

# Imagined Classrooms: Prospective Primary Teachers Visualise their Ideal Mathematics Classroom

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Research shows that personal experiences have a powerful influence on the views of teaching, learning, and mathematics held by prospective teachers. In this study prospective primary teachers were invited to describe their ideal mathematics classroom in order to explain their views about teaching mathematics. These imagined classrooms provide a valuable insight into their emerging identities as primary mathematics teachers. My analysis of these descriptions addresses the question: What views of the teacher's role, learners and learning, and mathematics are evident in prospective teachers' visualisation of their ideal primary mathematics classroom?

## Background

### *Entering Dispositions*

As school children, prospective teachers have already spent long periods of time observing teachers at work. Their beliefs and attitudes about the role of teachers, learning, and curriculum are accumulated and assimilated from the earliest school years. These initial dispositions are subsequently shaped and refined through a variety of formal and informal experiences as prospective teachers prepare to enter the teaching profession (Carter, 1994).

The importance of the relationship between what teachers believe about mathematics and the teaching of mathematics, and the way they actually teach has been well established (Ernest, 1989; Thompson, 1992). Ernest's model for conceptualising teachers' beliefs about mathematics illustrates the importance that is now placed on beliefs and the ways in which they influence the teaching of mathematics. Mathematical beliefs could be defined as "personal judgements about mathematics formulated from experiences in mathematics, including beliefs about the nature of mathematics, learning mathematics, teaching mathematics" (Raymond, 1997, p.551). Artzt (1999) refers to beliefs as the "teachers' integrated system of personalized assumptions regarding the nature of mathematics, of students, and of ways of learning and teaching" (p. 145).

There is a growing body of literature that investigates how prospective teachers make sense of their beliefs (Artzt, 1999; Cooney, Shealy, & Arvola, 1998; Lloyd, 2006a; Mewborn, 1999; Pajares, 1992; Skott, 2001). Brown and Borko (1992) argue that at least some of the prospective teachers' beliefs about mathematics and its teaching are in place before they commence in teacher education programs, suggesting that "they have lenses that dictate, or at least influence, much of what they encounter in teacher education" (p.649). Other studies (Brown & Borko, 1992; Cooney et al., 1998; Raymond, 1997) also indicate that prospective teachers' beliefs about mathematics and how to teach mathematics are influenced in significant ways by their experiences with mathematics and schooling long before they enter the formal world of mathematics education. Although Cooney et al.

(1998) and Raymond (1997) both argue that teacher education programs can only have a limited influence on changing prospective teachers' beliefs, other researchers (Artzt, 1999; Lloyd, 2006b) have investigated ways to change prospective teachers' beliefs about mathematics teaching and learning. Therefore, it is essential to understand not only what prospective teachers believe but also how their beliefs are structured and held for any possibility of developing prospective teachers' beliefs in the teacher education program.

### *Previous Experiences and Classroom Memories*

Previous personal experiences, including experiences as a student in mathematics classrooms, influence the views of teaching, learning and mathematics held by prospective teachers (Brown & Borko, 1992; Carter, 1994; Lloyd, 2006a, 2006b). As prospective teachers have extremely limited, if any, personal experience as teachers, their images of mathematics teaching are based largely on classroom memories. In this respect, prospective teachers have observed and participated in teaching and learning process as students for at least twelve years of their life (Artzt, 1999; Lloyd, 2006b; Pajares, 1992). As Mewborn (1999) observes, when prospective teachers enter the mathematics teacher education courses "they are rich in personal knowledge" (p. 317). However, the stories of previous mathematical experiences that Drake, Spillane, and Hufferd-Ackles (2001, p. 7) describe are unfortunately "dominated by disappointing and discouraging experiences learning mathematics in school. In addition, they all recall losing interest, confidence, or aptitude in mathematics at some time during their elementary or early high school years". It is therefore not surprising that many prospective teachers view mathematics as a closed set of procedures, teaching as telling, and learning as the accumulation of information (Lloyd, 2006a).

