# Mentoring to Alleviate Anxiety in Pre-Service primary mathematics Teachers: an orientation towards improvement rather than evaluation.

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Increasing numbers of primary pre-service teachers (PSTs) enrolled in Education degrees in Australia enter university with insufficient mathematical content knowledge (Livy & Vale, 2011) and low confidence levels about their ability to teach and do the mathematics required for their intended role as classroom teachers (Wilson, 2009). Mentoring of PSTs by highly capable and experienced classroom teachers, within the framework of a structured and well-planned mentoring programme (Hudson & Peard, 2006), has the potential for developing the confidence, and thus alleviating the mathematics anxiety exhibited by PSTs.

## Introduction

Pre-service teachers often complete their professional experience without having improved their skills, confidence, content knowledge, or repertoire of pedagogical skills in mathematics. In fact, it could be postulated, that due to a lack of exposure to excellent teaching of mathematics, their skills do not improve and the anxiety around having to eventually become responsible for the teaching of mathematics to a class on their own, actually increases. This is clearly not best practice and the consequence is a perpetuation of the limited capacities of the pre-service teachers leading to poor teaching and impeded learning opportunities for their students. What is even more disturbing is the clear anecdotal evidence that despite lack of confidence with mathematics content knowledge and lack of interest in mathematics as a subject, surprisingly few pre-service primary teachers are concerned about their ability to teach mathematics.

One way of addressing and potentially arresting and reversing this trajectory of negativity is a planned and focused mentoring programme (Hudson & Peard, 2006). A highly skilled and qualified mentor has the potential to ameliorate the mathematics anxiety often experienced by pre-service teachers and the scope to set them on the path to quality mathematics teaching and learning for themselves and their future students.

## Literature review: Mathematics Anxiety

Mathematics anxiety has been defined in various ways, each of which shares some fundamental and common characteristics. According to Wilson and Gurney (2001) mathematics anxiety is "a learned emotional response, characterised by a feeling that mathematics cannot make sense, of helplessness, tension, and lack of control over one's learning." (p.805). Chewning (2002) defines mathematics anxiety as: "an intense emotional feeling that people have about their inability to understand and do mathematics. People who suffer from math anxiety feel that they are not capable of doing any course or activity requiring mathematics" (p.1). This, clearly, would make the teaching of mathematics by the sufferer extremely problematic.

Harding, cited in Harding and Terrell (2006), defines mathematics anxiety as a "learned emotional response which usually comes from negative experiences in working

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with teachers, tutors, classmates, parents or siblings" (p.2). Greenwood (1984) supports such causality stating that mathematics anxiety often emanates from "A bad experience in a math class or with a math teacher" and elaborates by stating that mathematics anxiety, "results more from the way subject matter is presented than from the subject matter itself " (p.3).

What these definitions share is a predication on the belief that mathematics anxiety indeed exists and that it is both debilitating for the sufferer in terms of being able to perform mathematical tasks and also that the mathematics anxiety regularly stems from a negative experience in mathematics class or more specifically a negative inter-personal experience with a mathematics teacher.

## Mentoring

Mentors can play a significant role in shaping pre-service teachers' practices (Hudson & Hudson, 2010). Previous research has shown that mentors choose to be involved in mentoring programmes for pre-service teachers because of a desire to "influence the quality of pre-service teacher education" (Hudson & Hudson, 2010, p.1). As stated by Edwards (1998), "the role of mentor has considerable pedagogic potential for the development of pre-service teachers" (p.48) while according to Hudson and McRobbie (2004), mentoring can lead to improved classroom practices. However, the potentially positive relationship between mentoring and mathematics anxiety has not been adequately explored. Mentoring needs to be a planned and intentional process (Christensen, 1991) where the "the job of a mentor is to put the mentees' interest in the foreground of the relationship" (Lennox, Skinner, & Foureur, 2008, p.9).

