USING AN EMPOWERMENT PROFESSIONAL DEVELPOMENT MODEL TO SUPPORT BEGINNING PRIMARY MATHEMATICS TEACHERS

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This is a case study report from a larger study that focused on how an empowerment professional development model influenced the mathematics pedagogical practices and beliefs of Australian primary school teachers during their first year of teaching. The research used an interpretive approach for analysis of data from interviews, observations, reflective journals and group meetings. Initially, the challenges of classroom realities led the beginning teacher of this case study to discard the 'theoretical', 'modern', learner-focused ideas for mathematics teaching she had learned about in pre-service teacher education. Through the support of the empowerment professional development model she began to develop ways to navigate between theory and the realities of classroom practice.

PURPOSE OF THE STUDY

The directions that mathematics education has been endeavouring to follow in the last decade have been influenced by many factors. Curriculum guidelines developed to articulate and support new directions present mathematics teaching and learning as engagement in inquiring, meaning-oriented, challenging, purposeful and relevant activities (e.g. Australian Education Council, 1994; National Council of Teachers of Mathematics, 2000). This perspective is a departure from 'traditional' mathematics teaching in which teachers tell students how to think about concepts and how to perform particular procedures, with students then expected to practise skills and reproduce ideas. The two perspectives are based on different assumptions and beliefs about the nature of mathematics and effective mathematics teaching and learning. Hence, the reform efforts associated with current curriculum documents set ambitious goals for schools, teachers and students. They challenge 'traditional' views about mathematics and the appropriateness of related 'traditional' teaching and learning practices.

The new directions promoted for mathematics education therefore require changes in beliefs, values and practices on the part of teachers and students. These changes are not likely to happen without the support and guidance of appropriate professional development (Borko & Putnam, 1998). It was this concern that motivated the study upon which this report is based. Thus, within the context of mathematics education reform, the overall study (Sparrow, 2000) aimed to examine:

- the potential impact of an empowerment model of professional development, later named the 'fellow worker' model.

The research is of significance in reporting on beginning primary mathematics teachers' dilemmas and challenges, the related choices they make, how the foci or nature of their decisions change as they develop professionally, and how a 'fellow worker' can play a valuable role in this development and professional empowerment (also see Sparrow & Frid, 2002). In addition, the research highlights how beginning teachers struggle to make links between the theories of mathematics education espoused in their pre-service

education program and the realities of teaching practice as encountered in their classrooms.

THEORETICAL FRAMEWORK

The nature of teacher professional development

Teacher professional development, as conceived of in this study, aligns with constructivist philosophy in that learning to teach is viewed as a process of personal growth that is influenced by personal beliefs, commitments, and ways of operating in and interpreting one's world (von Glasersfeld, 1995). Means by which this growth can be facilitated are not fully understood and articulated within the educational literature, although various models for professional development have been designed and implemented. These models can be loosely grouped into three categories according to how the notion of 'change' or 'growth' is incorporated into the model (Sparrow, 2000). The three groups –Transmission, Partnership, and Empowerment – although inter-related, vary in the degree to which an external expert acts as a director or decision maker. Since the intent of this study was to support teachers in ongoing and long-lasting professional development, design of the professional development model needed to be consistent with what the literature reported as 'effective' principles and activities for changing beliefs, knowledge, and teaching practices. Thus, design of the professional development model drew predominantly on the ideas and mechanisms of the Empowerment group.

Principles for an empowerment model of professional development

Key within an empowerment model of professional development is that teachers' professional learning needs should be driven by their concerns, interests, and the realities of their daily classroom and school experiences. They should have ownership of their professional development so that 'coming to know' as a professional is based on their own reasoning processes, and so that their own ideas and voices can be effectively integrated with those of others (Cooney, 1996). The ideas and related practices may come from many sources, however, what is key is that the teachers themselves mediate the ideas, construct meanings from them, and act according to their own values and decisions (Richardson, 1994). Teachers are then empowered to develop a professional identity, and be analytical and attentive to context. Further, they are empowered to recognise themselves as their own change agents.

