

# Pre-service Secondary Mathematics Teachers' Reflections on Good and Bad Mathematics Teaching

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Research suggests that teachers' beliefs about teaching are strongly influenced by their personal experiences with mathematics. This study aimed to explore Pacific Island pre-service secondary mathematics teacher's perceptions about good and bad mathematics teachers. Thirty pre-service teachers, enrolled in a mathematics teaching methods course during their third year of University study were asked to write reflections on their personal mathematical memories. Results indicate that pre-service teachers rate good mathematics teachers using a varied combination of characteristics.

In recent years, much research has been conducted into the affective domain of mathematics education with results pointing those affective variables such as motivation or anxiety have huge impact on the learning of the subject (Boz, 2008). Teacher's experiences as a student in school influence how beliefs about teaching are shaped (Brown & Borko, 1992). In other words, teachers' personal experiences from the classrooms may affect how they conceive mathematics and its teaching. There exists sufficient evidence in the existing research literature that suggests that teachers beliefs or conceptions, which are somewhat shaped by teachers' personal experiences, have great impact on the classroom practices of teachers (Thompson, 1984; Koehler & Grouws, 1992; Balatti & Rigano, 2011; Prescott & Cavanagh, 2006).

The purpose of this study was to find out what pre-service teachers enrolled in a mathematics education course perceived about their own mathematics teachers. Most studies in this area have looked into identifying best qualities of mathematics teachers. These are the qualities which teacher educators often assume the pre-service teachers will uphold upon entering full-time employment. This research also aims to identify worst teacher qualities and will explore what aspects of the worst teachers the pre-service teachers would want to avoid when in full-time employment. Much of the research in the area of beliefs about the nature of mathematics and good mathematics teaching has focused on pre-service primary teachers, with relatively fewer studies involving pre-service secondary mathematics teachers (Prescott & Cavanagh, 2006). This study will add to our current understanding of how pre-service mathematics teachers perceive good and bad mathematics teaching.

## Pre-service Teachers' Views on Good Teaching

In a study of primary pre-service teachers, Brown, Mcnamara, Hanley & Jones (1999) found that eighty percent of the pre-service teachers found mathematics boring and difficult during their school days. A majority of the pre-service teachers came to initial teacher training with negative feelings associated with mathematics. At times, these negative emotions were triggered by the nature of the subject itself or by the teachers who were teaching the subject. The negative emotions were mostly generated by teachers' personal qualities, for example, not showing enough compassion. One pre-service teacher is quoted saying "you had to stand up if you didn't get it against the clock, and if you didn't get it in 30 seconds, you had to stand on the chair." (Brown et al., 1999, p. 306)

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According to Prescott & Cavanagh (2006), pre-service mathematics teachers see mathematics as a fixed body of knowledge that is best learnt by transmission mode. In this study, Prescott & Cavanagh (2006) found that pre-service mathematics teachers had little difficulties in telling their high school mathematical experiences. This research noted that pre-service teachers were able to recall their stories from primary school days, although these memories were rather sketchy than their high school memories. The pre-service teachers described lessons which had similar characteristics, mostly seated class work followed by doing lots of exercises from the text book. The pre-service teachers recalled the personal characteristics of their own mathematics teachers as being more motivating. Also, the ways in which teachers explained the concepts were seen as important. Good teachers, in short, were those who had good knowledge of mathematics, good classroom management, and were well organized. On good mathematics lessons, pre-service teachers recalled lessons where teacher explained well and had good control over the class.

Ewing (2005) found that traditional approach to teaching mathematics by the use of the text book alone dominated the experiences of the many learners interviewed. This approach meant that these learners were tasked with completing “pages of drill and practice exercises”, and to “keep pace with the class”. This kind of learning often discourages learners from fully participating in the class, and is likely to eventually result in a state where they “do not participate” or “withdraw or marginalize themselves from mathematics”.

In a similar study to this, Balatti & Rigano (2011) analyzed pre-service teachers’ reflections on what constitutes good teaching in the mathematics context. The study categorized pre-service teachers’ narratives into three types of stories: turning point stories, critical moment stories, and, pattern of practice stories. The pre-service teacher stories fitted in one of these three categories. The pre-service teachers’ experiences of good teachers came in terms of personal qualities they displayed, the behaviors they demonstrated, and the impact they had on their students. The study revealed that the least noted attribute were the ‘content knowledge of teachers’ and their ‘behavior management skills’ (Balatti & Rigano, 2011, p. 86)

## Methodology

### *Sample*

Thirty secondary pre-service teachers, enrolled in a mathematics teaching methods course, while working towards their Bachelor of Science and Graduate Certificate in Education Programme (BSc GCED), participated in this study. All these pre-service teachers had mathematics as one of their majors, with physics, computer science, chemistry or biology as the second teaching subject. These pre-service teachers were in their third year of study and had to attend a two-hour workshop on mathematics teaching every week throughout the second semester. There were 10 females and 20 male teachers. Majority were from Fiji with only five from regional countries (2 from Kiribati, 2 from Solomon Islands, and 1 from Tonga).