### *Emerging Identities*

As the beliefs, attitudes and conceptions of prospective teachers that have been formed by their previous personal experiences as students, and their classroom memories, are shaped and refined through a variety of formal and informal approaches during teacher education courses (Carter, 1994), an emerging identity as a teacher begins to develop. Lloyd (2006b) argues that shifting prospective teachers' perspectives on classroom events from student to teacher is a crucial aspect of teacher education. In addition to developing their emerging identities prospective primary teachers must also confront the issues of teaching and learning that are unique to the teaching and learning of mathematics.

However, identity formation is not a matter of free thinking individuals making rational choices, nor is it about emulating role models (Whitehead, Rossetto, & Lewis, 2005). Rather, identity formation is an ongoing, dynamic process that is open to modification and always occurring in a social context (Britzman, 1986). Other researchers (Lloyd, 2006a; Raymond, 1997) observe that when prospective teachers enter the classroom context, they do not consistently enact their recently developed beliefs about mathematics teaching and learning, as they modify their continually emerging identities.

### *Storied Identities and Imagined Classrooms*

In an effort to create an opportunity for prospective primary teachers to articulate their emerging identities as teachers of mathematics, the prospective teachers in this study were invited to provide a descriptive account of their ideal primary mathematics classroom. The

use of stories and narratives are not new in research about the experiences of teachers. Researchers over the last 20 years (Connelly & Clandinin, 1990; Goodson, 2006; Polkinghorne, 1995) have come to appreciate that teachers' stories offer a wealth of information about their individual identities and classroom experiences. Their work builds on the understanding that people live storied lives and share their experiences and identities through stories (Bruner, 1989; Doyle & Carter, 2003; Drake et al., 2001).

For prospective teachers, narrative and biography can be used effectively to understand how previous experiences can paint the portraits of "teacher" that they bring with them into teacher education (Pajares, 1992; Scott, 2005; Sliva & Roddick, 2001, 2002; Wilson & Thornton, 2005). The value of embarking on such an endeavour is corroborated by Doyle and Carter (2003, p.131): "To understand pre-service teachers' development, it is necessary to capture the stories within which this knowledge and understanding are embedded". Rossetto's (2006) research likewise commends the value of visualisation and imagination in the formation of emerging identities in prospective teachers.

### *Research Significance*

In this study, the writing of a descriptive account allowed the prospective teachers to explore classroom situations adopting the identity of a teacher, with the specific intention of encouraging the authors to create images of themselves as a teacher. The importance of research such as this is emphasised by Lloyd (2006b, p. 81): "Teacher educators ... may wish to explore ways in which analysis of preservice teachers stories might help to identify preservice teachers' views, to anticipate important aspects of preservice teachers' future development, and to offer opportunities to influence preservice teachers' development in very specific ways". That this research involves prospective *primary* teachers has been identified by Raymond (1997) and Thompson (1992) as an aspect of particular significance, as both note need for further investigations involving prospective primary mathematics teachers.

## Research Method

### *Participants*

The participants in this study were 22 prospective primary teachers enrolled in an undergraduate Bachelor of Education (Junior Primary/Primary) or a graduate entry Bachelor of Education (Junior Primary/Primary) at a South Australian university. The undergraduate participants were third-year students and the graduate entry participants were in the first semester of the two year graduate entry program. All students were undertaking the compulsory full year course Curriculum Studies: Mathematics. None of the participants had taken part in any teaching practice experience, or school visits, at the time of the data collection.

### *Data Collection*

At the end of the first 3 weeks of the Semester 1 all students studying this course were required, for assessment purposes, to describe their personal philosophy of teaching primary mathematics, specifically describing their ideal primary mathematics classroom. The written descriptions were between 750 and 1000 words in length. The research

participants volunteered to provide their descriptions to the researcher (who was also their workshop teacher) after the assessment process was completed.

The use of assignment work for data collection has advantages from the point of view of expediency and efficiency. It could be argued that the descriptions do not represent genuine beliefs as they may have been constructed to comply with the workshop teacher's point of view (Carter, 1994). However, the framing of the assignment invited the students to construct a personal account that could not be deemed either correct or incorrect thus minimising likelihood of this concern.