The 'fellow worker' professional development model of this study was designed to support these ideas of empowerment. More specifically, it was designed to use reflection and experimentation to actively involve teachers and provide for personal choices in their actions (Clarke & Peter, 1993). The researcher became the 'fellow worker' – a more experienced colleague who could support the beginning teachers in the process of reflection, consideration of options related to teaching practices, and small-scale experimentation with options. This role meant the fellow worker was a hybrid of a critical friend, colleague, listener, mentor, resource person, and supportive, interested person. His role was also as a catalyst by which the beginning teachers could reason about and learn from their own teaching experiences. In this context it was recognised that, as Easen (1985) noted:

> You cannot change other people, nor can they change you; people can only change themselves. The best anyone can do is to provide a structure, which helps others to change, if that is what they want to do. (p. 71)

Consequently, the fellow worker had to be more concerned with choice than with change, and be wary of reinforcing his self-image of mathematics teaching irrespective of the needs and wishes of the beginning teachers. Key features of the structure that framed the fellow worker professional development model are outlined in Figure 1 along with some of the literature sources from which these principles were developed.

- The fellow worker will be an experienced teacher.
- Reflection on practice and beliefs about mathematics and mathematics teaching and learning will be emphasised.
- The beginning teacher will decide which issue will be the focus of attention, and what will happen in the classroom or elsewhere.
- Options for action will be decided between the fellow worker and beginning teacher, with experimentation in the classroom encouraged to provide data for reflection.
- Meetings with other beginning teachers will be established.

(Clarke, 1994; Clarke & Peter, 1993; Eason, 1985; Feiman-Nemser, 1992; Knowles, 1984; Prawat, 1991; Pultorak, 1996) (Adapted from Sparrow, 2000, p. 72)

Figure 1. Key features of the fellow worker professional development model

METHOD

Since its aim was to understand the nature of a professional development learning process, this study was designed as a naturalistic, interpretive inquiry. Hence, qualitative methods, with their capacity to emphasise contexts, meanings and individuals' interpretations, were adopted (Marshall & Rossman, 1995). More specifically, the research involved case studies of four beginning primary teachers with the researcher (author 1) in the role of the fellow worker of the professional development model.

The four beginning teachers were volunteers for the research and they all had recently completed a 1-year Graduate Diploma in Education in Western Australia after prior completion of a 3- or 4-year Bachelor's degree. Data were collected from interviews, teacher and researcher journals, group meetings, and classroom observations. Interviews occurred at least twice in each of the four 10-week school terms, while group meetings took place at the end of Terms 1, 2, and 3. 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 analysis 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 beliefs and pedagogy.

Tiffany, the beginning teacher of this case study report, was 23 years of age when she began teaching in a combined grades 2 and 3 class of 34 students. The school, located in a country town about two hours drive from a major city, had an enrolment of approximately 180 students in kindergarten to grade 7. The student population included children from farming as well light industrial and professional families, and also included many Aboriginal children.

FINDINGS AND DISCUSSION

The following discussion focuses on the case of Tiffany as an exemplar of how use of the 'fellow worker' empowerment professional development model was a process that impacted upon teachers' practices and beliefs. Detailed discussion of the one case only provides a complete, coherent, and authentic account of one teacher's experiences without fragmenting the findings amongst more than one teacher. In this way, a picture of Tiffany's professional development pathway and its context are presented, with related commentary on how key components of the professional development model – reflection and experimentation – appeared to be influential in this pathway.

Initial reflections and related beliefs and teaching practices

Early in the year, Tiffany's reflections displayed conflicts between the ideas she had from her teacher education program and her underlying beliefs about children and mathematics learning. In particular, she knew about using concrete materials and activity-based teaching strategies for mathematics, and had tried to use them, but their effectiveness in practice was not evident. Instead, she had behaviour problems with the children that led her to adopt "the easier option of worksheet maths":

> … back to the first lesson I did, I think I used blocks and things like that, and that got pretty out of hand. That put me off for a while, so I went back to things that were easier to control.
>
> … For this reason I choose maths experiences that involve the children sitting and working on paper. To tell you the truth, it is just plain easier to teach maths in this class in this way.

