

Stories From the Classroom: The Developing Beliefs and Practices of Beginning Primary Mathematics Teachers

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This study examines the developing beliefs and practices of six beginning primary teachers. Their accounts reveal practices indicative of contemporary approaches to teaching and learning in mathematics. Additionally, a consistency appears to exist between the beliefs and practices of the beginning teachers, and the ideals for mathematics teaching formed during pre-service education. This is noteworthy as it is contrary to the literature that has described how the challenges of beginning teaching can have a significant negative impact on pre-existing beliefs and classroom practices.

Introduction

Mathematics teacher educators are currently faced with the task of preparing beginning teachers who can “break the cycle of tradition” in mathematics teaching and learning (Frid & Sparrow, 2007, p. 295). This is best achieved by encouraging pre-service teachers to reflect upon their existing beliefs and supporting them in forming newly developed ideals that they will take into their classrooms. However, the socialisation of beginning teachers can have a significant impact on the beliefs that will ultimately inform their practice. The literature suggests that the influences of pre-service teacher education are nullified in beginning teachers, and that they assume the beliefs and values dominant in the existing culture of the school (Brown & Borko, 1992; Zeichner & Tabachnick, 1981). If the cycle of tradition is to be broken, the newly developed beliefs of beginning teachers need to remain resilient even when they are challenged during the socialisation phase.

The focus of this study is to describe the developing beliefs and practices of a group of beginning primary mathematics teachers, and determine the factors that enabled, or challenged, these teachers in maintaining the ideals and visions for primary mathematics teaching that they formed during their pre-service teacher education.

Literature Review

Pre-service Teacher Beliefs about Mathematics Teaching and Learning

Recent research has found experiences as students in mathematics classrooms significantly influences the beliefs of pre-service teachers regarding mathematics teaching and learning (Lloyd, 2006; Sliva & Roddick, 2001). Typically pre-service primary teachers have negative attitudes and a lack of confidence regarding teaching mathematics as a result of disappointing and discouraging experiences learning mathematics (Brown et al., 1999; Drake et al., 2001). Such personal classroom experiences will also inform how pre-service teachers will ultimately teach mathematics. The participants in Brady’s (2007) study were clear that they would either call upon their prior positive classroom experiences to influence how they would approach teaching primary mathematics, or were adamant that previous negative experiences would not be repeated in their future classrooms.

Teachers' Beliefs and Classroom Practices

A number of researchers (Beswick, 2003; Cross, 2009; Nisbet & Warren, 2000) have investigated the relationship between teachers' beliefs and the classroom practices, which is often not clear-cut. Rather, the relationship is dynamic with each influencing the other (Nisbet & Warren, 2000; Thompson, 1992). Research also highlights the impact of the social contexts of teaching on teacher beliefs. Brown and Borko (1992) contend that personal biography is a strong factor in influencing the beliefs of beginning teachers, together with the impact of their teacher education programs, and their early experiences as teachers. However, Zeichner and Tabachnick (1981, p. 7) argue that the beliefs developed during teacher education are soon “washed out” of beginning teachers. The teacher socialisation literature suggests that when beginning teachers are confronted with the uncertainties of the real world of teaching they assume beliefs and attitudes that are dominant in the existing culture of the school and that they adopt the practices of more experienced teachers (Brown & Borko, 1992). However, in adopting the practices of experienced colleagues, beginning teachers may be accommodating their beliefs regarding ‘fitting in’ rather than actually modifying their teaching beliefs (Steele, 2001).

Beginning Primary Mathematics Teaching

Teaching mathematics is especially demanding for beginning primary teachers and the challenges confronted result from two broad factors. Firstly, although the literature emphasises the importance of beginning primary teachers having a sound mathematical content knowledge, most are typically generalist in their academic preparation and thus lacking in this regard (Kauffmann, 2002). The second broad challenge that beginning primary teachers encounter is managing the complex range of classroom contexts and practices that are required for mathematics to be effectively taught and learned (Frid & Sparrow, 2007; Sparrow & Frid, 2001).

Research Method

Narrative inquiry was selected as the method best suited to the purpose of this study: to describe the developing beliefs and practices of beginning primary mathematics teachers. A number of previous studies have successfully applied narrative approaches to exploring the development of beginning mathematics teachers (Brown, 2005; Kaasila, 2007; Rust, 1999). The participants were six beginning primary teachers mid-way through their second year of teaching (background information about the participants is summarised in Appendix 1). In this study, narrative interviewing was adopted as the means of data collection. The accounts were firstly examined to build a perception of the each participant’s individual beliefs regarding of the teachers’ role in primary mathematics, and learners and learning. A cross-case analysis of the transcripts then illuminated the commonalities and differences in the beginning teachers’ beliefs and practices.