### *Data Analysis*

The guiding question for this study is: What views of the teachers' role, learners and learning, and mathematics are evident in prospective teachers' visualisation of their ideal primary mathematics classroom? The analysis was conducted by firstly coding the accounts with regard to the three broad categories that arose from the research question: the views of the role of the teacher, the views of learners and learning and the views of mathematics. Specific sub-categories then became evident as recurring themes were identified within each of these broad categories. The following presentation of the findings of this research, the imagined classrooms of prospective primary mathematics teachers, is organised according to three key components of the research question.

## Imagined Classrooms

### *“I am excited by the prospect of teaching mathematics”: The Views of the Role of the Teacher*

Almost all of the prospective teachers in this study mentioned the importance of the role of the teacher in the primary mathematics classroom. This finding is consistent with other studies (Lloyd, 2006a; Sliva & Roddick, 2001). In considering the role of the teacher, many of the prospective teachers clearly identified that teachers bring to the role past experiences that may influence their practice.

A teacher's own experiences and attitudes can affect the way in which they teach mathematics.  
I am aware that there is a possibility that my past experiences could colour the way I teach mathematics.

Some stated they could call upon positive past experiences.

I would teach in my classroom with the approaches that have made the biggest impact on my learning.  
I could adopt some of the teaching methods which were helpful during my own mathematics education.

However, others were more adamant that their negative experiences of mathematics would not be repeated in their imagined classroom.

Hopefully I do not use my own negative experience of mathematics to base my teaching.  
In my own classroom I plan to teach maths far differently that I was [taught].

Research by Ball (1990) reveals that teachers are inclined to teach just as they were taught. Some of the prospective teachers seem innately to be aware of how this tendency may impact on the role of the teacher, regardless of their past experiences.

Teachers often fall back on the way they learnt and use it as a basis for teaching.  
We tend to teach in the way we were taught.  
Many teachers end up teaching in the same way they were taught when they were young.

The role of the teacher unavoidably includes “teaching”. The prospective teachers described a range of orientations to teaching that could be placed on a continuum from traditional direct instruction to teacher-as-facilitator (Sliva & Roddick, 2002). None of the prospective teachers in this study advocated adopting solely a traditional direct teaching approach, although some described how direct teaching may occasionally be part of the teachers’ role.

There will be times when it is necessary for me to teach information and provide students with answers.  
[Students] need to be provided with direction in their exploration.

Other prospective teachers found the teacher-as-facilitator role more compelling.

I think it is important to guide students through mathematics, not to get caught in the web of simply telling them how to do it.  
I see my role mainly as a facilitator in the knowledge acquisition of the students.

However, consistent with Whitehead, Rossetto, and Lewis’s research (2005) many of the prospective teachers in this study favoured the understanding that both direct teaching and facilitating would comprise the teachers’ role.

I would provide a balance between teacher-based instruction and student, peer related tuition.  
I would like to find a balance between instruction and facilitation.

The prospective teachers also described a range of other functions that they considered part of the role of a teacher: knowing the students, having expertise in mathematics, motivating students, and making decisions. The importance of knowing the students as part of the teachers’ role was evident in many of the accounts.

I must be mindful of individual student’s strengths and weaknesses.  
I must gather a sound awareness of the student’s developmental age level.  
I would need to know the current understandings of each student.

Although the prospective teachers recognised the importance of knowing the students as part of teachers’ roles, their conception of that aspect was limited to teachers knowing the students purely as learners. Only one prospective teacher considered that teachers might need get to know their students more broadly.

I need to gain insight into the backgrounds and other needs, interests and abilities of individuals within the class.

Having expertise in mathematics, as an aspect of the teachers’ role, featured in several descriptions.

As a teacher I want to be very knowledgeable and have a clear understanding of how mathematics works.  
A teacher that is well educated on the topic is more beneficial to students’ learning and understanding.  
In order to be able to teach mathematics well [teachers] need to understand it.

There is strong evidence that many prospective primary teachers have mathematical anxiety and see themselves as unable to learn mathematics (Haylock, 2001; Hembree, 1990; Wilson & Thornton, 2005; Wolodko, Willson, & Johnson, 2003). Hence, it may be

surmised that the focus some of the prospective teachers in this study placed on the teacher-as-expert component of the teachers' role may be a reflection of their anxiety regarding their ability to fulfil this facet.

