Implementing Beliefs, Knowledge and Practices:
A Beginning Teacher's Story

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This paper presents a case study of a primary teacher in her first year of teaching. As a preservice teacher, Ann was a participant in a longitudinal study that investigated the impact on primary teachers' mathematical beliefs, knowledge and practices of a mathematics education course that utilised a constructivist approach. The current study investigated the extent to which such changes were sustained and enacted upon in the transition to teaching. It was found that while Ann's personal beliefs were quite resilient to change, 'school issues' created challenges to the enactment of these beliefs.

My philosophy of teaching has not changed and I battle with that everyday, not with the philosophy, but with the *style* versus what I want.

(Ann, beginning teacher)

This is a story about Ann, a teacher in her first year of primary teaching. She was one of twelve participants in a longitudinal study that investigated the impact of a preservice teachers' course on the mathematical beliefs, knowledge and practices of its students. Initial findings of this study have been reported elsewhere (Aldridge & Bobis, 2001; Bobis & Aldridge, 2002). These findings have led us to believe that when preservice teachers' learning is situated in multiple authentic learning contexts during their mathematics methods courses the learning is more effective. However, the question as to whether our graduates would translate their beliefs and knowledge into practice due to the employment of such an approach remained. The final stage of our study was designed to explore this concern and is reported in this paper.

An Interface for Theory and Practice

The inability of beginning teachers to translate the theory-based knowledge of the university context into classroom practice has been clearly documented (Foss & Kleinsasser, 1996; Wubbels, Korthagen, & Brekelmans, 1997) and is a point of concern for many mathematics educators (Frid, 2000; Klein, 1999). With the adoption of a constructivist approach by the majority of teacher education programs, it was anticipated that such an approach, if modelled by teacher educators, would translate into the classroom practices of our graduates. Unfortunately, research evidence as to the degree constructivist approaches have been translated into classroom practice is disappointing, and at best, unclear (Frid, 2000). However, the significant role of teachers' beliefs and their relationship to actual classroom practices has proven to be more fruitful in understanding the problems associated with the translation of theory into practice (Thompson, 1992). Corporal (1998, cited by Korthagen & Kessels, 1999) considered changing attitudes and beliefs to be a vital factor in a person's ability to translate theory into practice. This is significant since all preservice teachers begin their teacher education with a past history. Korthagan & Kessels (1999, p. 6) refer to this as a "student teachers' theory". Normally this theory contains beliefs about mathematics and its teaching that are initially quite different from the theories

espoused by the teacher education programs. It is essential that student teachers' histories are acknowledged and that they be challenged to construct a theory that builds on these experiences. This is imperative if theory and practice are to effectively translate.

Another important factor that has emerged from the research literature concerned with the translation of theory into practice, is the integrative design of teacher education programs. Brouwer (1989) found that the degree to which programs integrated and alternated theory and practice could significantly determine the degree to which beginning teachers were able to translate theory into practice. Our findings have previously indicated that the multiple authentic learning contexts provided an effective interface for such an integration and alternation of theory and practice (Bobis & Aldridge, 2002).

As teacher educators, our concerns have focused on how best to help our graduates translate their beliefs and knowledge to their practice once they make the transition to teaching. Case studies, such as the following, help us reflect on what we might do to better prepare our graduates for such a transition.

Background to the Study and Method of Inquiry

Ann was one of 12 preservice primary teachers who participated in a longitudinal study designed to investigate the impact of a teacher education program on their mathematical beliefs, knowledge and practices. The program in question is a 2-year postgraduate initial teacher education program that adopts an inquiry and case-based approach. As part of this program, prospective primary teachers complete three units of study in mathematics education — approximately 36 hours of instructional time in total.

For the final stage of the study it was decided to select a graduate for case-study. Ann was selected mainly for reasons of a logistics. Namely, she was able to secure a full-time teaching position after graduating, both she and her principal agreed to observational visits by the researchers, and her school was within a 20 kilometre radius from the University, thus making field observations during the university semester a possibility.

