour difficulties that I have with five or six children that make me go for the option of 'worksheet maths'. (Tiffany)

In comparison, Harry managed the dilemma by concentrating more on his personal beliefs about mathematics teaching, with much lesser emphasis upon children's behaviour and reactions. He chose a textbook approach to teaching, partly to allow him to manage a large class with a range of ages and abilities, but also because he believed his children would not learn anything through more open-ended or hands-on tasks. He rejected these alternative approaches because his experiences and beliefs were that children just wanted the answer and did not want to think. A similar decision process occurred with Gaz, with the children's mis-behaviour during open-ended or hands-on tasks initially leading him to use traditional, individual, teacher-centred activities.

Exactly what the teachers focused on as most important in resolving the dilemma varied between individuals. As well, individuals themselves changed their foci and resultant actions as they progressed through the year, indicative of both their personal development as reflective teachers, and the inherent insolvability of dilemmas. For all the teachers, as the year progressed, a range of factors came into play that prompted them to deal with the beliefs-versus-recommendations dilemma in different ways. These factors included: more confidence in the classroom, increased knowledge of the curriculum, more knowledge of the children, and a questioning of what in fact the children were learning. In all cases, an increased desire to have mathematics lessons foster interest and understanding prompted the teachers to sometimes try non-teacher-centred strategies. The degree to which they made changes varied, as each person struggled with the related dilemma of: what appears to be working versus alternative strategies that supposedly will work but for which one has little evidence from personal experience. They began to question what in fact was 'working', particularly regarding what students were learning. In this way, they began to consider the potential relevance of alternative ways of working that would be more closely related to recommendations they had learned about in their teacher education program. This re-focusing relates to the dilemma discussed in the next section.

Learning With Understanding Versus Learning to Perform

All the teachers experienced a tension between teaching for understanding and teaching to demonstrate correct responses. It was an ongoing feature of their discussions over the year. They saw it as their duty to teach facts and skills in a way that the children would remember and reproduce successfully, and they felt a pressure to cover the syllabus or pages of the textbook.

Thus, the teachers had the dilemma of choosing between a focus on performance versus a focus on understanding. A performance focus could assist covering the material quickly, while a shift towards understanding involved more time. This meant that teaching for understanding was not a preferred option if one wished to complete coverage of the

syllabus content. For Harry, coverage of the syllabus was a primary concern, to the extent that his class completed the required components of the school mathematics program within the first half of the year: "Last term [Term Two] we finished with WA maths. We've actually been through the whole book and a good deal of extra material as well …" (Harry). Only later did the teachers reconsider the understanding-versus-performance dilemma, when they considered what else students might achieve in their mathematics learning. That is, at various points in the year, they began to question the educational validity of a focus on completion of the syllabus. This was usually in the context of questioning their viewpoints of mathematics and what it might mean to learn mathematics:

> Mathematics I guess I think in my own head is that, it's about numbers. It's about adding, subtracting, dividing, multiplying, money, decimal points, place value, all those words. It's not necessarily about living. And I think that's the key thing I learned today, is that you can do maths, or kids can do maths every day without actually knowing it … they've worked out that [an application]. … And that's something I wasn't aware of, or wasn't focused on, is that maths is more than chucking up a whole heap of numbers on the board … (Gaz)

In relation to examining the nature of mathematics and mathematics learning, some of the teachers began to consider the ways their choice of teaching strategies impacted upon student learning. However, this was not always the case, and appeared to relate to the first dilemma with regard to the teacher's perceptions of what the children allowed or preferred to have happen. For example, Gaz, co-teaching with the school principal, began to question his expectations of students' capabilities. In comparison, Tiffany continued to believe that her students needed rote learning:

> I pre-judged negatively, the kids were not interested because I was, I was teaching them as if they were stupid … You actually need to give them a go. I wasn't willing to give them a go and it backfired. (Gaz)

> I don't see any evidence they've learnt anything from it [maths games]. And so I find that the only way these kids seem to learn is if you sit down and you know, you just do the straight kind of work … And that's where I am coming from, because like we were taught to try to make it interesting and concrete things, but really these kids seem to just, they don't seem to be learning at this stage. These kids, just these kids. I'm not saying all kids. (Tiffany)

Teaching mathematics with understanding involves sound mathematical knowledge along with knowledge, skills and confidence in learner-focussed teaching strategies. These beginning teachers often did not have sufficient background experiences to work in a learner-focused mode, even when they wished to do so. Hence, they found themselves in the dilemma of having to choose between what they knew they could make work and what they felt inadequate to implement but which they felt might be a more effective approach. This dilemma is discussed next.

Risk Taking Versus Playing Safe With Familiar Teaching Approaches

After the first half of the school year had elapsed and they had survived, the teachers were more confident in their classroom management capacities. They were then more willing to try something different or non-traditional in their teaching strategies. However, this meant going out of a newly found comfort zone and taking a risk that things might not go as planned. The fear of a disaster or failure was strong, but if they did not take the risk then they might not reach a pedagogical goal to which they aspired.