What Tiffany witnessed in practice was that when you do "like we were taught, to try to make it interesting and use concrete things … [then] they don't seem to be learning". Her interpretations of her children's responses to her mathematics teaching were that students did not enjoy or learn from other than the "sit down and … just do the straight kind of work". This caused her confusion because it conflicted with the theories and teaching strategies she had learned about in her pre-service program:

> I've had a sit down where we've had lists of sums [written computations]. … They just loved doing it, and they'll do pages and pages of that. … And it was amazing, they just seemed to like it, and they've actually told me that's what they prefer to do. … It was weird because we are sort of taught, you know at college, that you do all these open-ended things. But it doesn't really work with my kids.

Hence, Tiffany found herself in a dilemma. She expressed a desire to use more hands-on, investigative, or game-based activities to "get a balance", but she was not convinced that this would support mathematics learning:

> Like it's good to do. I've tried a few number recognition games and stuff, but really I don't see any concrete evidence that they've learnt anything from it.

At this time, early in the year, it was not clear what Tiffany's beliefs were about what constitutes mathematics learning, particularly because she could not clearly articulate her ideas while she was experiencing much confusion. Her beliefs appeared to be related to notions of children sitting quietly, staying on task, and accurately completing worksheets and written calculations. She did not appear to have the mathematics knowledge or pedagogical knowledge to see what learning might be embedded in other types of learning activities. This, along with what appeared as a lack of pedagogical experience for managing children's behaviour when implementing alternative activities, led Tiffany

to initially adopt a 'traditional', rote-learning, teacher-centred approach for her mathematics teaching practices. She appeared to believed that her children needed to learn by sitting down, being told what to do, and then remembering and practising procedures.

Ongoing reflections and experimentation

The role of the fellow worker became vital as Tiffany continued reflecting on her classroom experiences and what they might mean in relation to her teaching practices, children's learning, what she had learned at university, and what she wanted to try in her teaching. He was able to support her to explore some of her ideas and to then see related successes. Through explicitly asking Tiffany to reflect upon positive things that happened in her mathematics teaching, no matter how small, he was able to assist her to examine what in fact children were showing about their mathematics thinking and learning. At the same time, Tiffany was supported in taking small risks to try new things or re-try things that had not worked earlier.

Examples of how the fellow worker supported Tiffany to experiment with new teaching practices arose in relation to the use of concrete materials, calculators, games-based activities, open-ended tasks, and alternative assessment (i.e. techniques other than paper and pencil tests). The use of concrete materials will be briefly discussed here as an exemplar of how Tiffany was empowered via experimentation and reflection to develop insights into children's learning, as well as the skills and confidence to implement new teaching strategies.

Tiffany repeatedly expressed a view that mathematics learning should involve concrete materials and related activity-based tasks, although it was not clear if this commitment came from personal beliefs or from beliefs that the theory she had been taught at university must contain some truth. The fellow worker prompted her to talk about her experiences with concrete materials, encouraging her to reflect upon what had or had not happened and why this might be:

> Well if you want to try a bit more, let's try to pick the eyes out of it if you like, and see ways in which it might go forward, but little ways. (Fellow Worker)

Subsequently, once options had been examined with the fellow worker, Tiffany experimented, with varying degrees of success, with using concrete materials:

> I actually intend to do it again with some different material. I think they can do it. I mean, I said last time they couldn't do it, but sometimes they can.
>
> Because I thought, well I shouldn't give up on it. … It's a matter of changing the way you do it and adapting to what they can handle, and then I can sort of do it.
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> They seem to have gotten on to it quite well [using concrete materials for fractions]. Like I thought, first, they're writing fractions and they're not going to have a clue. But the way we did it, I did the concrete things with the pattern blocks … a lot of them seemed to have understood the concept of a fraction.

Without the support of the fellow worker, one might speculate that Tiffany would have continued to see the use of concrete materials as too difficult to pursue, abandoning her efforts as she had done at the beginning of the year. Instead, the reflection and experimentation process, supported by the fellow worker, appeared to be a catalyst to both initiate and facilitate change:

> [The journal] … it's actually quite good because it makes me think about it as I'm writing. As I was writing one, I thought, well then you could have done something different that you wouldn't have had that problem with.
>
> I think you get stuck in a mindset. Like once you get into the practical, teaching that way [traditional method], it's hard to get out of it. You know, like you are just thinking all the one way. But if you start thinking, reflecting, then you can in fact probably think of a million things to do.