To tell Ann's story, we selected data from three significant 'points' in her journey to becoming a teacher. The first point was at the beginning of her teacher education program, the second was towards the end of her degree, soon after completing a 10 week internship. The final data gathering point was at the end of her first year of teaching. The first two points were selected due to the fact that Ann identified them in her final interview as being the most significant phases in her preservice teacher education for the formation of her beliefs about mathematics and the teaching of mathematics.

At each of these points, data was collected from at least two different sources, namely, concept mapping and semi-structured interviews. During the final phase of the study, data was also collected from three lesson observations. The observations incorporated detailed observer notes and photographs of the classroom environment. Informal conversations with Ann about her teaching prior to and after the lesson observations were also used as a source of data.

Concept mapping was used to investigate changes to Ann's beliefs and knowledge (Novak & Gowan, 1984). On each data-gathering occasion, she was asked to construct a concept map for the word 'mathematics' (see, for example, Figure 1). The map was then used as a stimulus in the interview to elicit explanations of her personal theories about

mathematics and her teaching of mathematics. In addition, during the final interview, Ann was asked questions regarding the degree to which she felt she was able to enact upon her current personal beliefs and whether they had changed from those envisaged during her preservice education.

Lesson observations were undertaken to investigate the extent to which Ann's espoused beliefs and practices were enacted upon in the classroom. Observations were made on three separate occasions over a two-week period by both researchers. Each lesson was approximately forty-five minutes in duration. Photographs were taken to provide a richer picture of the classroom environment. During the analysis of observation notes and interview data, it was recognised that the photographs were another valuable source of information, providing evidence to the degree to which Ann was able to translate her personal beliefs and theories into her classroom practices.

Prior to the observations taking place, decisions were made as to the type of observations that would be made and the kinds of notes that would be taken on the lessons. Cohen and Manion (1989) identify two types of observer—participant and non-participant. In the case of a participant observer, the researcher becomes part of the group and engages in the activities that are to be observed. Non-participant observers separate themselves from the context in which data is gathered so that they do not interact with the group. We were conscious that any presence in the classroom was a perturbation, whatever level of involvement (Jaworski, 1994). Hence, we chose to be participant observers. Our level of engagement varied from being a teacher (helping a child or small group of children solve a problem through carefully structured questions) to passively watching a portion of a lesson from the back of the classroom. We considered that our presence as participant observers would more closely parallel the presence of a parent-helper and as such would minimise non-routine behaviour of both Ann and her students.

In regard to the kinds of notes that would be taken, we felt some tension. We did not want to be criticised for observing practices simply because of what we were hoping to observe. However, we were not there to observe just *any* teaching—our aim was to determine the extent to which Ann's espoused beliefs and practices were enacted upon in the classroom. We took advice from other researchers and to wait for "significant" events (Jaworski, 1997, p. 115). It was considered that all observations were selective and if we made notes about some event, it must have had some level of significance for us. Significant events were those that caught our attention. Cohen and Manion (1989, p. 134) describe participant observation as 'a process of waiting to be impressed by recurrent themes'. We used these themes to guide observations of *significant events*. Both researchers independently observed the teacher and made notes of *significant events* in the lessons. These notes were then compared and analysed in conjunction with data from Ann's final concept map and interview data.

In the following section, we have integrated data from each of our primary sources (concept mapping, interviews and observations) to tell Ann's story. The narrative approach (Connelly & Clandinin, 2000) allows us to see the *whole* person rather than report separate 'findings' from the various data gathering sources.

Ann's Story

Ann entered her first primary mathematics methods class at university feeling a little nervous. This was definitely not going to be her favourite class each week. However, the first class was not what she had expected. The lecturer spent a lot of time talking about what she referred to as the *baggage* students bring to her classes. She realised that she was not alone in her feelings towards the subject or her experiences with mathematics.