Sullivan (2011), in analysing the Japanese *Lesson Study* approach, as described by (Inoue, 2010), explored the value of teachers watching, critically reflecting, and supporting each other as a way of developing profoundly valuable mathematics lessons. He suggests that: "by building trust between teachers and emphasising an orientation to improvement as distinct from evaluation, this approach will result in powerful mathematics teacher learning. (p. 59)" Although Sullivan is referring to fully qualified teachers working together within the framework of a very specific methodology, this could be extrapolated to the context of mentor and pre-service teacher working together in the same way as planned for this study. Sullivan goes on to state that: "the principles of collaborative planning, with observation and review of the lesson rather than the teacher, can be effectively incorporated into the practicum experiences of prospective teachers. (p. 60)" It could be suggested that Sullivan's focus on improvement rather than evaluation is more likely to occur outside the professional experience blockwhich is based around evaluation.

Mentoring of pre-service teachers by experienced teachers occurs most often during their professional experience block. Many teachers who supervise and mentor pre-service teachers on their placements have received no "professional development in mentoring to support pre-service teachers in the school context" (Hudson & Hudson, 2010, p. 5). Consequently, the scope for mentoring and supervising to be of a high quality, and to significantly add to the pre-service teacher's developing expertise, may be compromised.

Exposure to best practice in the teaching of mathematics by supervising teachers as well as support and opportunities to lead mathematics lessons in a structured, planned and non-threatening environment, is essential for pre-service teachers. PSTs would benefit from observing creative, engaging, challenging, differentiated lessons modeled by teachers displaying confidence, sound pedagogy, and having sound content knowledge. However, this is not always the case. Mathematically anxious pre-service teachers are not always partnered with a competent teacher during their professional experience blocks.

## Professional Experience Block

The logical forum for PSTs to benefit from exposure to informed mathematics teaching is the professional experience block. Professional experience or practicum blocks form part of the assessable component of pre-service teachers' degree courses. Supervising teachers observe and assess the teaching of their pre-service teachers and grade the students on their efforts. University supervisors also monitor student professional experience units and work in conjunction with the supervising teachers to make decisions about whether or not the pre-service teachers meet the required standards in order to *pass* the professional experience and, therefore, progress further in their degree. If the students are deemed to have performed poorly, they can *fail* the professional experience. The *on the job* pressure of being monitored in such a way is a valuable way of ensuring that future teachers meet the necessary standards for entry into the profession. An unintended and perhaps unavoidable side effect of this experience is increased anxiety and stress in pre-service teachers who are uncertain about aspects of their practice and unfamiliar with being monitored in such a potentially high stakes forum. Such a forum is conducive to pre-service teachers limiting risks, *playing it safe* and masking any inadequacies they may have. They will swim in the shallows for fear of being found out for not being proficient once their feet can no longer touch the bottom.

For this reason, a fundamental aspect of this study, and its key point of difference from other such mentoring approaches is that it separates the mentoring process from the professional experience block. The study involves pre-service teachers being mentored for a school term with experienced and highly capable mentor teachers in the mathematics classroom, outside of their professional experience. The pre-service teachers who nominate to take part in the study are encouraged to take risks with their teaching in an exclusively supportive environment with a deliberate and planned focus on diminishing the fear of judgement or failure.

Bly (1988) suggested one difference between the traditional classroom and the playful classroom:

> In a traditional mathematics classroom there are a set of rules and if you get something wrong, it leads to shame. In a playful mathematics classroom, there are a set of guidelines and if you do something different, it leads to conversation" (cited in Breen, 2001, p.46).

It is possible that the source of fear and anxiety felt by pre-service teachers in relation to their mathematics has: "more to do with the personality and style of the teacher than with the content of the mathematics and their ability to cope with it" (Breen, 2001, p. 45). It would be fair to suggest that the pre service teachers who self-nominated to be a part of this study may have experienced the shame and humiliation of the traditional classroom and more specifically the traditional teacher. It is for this reason that each experience that the pre-service teachers has during the process is exclusively instructive and reflected on in such a way that future improvement leading to best practice was the goal.