Some functional aspects of the teachers' role, such as planning and preparing lessons and behaviour management, have been disregarded by the prospective teachers in this study. The prospective teachers may have overlooked lesson planning and preparation as this aspect of the teacher's role normally occurs "behind the scenes". None of the prospective teachers in this study identified behaviour management as being part of the teacher's role. Yet their classroom memories most certainly would have included observing or participating in this aspect of teachers' work. In the imagined classrooms teachers had a far more idealistic relationship with the students.

### *"Children learn in different ways and use different strategies": The Views of Learners and Learning*

The views of learning and learners dominate the descriptions of the imagined classrooms. Fundamental to the prospective teachers' view was that all learners are individuals.

Children are unique in the way that they absorb, understand and process information and have preferred learning styles.

Children learn in different ways.

Dealing with the diverse needs of individual learners was also paramount for many of the prospective teachers in this study.

I would endeavour to create lessons geared toward many styles of learning.

I must consider the whole class, aiming to cater for all abilities.

Because every student is different you need varied learning materials.

The prospective teachers also expressed a strong commitment to providing a safe learning environment where learners are supported and encouraged.

I want to create a classroom where children feel comfortable and safe.

I would like the students to feel they are supported and encouraged in mathematics.

I would like to teach mathematics in a way that children do not feel threatened.

Closely aligned to the view of learners as individual, many of the prospective teachers in this study elucidated a view that learning should build upon existing knowledge. This confirms research by Scott (2005) detailing the intention of prospective primary teachers to find out and build upon children's experiences. The prospective teachers in this study had been provided with a broad exposure to the term "constructivism" and no doubt the principles of constructivism informed this view of learning. However, it is pertinent to note that very few of the prospective teachers in this study used the term "constructivism" in their descriptions, choosing instead to describe the concept in other ways.

Students should be able to link the new concepts to their existing knowledge.

Students are building on from what they already understand and it is a good basis for them to learn and understand new concepts.

I would seek to provide strategies that allow the children's previously acquired knowledge to be applied in new and unfamiliar situations.

Students use the knowledge they have previously learned to interpret new information to devise new meaning.

The prospective teachers described a broad range of learning strategies to be employed in the imagined primary mathematics classrooms. These included the active involvement of learners, collaborative learning processes, creating an appropriate physical classroom environment, ensuring learning is relevant, transferable and fun, and the cross curricula integration of mathematics.

The active involvement of learners was deemed to be a high priority for the prospective teachers. The terms “hands on” and “interactive” abound in the accounts and consistent with Scott’s (2005) research the prospective teachers in this study had a strong commitment to the use of physical manipulative resources in learning activities.

I will endeavour to make the use of manipulatives available to students wherever possible.  
[I would] incorporate the use of concrete materials into my mathematics lesson.

The physical environment of the imagined primary mathematics classrooms also played a part in active learning.

The teacher will need create a physical...environment that is conducive to learning.  
I would like to make my classroom a very visual one...having lots of posters and equipment for hand-on learning.  
My classroom would need to be laid out in such a way as to include floor space where children can spread out.

Many of prospective teachers embraced a range of less traditional learning activities in mathematics such as the use of stories, learning stations, games and technology including software packages and the internet in their imagined mathematics classrooms. Nevertheless, a few still found a place for more traditional approaches to teaching and learning in mathematics.

Some old practices are as useful as new ones.  
I would always set written homework along with arithmetic homework.  
Some aspects of the curriculum such as multiplication will have to be done by rote learning.  
Include learning tables, the ability to manipulate numbers, such as adding, subtracting, multiplying and dividing numbers.

Others however, questioned the effectiveness of such approaches.

Many students cannot learn by this method of memorising and repetition.  
Maths can be more about critically thinking, problem solving and logic rather than the more traditional memorizing and focus on finding answers.

Since it has been established that the prospective teachers in this study have recognised that it is likely their teaching practice will be influenced by their previous experiences in school mathematics, these descriptions ought not to be surprising as they quite possibly reflect the bearing that past experiences have had on their views of learning in mathematics.