Ann was asked to draw a concept map using the word 'mathematics'. The lecturer assured the class that there were no restrictions on how they responded. Ann's concept map was typical of many of the students in her class (see Figure 1). It included words to describe feelings or emotions negatively associated with the subject (e.g. 'panic' and 'blackout'). It also included a view that conceptualised mathematics as a content-driven subject (Aldridge & Bobis, 2001). When discussing her concept map, she explained that she had always been "in the top stream and achieving well" at school. However, when it came to mathematics "my mind blanks out,… I feel stupid, inadequate and embarrassed. It is just one of those weak points that I try to push to the back of my mind…that I never want to have anything to do with maths". She knew "she wasn't stupid, but in the case of maths that was how I was made to feel".
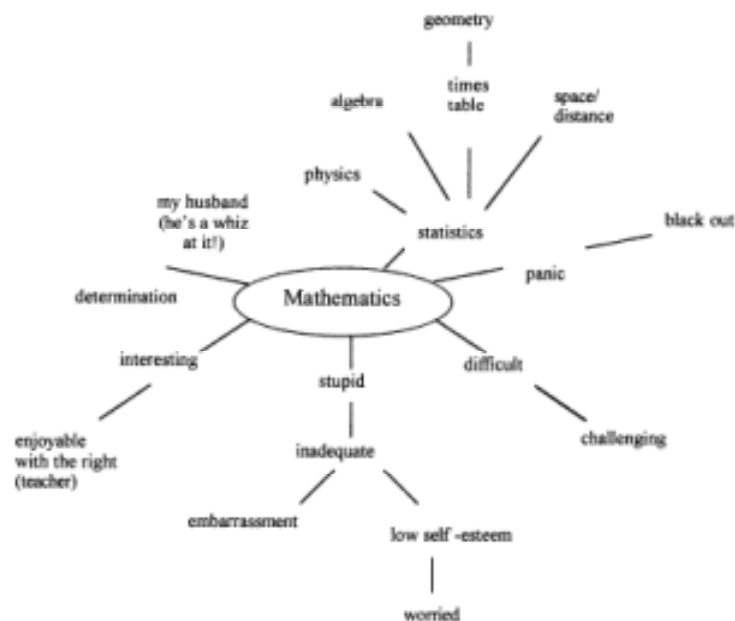

Figure 1. Ann's initial concept map.

Ann had definite ideas for what she hoped to achieve as a result of undertaking the mathematics methods courses at university. She was "determined to get over" her fear of mathematics "and figure the maths out". It was important "that those fears of mine are addressed before I go into the classroom. Ann recognised the significant impact a teacher's lack of confidence could have on children.

Despite her negative experiences and feelings Ann was willing to change. She even had some preconceived ideas on how she wanted to teach mathematics. She was "interested in different ways of approaching maths, working in groups and relating it to everyday life. That makes sense". Unfortunately, she felt she would always be worried about whether she could or could not do the mathematics. Her history with mathematics had left her a legacy that she felt at this time could never be resolved.

Ann's Story Unfolds: Theory Into Practice

Ann completed her ten-week internship with a positive feeling towards mathematics. She wondered how she could have ever felt so unsure about it. She looked at her first concept map and mused on how different her feelings now were about the subject. This was what struck her most. She felt she had "rediscovered" mathematics and that she actually enjoyed teaching it. It was now her favourite teaching subject and the one she felt most confident teaching.

Ann also thought about the subject itself. It "wasn't about rote learning and memorising—it was about searching for patterns, hands-on activities, making sense of what children do and is relevant to everyday life". This was a whole new way of thinking about mathematics that she had not thought possible only eighteen months earlier.

While reflecting on her internship, Ann highlighted several new aspects of her practice that she now considered central to her beliefs about teaching mathematics. In particular, she discovered how valuable it was for her students to link mathematics to literacy. She "was amazed by the way she was able to make connections between the children's everyday language and the language of mathematics". However, questioning remained a challenge. Ann was frustrated by the fact that she wanted "to focus on questions", but had to struggle to find the right "questions to push the children's knowledge to the next step".