Breen (2001) refers to the work of Davis (1996) identifying three forms of listening which he believes limit or enhance the thinking and self concept of the pre-service mathematics teacher. These three forms of listening are: *Evaluative listening* based on judgement; *Interpretive listening* based on subjective nuance; and *Hermeneutic listening* which is based in respect for the teller, where the teller and the listener are engaged in a shared purpose and the views of each are valued as worthy of consideration and the desire to come to a shared and improved understanding is mutual. Such an approach requires the

deliberate addressing and breaking down of the traditional power dynamic between teacher and student or mentor and mentee.

The aim of this study is to develop a strategy that will allow university mathematics educators and school staff development teams to address issues of mathematics anxiety through a practical and manageable mentoring programme as a means to improve the confidence of pre-service teachers and ultimately, the quality of mathematics outcomes for their students. It is aimed at utilising the capacities and skills of expert teachers as mentors for those entering the profession in a collegial, supportive, and non-threatening environment. The research question being addressed in this aspect of the study is: In what ways can a mentoring relationship outside of the professional experience block increase the confidence of pre-service teachers who identify as suffering from mathematics anxiety?

## The Mentoring Model Proposed for this Study

Several aspects of both Hudson and Skamp's (2005) and Rogoff's (1995) models have been incorporated in a proposed model, which focuses on the following requirements for the selection of the mentors:

- Experience–a minimum of 5 years' teaching experience
- Professional Responsibility–a desire to improve the profession by working with pre-service teachers to improve their ability to teach mathematics. Along with a desire to read and learn from articles about mentoring best practice.
- Mathematical Confidence–a very confident disposition towards both doing and teaching mathematics based on a subject matter knowledge
- Teaching Expertise–a proven track record of successful maths teaching evidenced through positive dispositions of their own students towards mathematics, creative approaches, positive classroom environments, engaging lessons, differentiated opportunities for students
- Appropriate personal attributes–a demeanour appropriate for mentoring pre-service teachers who lack confidence in this subject. Characteristics such as: good listener and communicator, empathy, sense of humour, supportive, encouraging, ability to deliver feedback positively and constructively
- Time–A preparedness to plan and review lessons with the PST's and to respond to their reflections of the experience.

## Methodology

This investigation was carried out as a case study of eight 3rd and 4th year students from a metropolitan university in Sydney. The students were selected as a result of self-nominating to be part of a mentoring programme to address mathematics anxiety from which they had indicated they were suffering. 227 3rd and 4th year students completed an adapted Mathematics Anxiety Rating Scale (Richardson & Suinn, 1972)) survey with 38.29% (n=85) indicating that they suffer from mathematics anxiety according to Wilson and Gurney's (2011) definition of mathematics anxiety as a "learned emotional response, characterised by a feeling that mathematics cannot make sense, of helplessness, tension, and lack of control over one's learning". From these, 8 pre-service teachers (PSTs) were selected based on the extent to which they were negatively impacted by their mathematics anxiety. The PSTs were paired together to form 4 groups.

Mentors were from Catholic primary schools in the Sydney archdiocese, nominated by their school principals according to their meeting the six criteria listed above. The mentoring process took place in Term 4, 2014 with 2 PST's working with 1 mentor teacher in their primary classroom for a 1-hour mathematics session once per week for 8 weeks. Where possible, the team of 3 met for approximately 10 minutes prior to and/or 10 minutes after each session to explore what would be happening in class that day.

These mentoring sessions were underpinned and supported by the reflective practice of journaling via the use of a blog specifically established for this project. Pre-service teacher mentees in the programme were expected to reflect on their experience and practice, celebrate their successes, and support their fellow pre-service teacher mentees via the blog on a weekly basis. The mentors were also expected to blog their own thoughts and responses to the mentees postings. At the completion of the project, mentors and mentees completed a post survey and a semi-structured interview with the researcher. Due to work and travel commitments, only 6 of the 8 mentees and only 2 of the 3 mentors have been interviewed thus far.