Both Sliva and Roddick (2002) and Scott (2005) found that cooperative or group learning processes were highly favoured by the pre-service teachers. This view of learning is shared by the prospective teachers in this study. On the basis of her research, Scott (2005) contends that not all prospective teachers share the same understanding of group learning. However, in this study, the prospective teachers shared a more common view of cooperative group work, emphasising the social aspects of learning.

Students should work together to build understandings and also to learn from each other.  
I would encourage classroom discussion and provide opportunities for the sharing of ideas.  
Students need to learn together cooperatively.  
I would like to incorporate a time for social interaction in mathematics.

In general, learners and learning have been somewhat romanticised in the imagined primary mathematics classrooms. None of the prospective teachers in this study have expressed the view that some students may find learning mathematics a challenge, despite the fact that a number have described the personal difficulties in their past experiences. On the basis of this study, the emerging identities of prospective teachers appear to be heavily influenced by idealism.

*“Mathematics ... is something that a person does”: The Views of Mathematics*

There is sound evidence that suggests that a teachers’ view of mathematics can have a significant influence on teaching practice (Dossey, 1992; Raymond, 1997). Whilst the prospective teachers in this study furnished a range of views of mathematics, their articulation of this aspect was less pronounced than their views of the teacher’s role, or learners and learning. The reluctance of the prospective teachers to describe more expansively their views of mathematics could be directly linked to their limited mathematical backgrounds or a lack of confidence in expressing mathematical understandings.

Ernest (1989) developed three categories the describe teachers’ conceptions of the nature of mathematics: the view of mathematics as unified body of knowledge; the view of mathematics as an expanding field of human inquiry; and the view of mathematics as a useful collection of facts, rules, and skills. In this study none of the prospective teachers gave any indication of aligning themselves with Ernest’s first view of mathematics as a stable body of knowledge. Some of the prospective teachers approached an association with Ernest’s second category, indicating the view that mathematics underpins many aspects of human endeavour.

Mathematics is not just a subject to be learnt in isolation, but it is found in the world around us: there’s mathematics in language, literature, geography, environment, science, art, music and sports. Maths can be found everywhere.

Additionally, a few of the prospective teachers clearly aligned with Ernest’s third view of mathematics.

Students need to have a sound understanding of the rules, the ability and skills of using numbers.

More evident in the prospective teachers’ accounts were quite emotive views of mathematics. The negative influence of past experiences in mathematics was evident yet again in some of the prospective teachers’ views that mathematics is difficult or frightening.

Children need to be made aware that sometimes they may find mathematics difficult. Mathematics is still seen by some children as a subject to be feared. Strike “mathematics” from the key learning areas all together, and replace it with numeracy, a much less threatening word.

Positive views of mathematics were far less prevalent, though it was encouraging to note that for one prospective teacher.

In my classroom mathematics will be a highly anticipated subject!



## Conclusion

In this study the imagined classrooms that were described by the prospective teachers afforded valuable insights into their views of the role of the teacher, learners and learning, and mathematics.

These prospective teachers clearly recognised that their past experiences and classroom memories would influence what they might bring to the role as a teacher. Many appreciated that an aspect of the teacher's role is to utilise a range of appropriate teaching strategies. However, the lesson planning and preparation and behaviour management were totally disregarded by the prospective teachers. It could be anticipated that once they have undertaken periods of teaching practice these more utilitarian functions of the teacher's role will be assimilated into their emerging identities as teachers.

Views of learners and learning dominated the descriptions of the imaginary classroom. However, the prospective teachers idealised their views of learners and learning in mathematics. Their imagined classrooms were going to be “safe havens” where mathematics was “fun and enjoyable” and lessons would be “interactive and relevant”, incorporating a broad range of learning activities. In these imagined classrooms learning was never going to be difficult or boring, even though for some of the prospective teachers their view of mathematics was that is difficult and frightening.

This study is the first phase of a proposed longitudinal study. The prospective teachers in this study have graduated and are now first-year teachers. The researcher plans to re-visit these beginning teachers to observe their *real* primary mathematics classrooms. Of interest will be differences between the real and the imaginary classroom, and what has become of the idealism that was found in the prospective teachers' emerging identities.

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