Findings and Discussion

Teacher’s Role in Primary Mathematics Classroom

The participants all held firm views regarding the teacher’s role in the primary mathematics classroom, some very similar and some distinctly different. One key role of the primary mathematics teacher that Jenny, Sarah and Verity identified was planning for learning. As Verity explained this firstly involves considering their students’ existing

understandings: “I’m just a believer [in] making sure children start from where they’re at and move them on from there”. For Jenny this also involved planning for the current and future learning needs of her students: “I find it really hard, unless I have an aim, what do I want the kids to get from this lesson? ... I think you need to know where it's going as well because then it makes it easier to make the connections”. As a special learning needs teacher Sarah similarly believed that a key aspect of her role was to determine prior understandings in order to plan for future learning:

I see it as meeting the student where they’re at, so working out a baseline understanding and the strategies that are already being used and then moving the student on by carefully selecting resources and manipulatives and concepts that’s within their grasp.

One key point of difference was their view of the teacher-as-expert role of the primary mathematics teacher. In Verity’s opinion, teacher expertise is essential:

... the best maths teaching is having a good understanding of what you’re teaching ... when I came here I thought, “Ah, Reception maths; it’s basic”. But I had to revisit things like base ten understanding and [other] things that I hadn’t necessarily thought about ...

Jenny had a similar belief because the occasions when she has felt less than expert have caused her some anxiety: “I think it is hard to teach if you don’t know what you’re teaching ... I think it is really important”. On the other hand, Donna did not appear to place much importance on the need for anything more than a basic level teacher expertise:

I think you’ve got to have a good understanding of the basic concepts, if I don’t know something I’ll just go and grab a book ... if you’ve got the capabilities to even know that basic concept or learn that basic concept yourself and you’re prepared, I don’t think it’s too bad. I don’t think you need a huge amount of expertise; I think you do need to understand the basic concepts of maths.

Hannah was very content to compensate for her lack of expertise by modelling being a learner to her students.

I go through the concepts myself and make sure that I’m 100% happy with it. If I don’t know exactly what I’m doing I get help before I go into the classroom to do it and make sure I am clear on that. If I come up against something in the classroom that I’m not 100% sure about I won’t lie to the kids ... [When they] ask me a question I’ll say “You know I really don’t know this, maybe we need to look into that to find out”, and I think they appreciate that I’m not a know it all.

Adopting a range of approaches to teaching mathematics is a facet of primary mathematics teaching that many of the participants readily embraced. According to Angela the classroom strategies she selected depended upon what she was teaching: “sometimes it’s whole class direct instruction and sometimes it’s just groups and I have different groups depending on what we’re doing”. On the other hand, Donna saw her role primarily as encouraging student-centred classroom interactions:

... sometimes they can explain it way better than I can explain it to them anyway then if we’re doing other group stuff, I usually try and do mixed abilities just so that there is someone there who knows and then they can help explain it to the others.

Whilst Hannah guided and facilitated her students’ learning by breaking tasks down into smaller steps:

I put a few questions up on the board ... only three or four on the board at a time and then do the first one, talk through it with them what to do and put step by step, usually in a different colour for the different steps so they can say “Oh I’m up to the red step, I’m up to the purple step”.

Sarah’s beliefs in this regard appeared to reflect the perspectives of a special learning needs teacher and were somewhat at odds with those expressed by Hannah, Donna and Angela. Accordingly Sarah believed that direct instruction ought to most definitely form part of the

primary mathematics teacher role.

Directed instruction provides [an] awareness and empowerment and the self-determination that maybe facilitation doesn't. If you're doing something for yourself, you may not always realise what you're actually doing, whereas if you have direction and instruction, that's in combination with the facilitation, then you can actually be made aware of what you're actually doing.

A final aspect of the primary mathematics teacher role that Verity and Sarah identified was the selection and use of teaching resources. Verity held some firm views about the types of resources that were most appropriate to her mathematics classroom, specifically, "I cannot think of a maths lesson I would not use manipulatives". Sarah, conversely, considered the use of manipulatives in an activity-based approach to primary mathematics teaching was not necessarily effective:

... you can have a hands-on lesson but it doesn't necessarily mean that it's going to be successful ... having stations can be great, and let's get into groups and it's all very well, but sometimes I have found that what is missing is a structure. You can't really say to a child, "Here you go, here's some manipulatives, here's an object, here's something to explore, now go away and explore it" ... to make it mathematical and to make it effective, I just think the structure and the idea behind what you're actually wanting them to connect with is a bit lost.