Ann identified other aspects of the internship experience as constraints to the way she wanted to teach mathematics. The textbook was the biggest hurdle. During her two practicums and internship, each school used a textbook to some extent. She wondered how she would address this if she were told that she had "to cover 10 pages a week". She knew what she would do—"scream". Ann thought that she would probably "have to compromise" and "build it (the textbook) in" to her teaching. Timetable restrictions and resources were two other constraints to the way she envisaged teaching mathematics. She thought that if she were in an *ideal* school she would have calculators in her room for every child, "lots of materials for them to count and to make patterns, balance beams to do practical measuring stuff", but that "this is what dreams are made of".

Deep down, Ann still felt a lack of confidence in her own mathematical ability. Despite the fact that she had learnt so much there was still the worry that she would not be able to answer a child's question. However, she was convinced of the importance of a good teacher and this was what she wanted to be.

Soon after the internship, Ann completed her degree with first class honours. She was targeted by the New South Wales Department of Education and Training and relieved to think that she had a *real* teaching job in the new year. She visited her school prior to the children breaking for Christmas holidays. It was a large school with over 800 children—90% of whom were ESL.

The Reality of the Classroom

> My philosophy of teaching has not changed and I battle with that everyday, not with the philosophy, **but** with the *style* versus what I want.

Ann had been teaching for almost a year when we visited her classroom and asked her to construct and explain another concept map. On entering her Year 2 classroom, many significant features provided evidence of what she valued in mathematics teaching. The mathematics table was carefully arranged with packaging from everyday life (see Figure 2). A card with an open-ended problem was placed amongst the boxes and another card with the words: "I challenge you to solve this problem" pinned to the wall beside it. Ann had always considered it a priority to relate mathematics to the real world and she took every opportunity to help make connections for the children. The link between mathematics and literacy was also still very strong with numerous examples of the children's writing about mathematics displayed around the room. With 90% of "my class coming from an ESL background this is really important". The students in Ann's class were familiar with the way small groups operated. Her insistence on using concrete materials whenever possible was indicative of her belief in the importance of "hands-on" experiences.

Figure 2. The maths table in Ann's classroom.

What had changed most in Ann, was her level of confidence with the mathematics content. All through her life, she had lacked the confidence in her ability to do the mathematics. However, now "I don't mind what maths gets thrown at me. I can go back and I know the strategies to work through it". She felt that this change was mostly due to the fact that "I was prepared to teach mathematics really well". She considered that her philosophy of how she wanted to teach mathematics had not changed since her internship. However, it was a daily battle as to how she could teach the way she wanted. Constraints, or what she referred to as "school issues", were imposed upon her by the lack of resources and the school's insistence on the use of a textbook. These issues were foreshadowed by Ann while still an intern. She admitted that she had had to "make compromises" to her teaching because of the textbook.

It is no surprise to say that the textbook is my biggest challenge. My worst fear was realised when I was told that the children had to complete the textbook by the end of the year. This was an 'unspoken rule' at the school. There was a culture at the school that you had to have pages of the textbook finished to show the children had learned something. I did rise to this challenge. I used a mix of some textbook and some hands-on activities. It seems it is always a compromise. But I don't just use the textbook. I didn't change my philosophy, I just had to adapt it to suit the realities of the classroom.

It was evident that Ann still espoused the same beliefs about teaching mathematics as she did prior to her first year of teaching. However, it was also clear that the realities of the classroom had caused her to make compromises as to how she might enact upon them. On reflection of her situation, Ann considered that every school would have its own *issues* and that "no school would ever be ideal. I will always need to consider the context and reflect on how my goals can be translated into it".

Implications for Teacher Educators

As teacher educators, our ultimate aim is to improve the quality of mathematics instruction in schools. We can do this only if our graduates are able to translate their beliefs and knowledge about teaching mathematics into practice. In this study, our concerns focused on the degree to which the beliefs and espoused practices of a beginning teacher were enacted upon with her transition to teaching. It was revealed that, in the case of Ann, her personal beliefs were quite resilient despite a number of 'school issues' that she identified. Case studies of beginning teachers provide us with crucial information as how to improve the preparation of our teachers so that their personal beliefs about teaching mathematics remain resilient in the face of such challenges. We are still examining our own practices in the light of these findings.

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