The data showed that gradually, although it varied between the individuals, the teachers started to take small risks by attempting different pedagogical practices. For example, Stephanie and Tiffany adopted a more learner-oriented style of teaching once

they began to notice and become dissatisfied with the level of understanding displayed by their students:

> It would have been good to get the kids talking and writing about their maths from the beginning. I started a bit of it towards the very end of the year … and that was good and that sort of seemed to get the kids thinking a bit, but also helped me understand what they knew and didn't know … but I didn't do it till the end of the year. (Stephanie)

Tiffany was even willing to return to a hands-on style of working, an approach she had abandoned earlier in the year when its use led to classroom management problems. This willingness to risk a change arose from her reflections on her views of what mathematics teaching should be, as well as some small successes with using hands-on activities:

> That was a good success [using base ten blocks] … I used a sheet that had tens and ones on it, and of course we used MABs and we used, you know, two tens and three ones, or whatever. That was a success actually. They all seemed to manage how to do that … I think maybe I got into this habit of I've got to tell them, otherwise I'm not teaching them maths. But I mean I don't do it for language. … Well I think I should be a coach, because they need the guidance, they can't be totally left alone to find things out, they need some sort of encouragement … I don't think you should be telling them all of the time. Get them on the field and they do their own thing. (Tiffany)

In comparison, Harry was more reluctant to make changes because he had quite strong beliefs about how mathematics should be taught. These beliefs focused on providing students with exact directions for how to do things, and they thereby constrained him in making changes towards a less teacher-centred approach. When he had tried a hands-on, activity-based lesson earlier in the year it had led to behaviour problems in the class. This further strengthened his view that maths learning needs to be highly directed. In conjunction with this perspective was a lack of confidence in his ability to be a mathematical problem solver. He did not want to take the risk of "teaching something I can't do myself".

Less Able Students Versus the Rest of the Class

Working with mixed-ability and multi-age classes presented the teachers with numerous problems related to choice of overall goals, curriculum content, teaching strategies, and classroom management. In particular, a recurring dilemma that was mentioned within interviews and reflective journals was: "Do I concentrate on the less able students and ignore the rest, or should I aim for the middle range?" Children classified as 'less able' were perceived in this way for a variety of reasons, including inability to read and write, lack of general knowledge or basic skills, short attention span, limited capacity to work independently or follow directions, and low motivation. For example, Gaz noted:

> I've got kids who can't write, I've got kids who can't write but really want to, … plus you've got your mainstream kids that are just plain lazy. I find that I can't cope in a scenario like this. Obviously teaching the one lesson, there it is, because you either do it at such a baby level that your upper kids won't do it, or you do it at such a level that … [others] just sit there and go, "What are you doing, what are you talking about." (Gaz)

Generally, the teachers' initial resolution to the dilemma was to start everyone on the same task and then work more closely with the students having difficulties. The remainder of the class had to cope on their own, or if they were at the more capable end of the spectrum, they had to find something else to do when they finished. In addition, as a way of initially resolving the dilemma, the teachers expressed a desire to have the students working at roughly the same level of achievement:

> The practicalities come in and you can't always have something else for the other kids to do, and you don't want them to get too far ahead on the next thing you are doing because then you're going to get them even further in front. (Tiffany)

As the year progressed, some of the teachers began to express dissatisfaction with treating all the children similarly, saying such things as:

> Sitting them all down by themselves, not working in groups, basically they all did the same thing, which wasn't really catering for their different abilities. But they all did the same thing, and the ones who could do it probably just finished earlier and I didn't really cater for extending them, pretty much just do this. (Tiffany)

As the teachers gained experience and confidence in the classroom, they began to seek other resolutions to the dilemma by setting different tasks for different groups of students:

> I'm finding myself looking for extra resources now, not only to extend the children but to try and short-cut perhaps the children who are a long way behind … So now I've tried to make it more individual and I'm keeping a lot more notes on where each child is at. They've all got to improve, that's my standard now. (Harry)

However, this increased focus on individual learners did not occur to any substantial degree, and thus, the dilemma remained of high concern, with ongoing struggles of where one should place one's planning and teaching priorities within a class of diverse levels of achievement.

Implications for Teaching and Research

The identification and elaboration of the dilemmas faced by the beginning teachers suggest three main things concerning teacher education and related research:

- The impact of pre-service teacher education programs needs to be examined, particularly with regard to ways to bridge the gaps between university studies and prevalent classroom practices.
- In pre-service teacher education, teachers need more opportunities to examine the inherent complexities and conflicts of teaching alongside a wide array of potential resolutions and their related advantages and disadvantages.
- More mentoring or other forms of support are needed by beginning teachers as they 'survive' their initial placements and the many challenges they face in curriculum planning and implementation, classroom management, and personal professional self-esteem.
- Teachers' perceptions of their students' behaviours had a strong influence on pedagogical beliefs and practices, yet this has not been an area of focus within the research literature on teacher beliefs.

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