Learners and Learning

Unlike their views regarding the primary mathematics teachers' role, the participants' beliefs about learners and learning were in almost total accord. The key tenet evident was their appreciation that learners have differing mathematical abilities. Accordingly, to accommodate students with a broad range of mathematical abilities Angela attempted to differentiate the learning activities for her students: "I don't think it's fair to hand out a whole class the same work. Even if we do sheet work, the sheets I use are out of three or four different levelled books".

When managing the learning needs of less mathematically able students, both Donna and Hannah found ways of providing extra individual attention. Donna made sure "that they're the first people that I scoot around to spend that little bit of extra time explaining explicitly what they need to do". Hannah used a similar approach: "[When] the lesson is going through some group activities together, I'll go work with those that are having some difficulty with it". Additionally, Verity and Donna also acknowledged that the mathematically more able students have specific learning needs that need to be met. Donna's approach was to "make sure that I've always got something extra for them to do, not necessarily just more work but broader than more". Then again, it had not been easy for Verity to balance the learning needs of all of the students in her class:

I've had some children in here that are very, very bright, particularly in maths, and it's been a challenge to be able to make sure they're being extended and to be able to obviously cater for the children that do struggle.

Most of the participants, however, appeared to give far greater consideration to variances in students' mathematical ability, than the differences in their learning styles. Hannah, though, embraced the notion that learners have differing learning styles that needed to be accommodated by "just knowing how they prefer to learn, like some prefer to learn through the board, not on the floor doing games, whereas others really prefer just to be on the computer doing it". Likewise, Verity was cognisant of accommodating a range of learning styles through the use of various strategies:

... it's so fantastic to have an interactive whiteboard because I can cater to those visual learners. There are some children who learn best through auditory means so we talk about things ... it's just making

sure that you do incorporate a range of things, a range of activities ... some children learn best through doing, through the kinesthetic means [and] you give the opportunity for that.

A direct implication of their appreciation of learner diversity was that all participants identified that primary mathematics learning best occurs when learners are provided with a variety of learning activities. The point of difference between the participants was their expressed preferences for particular approaches to learning. For example, Verity stood by her convictions that learners learn best through inquiry, stating that she is “a big believer in inquiry, inquiry, inquiry”. She also held to the view that learning naturally occurs when learners are engaged in practical activities: “we use lots of manipulatives and things to be able to show understanding ... often I just start by letting them play and do stuff with junk material”. Whilst Angela valued the importance of the practical activities, she also appreciated the place of social engagement in mathematical learning:

... we've been doing a lot of hands-on stuff, actually doing that physically, I'm finding that they've really enjoyed it, they've all been motivated, they're all joining in ... I do believe that kids work better when they're doing social stuff together when they're learning.

A final view regarding learners and learning in primary mathematics expressed by both Angela and Sarah was that learners needed to make their own connections and build their own mathematical understandings. For Sarah this involved “not providing them with information but providing them with the opportunity to give themselves knowledge because that's how it's going to be effective and meaningful”. Therefore, in Sarah's view, if learners discovered and developed their own successful strategies “this needs to be celebrated and nurtured and acknowledged”. Angela was of a similar mind and firm in her view that learners “build that knowledge much more when they have the opportunity to do it at their own pace, and to actually explore what it means, and to go off on tangents. In a rare point of dissent regarding learners and learning, Hannah held a contrary position that teachers ought to “not assume kids can do it on their own and make them work independently”.

Sustaining the Vision

The literature suggests that the socialisation of beginning teachers in school contexts can have a significant impact on the beliefs they developed during their pre-service teacher education. There is no evidence in this study, however, that this has occurred. Many of the participants were able to recollect the visions that they had formed during their pre-service teacher education. For example, Donna recalled that her ideals for mathematics teaching included the use of group work, together with teaching mathematics explicitly, and that in her classroom mathematics would be fun. Hannah remembered that as a pre-service teacher: “I said I was going to [have] visual, hands-on learning space, and I think that's because that's what I wanted when I was at school”. Jenny recalled that her vision for primary mathematics teaching was “always being constructivist, always letting them make their own meaning”. Thus, the participants' accounts of how they approached mathematics teaching and learning seemed to be in accord in the visions that they recalled from their pre-service education, and the findings of Brady (2007).

Donna recognised that her students' enthusiasm for mathematics had been the most influential factor in implementing the ideals she developed as a pre-service teacher. She observed: “there's a couple of kids in here that love maths ... so they're excited about it which makes me more enthusiastic to teach it”. Hannah, on the other hand, considered that she has been able to realise her ideals because she perceived many of her students had a similar learning style to her own.

I was always a visual learner. I still am a visual and hands-on learner as opposed to I could read it in a book ... so I think that's what's made it easier for me to stick to it ... just noticing that my kids are a lot like what I was and still am.