## Results and Discussion

One of the most prevalent themes to emanate from the interviews conducted with the students after the mentoring programme was the relationship between professional experience and the mentoring programme. Professional experience, also known as prac, is the time that students spend in classrooms with cooperating teachers, to improve their professional practice. In NSW it is mandated that all teacher education students spend a minimum of 80 days, which equates to 16 school weeks, working in classrooms during their four-year degree.

There has been much criticism of teacher training in NSW in the media over the past 12 months and one of the areas being challenged is the professional experience blocks. The pre-service teachers in this study complete extensive professional experience with their course requiring them to complete 31 weeks of professional experience during their 4-year programme. One of the great difficulties universities face is the sourcing of professional experience opportunities for their students. With increasing numbers of students enrolled in education courses, there is increasing pressure on the Professional Experience Office at universities to place their students. The professional experience block should be an opportunity for students to work with experienced and highly capable teachers in a mentoring relationship, which adds a practical component to the theoretical input at university. A concern outlined by the government reports into teacher training (Piccoli, 2012) is that the cooperating teachers in the professional experience are not given sufficient training in mentoring and can sometimes provide a less than perfect learning opportunity for their prac students.

> AMac: It was good to be guaranteed a good teacher and someone you knew wanted to help you however they could. And she was always willing to answer our questions … which sometimes on prac is a little bit challenging.

Of the 8 students involved in this study, all 8 suggested that the mentoring approach was superior to their professional experience. When questioned as to why this was the case, two prominent themes emerged. Firstly, and most importantly, was the relationship between the student and the mentor as opposed to the relationships they have experienced with their cooperating teachers during professional experience placements. All 8 students

suggested that the relationship with the mentors was more collegial and relaxed with a distinct focus on improving their skills.

> TW: This project was all about bringing our weaknesses out into the open, exploring them, and actively working towards strengthening them.

Secondly, the mentees suggested that the *high stakes* aspect of professional experience meant that they were always under pressure, that the environment was stressful, they felt that they were being judged, that they were expected to be highly proficient, and that as a result, they were disinclined to take risks and that they kept their deficiencies to themselves for fear of being judged and potentially failed by their cooperating teachers.

> AM: On prac, you are watched like a hawk. You're paranoid the whole time just to perform well. Prac is smoke and mirrors.
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> SA: [T]hat pressure just not being there. It was so much more human, the relationship with the teacher, which is not something you have on prac."

This consequently led to low level activities during professional experience, based around keeping all students busy and trying to make themselves look capable rather than rich, challenging tasks that may not be immediately successful. One of the mentors stated:

> MM: [A] key difference, they don't have that fear of failing. They don't have the fear of being assessed and they could just get on with it.

A second major theme to come out of the study is the reduction in fear felt by the mentees that they had to be experts in Mathematics and know all the content from the syllabus in order to be able to teach it well. Many of them commented on the fact that they knew a lot more than they thought they did.

> AM: What I really picked up on - I have just gone, 'Maths as a subject, I don't know it: I'm hopeless at it.' because that's just the attitude I've always had. But being in the classroom over the eight weeks I went 'There is a lot I actually know.'
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> TW: I also learnt more about myself, my skills and abilities. I walked into the project thinking that I wouldn't be able to complete any Stage 3 mathematical content. I now know that there are only a few gaps and I can work on filling those gaps with knowledge.

The mentors supported these thoughts. For example:

> MM: I said to them, teaching's not about knowing everything. I said, look, we teach Maths, I said look at me, look what I'm teaching in history and science, I said I can't possibly know all of this at any one point in time.

There are many more themes to explore and draw out from this research project. What has been interesting is the unanimous consensus among the mentees that there has been some shift from anxiety towards greater confidence as a result of completing the mentoring trial. The precise reasons for this movement towards greater confidence need to be teased out more specifically but at this stage, the results look promising. What is also noteworthy is that the mentors found the process valuable and productive which augers well for future trials.

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