Tiffany's words in these interview excerpts display her increasing awareness and appreciation of the value of reflection. She simultaneously showed development of her capacities for both breadth and depth in reflection, demonstrating an increased capacity to analyse her own pedagogical practices and the nature of children's mathematics learning and related learning needs:

> Sitting them 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 finished early, and I didn't really cater for extending them.
>
> They just need more realistic practice. I don't know exactly what I mean by that. I guess not just a subject on a page is what I was meaning. They need experience at counting real things, in the room and outside. And like, with those games, that was sort of a real thing, and they need more practice at that sort of stuff … to apply the principles from there to the real world.

As the year progressed, Tiffany started to develop options and solutions herself, relying less on the fellow worker to offer possibilities. At all times, even initially when the options were largely generated by the fellow worker, possible solutions were considered in the context of Tiffany's own classroom experiences, teaching capacities and beliefs. That is, both reflection and experimentation were grounded in the specifics and realities of practice rather than the generalities of theory. In this way Tiffany was able to develop personal meanings for and ways of operating with the theories of mathematics teaching and learning that she had learned about at university.

Changes in practices and beliefs

While Tiffany was supported by the fellow worker in navigating between theory and practice, she shifted in her teaching practices as well as her beliefs about teaching and learning. Specifically, her practices developed to include more use of concrete materials, games-based activities, open-ended tasks, calculators, and observation and portfolio assessment. When non-traditional teaching strategies were implemented, though sometimes with only a limited degree of success, Tiffany began to trust the worth of alternative methods that she had previously viewed as the theory from university that "doesn't really work with my kids". Thus, positive experiences in experimenting with putting theory into practice, in the specific context of her own classroom, began to affect her beliefs about mathematics teaching and learning. She explicitly noted late in the year that she now recognised she had been struggling with a belief that mathematics teaching is "telling":

> You know what I think it is? I think it was because I had in my mind what maths should be. I'm standing there and they are all sitting there. … so when they are actually learning by themselves, I think that's just a time filler. It's not a maths lesson. But really it is. But I had the view that I should be up there teaching all the time.

At the end of the year Tiffany was thinking much more of the mathematics teacher as a coach, rather than a director with a pre-determined script. She now believed that children needed guidance to obtain their best performance, and she still appeared to believe there was a performance to be refined, and thus, a correct way to do mathematics. However, she had begun to recognize value in allowing learners to make some use of their own thinking:

> Well I think I should be a coach, sort of like, because they need the guidance, and then they need, they can't totally be 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 then they do their own thing.

CONCLUSIONS AND IMPLICATIONS

Tiffany's journal notes as well as comments in meetings with the fellow worker indicated she found herself in an ongoing struggle with what she felt should be done in mathematics, what she tried to do, and what the children preferred or were in fact able to do successfully. Her pre-service teacher education program had presented a picture of how one might teach, but early attempts to implement this style did not work. However, she was able to make changes, from a traditionally-oriented teacher to one who was experimenting with a variety of teaching and assessment styles. Whether this development can be attributed solely to the empowerment professional development model is debatable. However, there is evidence to suggest that is was influential in that with the assistance of the fellow worker instances of 'good' practice were supported and further developed.

These findings suggest three main things concerning mathematics teacher education and related research:

- More mentoring or other forms of support are needed for beginning teachers as they deal with the many challenges they face in their classroom management, curriculum planning, teaching and assessment practices, and professional beliefs and identities.
- The impact of pre-service teacher education programs needs to be examined, particularly with regard to how to bridge the gaps between what is promoted in mathematics education studies and what are the realities of schools and classrooms.
- In pre-service education, teachers need to further develop their skills and confidence as reflective practitioners who can examine the inherent complexities and conflicts of teaching alongside a wide array of potential resolutions and how they might be put into practice.

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