Jenny remained firmly convinced of the efficacy of the ideals for mathematics teaching and learning that she developed as a pre-service teacher and recognised that this had been an important factor in sustaining her vision: "I know this is how I want my kids to learn, I know that this is my idea of teaching maths". Additionally, she acknowledged that positive encouragement from some colleagues has also contributed to her capacity to hold onto her vision for teaching primary mathematics.

Not all of them but quite a few share the same vision. If I didn't have a supportive team, and if I [had] someone else's vision pushed on me, that would make it harder ... but when they're supportive and encouraging it makes it really easy ...

Whilst the participants identified a range of factors that have enabled their pre-service visions to be sustained, they all also described the challenges that they have faced in doing so. For example, Donna believed that the most significant issue that has challenged her capacity to implement her vision for teaching primary mathematics was the degree of student diversity that she needed to manage. Angela identified other constraints: "you get to a classroom that's got a really crowded curriculum or a very tight budget and ... I'd love to be able to do more of that stuff". It had not been easy for Jenny, either, to hold onto her beliefs in the face of colleagues who used more traditional approaches.

... [it's] hard to keep it fun, hands-on, learning ... because it looks like play and it feels like play. You've got kids [and] things everywhere ... sometimes the Principal comes in and I can just see him thinking, "What's going on here?" In the class next door they're always sitting in their chairs, and they're all sitting up and they're writing beautifully and there's not even a sound and then there's my classroom and it's like a wild zoo and you think, "Am I doing it the right way?"

Verity felt parental expectations had impacted on her capacity to realise her ideals.

... parent expectations here are very high ... they expect their child to be fantastic, they expect their child, because they're coming from homes of doctors and pilots, to be successful ... you've got parent expectations and school expectations, it does get pretty full on sometimes, [and] you just go, "How am I going to do this?"

Finally, the most significant impediment that Sarah identified was one associated with the peculiarities of her role as a special learning needs teacher, namely a mismatch between her preferred approaches and those of colleagues.

... the barrier I find is when [what] I'm doing is different to what the classroom teacher is doing in terms of how to present a concept ... if I know that the teacher has presented a concept in one way and then my job is to help the ones that don't really understand it very well to understand it, I have to find the balance between presenting it in the way I want to present it to them ... that can be a real challenge because often, without sounding really negative and pessimistic, in the classroom it's not presented the way I would see it as ideally being presented.

Conclusion

The purpose of this study was to explore the developing beliefs and practices of six beginning primary mathematics teachers, and to determine the factors that enabled, or challenged, these teachers in maintaining the visions for primary mathematics teaching that they formed during their pre-service teacher education. Their accounts revealed classroom practices that indicated they are moving toward breaking the cycle of tradition in mathematics teaching and learning. Additionally, a high degree of consistency between the beliefs for teaching and learning that these beginning teachers had adopted, and the visions for primary mathematics teaching that they recalled having formed during their pre-service

teacher education was evident. This is a noteworthy finding as it is contrary to a body of literature describes how the challenges of school contexts, and the socialisation of beginning teachers, can have a significant impact on their pre-existing beliefs and, ultimately, their classroom practices. The participants' accounts reveal a range of factors that had supported their capacity to sustain their pre-service visions and ideals, and the challenges that they have faced in doing so. In this regard, further research is required to more closely examine the means by which beginning teachers sustain their ideals, and the manner in which they manage the challenges to their visions as they arise. In summary, the outcomes of this study provide a degree of optimism that beginning teachers are able to develop resilient views about mathematics teaching and learning, and that these views can be sustained in order that their visions can become a reality.

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Appendix 1

Background Information of Participants

<i>Name</i>	<i>Age</i>	<i>Profile</i>
Angela	40s	Commenced pre-service teacher education as mature age student. At time of the study on a 12-month contract teaching a Year 2/3 class at a large metropolitan government primary school.
Donna	20s	After a period of relief teaching, at the time of the study on a 12-month contract at government primary school teaching a Year 4/5 class.
Hannah	20s	At time of the study had a permanent position teaching a Year 4/5/6 class in a very small, remote R –12 school. During final undergraduate practicum placement at the school was offered the permanent position.
Jenny	30s	Following graduation accepted a one-term contract at a small, regional R - 12 government school. Had remained at school on contract and at the time of study, was teaching a Year 6/7 class.
Verity	20s	At time of the study held permanent position teaching a Reception class at metropolitan Lutheran primary school in a high SES suburb.
Sarah	30s	At time of study had a permanent position as the Inclusive Education teacher for the primary years at a large, Catholic R - 12 to girls' school located in a high SES suburb.