### *Instrument*

As part of first weeks workshop exercise, the participants in this study were asked to write a reflective piece on the topic: *Mathematics - My own story*, following a series of prompts. Teachers were asked not to give their names. The task was adopted from

Westwell (2005) who argues that it is important for mathematics teachers to look back and reflect on their own experiences. The following prompt questions from the “mathematical memories” task suggested by Westwell (2005) were selected for this study.

1. How do you rate your ability in mathematics?
2. Who was your best mathematics teacher? And what about this teacher most impressed you?
3. Who was your worst mathematics teacher? What it was about this person that led you to such a judgment?
4. Why did you decide you wanted to become a mathematics teacher?

(Westwell, 2005, p. 8)

## Results and Discussion

### *Teachers' Ability in Mathematics*

Teachers were asked to describe their ability in mathematics and how they came up with their ability rating. They were also asked to describe if they thought that they were born with this ability or was it a product of their education, or was it due to both or neither? All the teachers rated themselves highly in terms of their ability in mathematics. Majority of these teachers remembered that they were good in mathematics from the beginning, meaning from the primary schools years.

I was doing well in mathematics in primary school (male, 11).

I loved maths from primary school (male, 8).

Two of the teachers said that they were not very good at the start.

At primary, I was only an average student...got better over the years (female, 1).

I was not very good in primary mathematics...but in secondary, I did well...came first (female, 2).

Majority of the teachers rated themselves based on the examination marks they received or for any special awards or certificates they received. Some used their positioning in the final exams to judge their ability. Such ratings, as shown in the following quotes, show the high degree of reliance these pre-service teachers placed on examination results and their positioning in class.

I used to get above 90... (female, 3).

I received an award while taking part in maths quiz... (male, 1).

I used to come first in class from the start (male, 2).

It also points to the fact that teachers and students both are likely to give higher importance to examination results in a context which has been heavily dominated by the examinations culture. All the pre-service teachers rated themselves based on summative tests and this tells us that when it comes to rating of ability in mathematics, these pre-service teachers are likely to favor summative practices.

On the nature versus nurture issue, majority of the pre-service teachers held the view that they were not born with this ability and it was purely a result of their educational experiences. For example,

I think I was not born with it...it was my teacher (male, 7).

My abilities developed as a product of my education (male, 16).

None of the pre-service teachers gave full credits to the nature. In fact, those who did say that they were born with it went on to say that being born with it alone was not sufficient. They gave other factors which contributed to their ability in mathematics. For example, some said it was their parents, or their teachers or it was the result of their own efforts.

I was born with this ability...and my education has further added to it (female, 5).

I was born with it, but my teacher helped me realize it... (male, 20).

It is interesting to note that pre-service teachers' viewed ability in mathematics as a result of one's effort, or in part, effort of the teachers and/or parents. Very few pre-service teachers said that they were born with a good ability in mathematics, and these pre-service teachers believed that it was a combination of the nature and nurture which predicted their ability in mathematics.

### *Best Teachers*

Many of the pre-service teachers described their most recent mathematics teachers as the best teachers. In other words, the teachers in this study mostly reflected on their own experiences at the upper secondary level. As expected, majority had little difficulty in recalling their form 5, 6 or 7 mathematics teachers as the best teachers.

My best teacher was in form 7. He had a lot of patience and treated everyone equally... (female, 7).

The role model teacher was my form 7 teacher (male, 6).

Only two pre-service teachers gave descriptions of their primary school teachers.

I had some good math teachers at primary school. These teachers were very dedicated and prepared their lessons well (male, 5).

I remember three names. My class six teacher...(male, 7).

These short reflections show that some teachers are able to relate to their teachers from as early as primary school years. However, lack of detailed descriptions would mean that the memories may be a bit sketchy. The most common descriptions of best mathematics teachers contained teachers' affective characteristics. In most cases, however, other characteristics, such as teacher preparedness and resourcefulness, teacher content knowledge, or structure of lessons, were described simultaneously with teachers' affective characteristics. These affective characteristics often contained behaviors such as being caring and nice, being approachable and available for providing extra help, being able to counsel students on important matters, being punctual and regular to classes. Some of the comments were:

He was dedicated and hardly missed school (male, 12).

This teacher understood my difficulty and helped me accordingly (male, 7).

Although she was pregnant in that year, she never missed any class,...was punctual, energetic, kind, and approachable (male, 16).

Apart from the affective characteristics, these pre-service teachers also mentioned content knowledge as well as pedagogical factors. One of the important qualities of best teachers was seen in terms of the teachers' preparedness and resourcefulness. Another important quality, often described together, was how these teachers were able to structure their lessons and explain the concepts in simple terms, or even repeating their explanations

so that students could explain. These pre-service teachers saw preparedness in terms of teachers giving a lot of exercises, clear examples, and summarized notes. Being prepared and resourceful meant that teachers were not carrying the text books into the classrooms and repeating what was given in the texts. Not carrying the textbooks or written materials while teaching meant that the teachers had a very good knowledge of the content, or was very experienced. Being prepared also meant that the class was well structured, with the usual flow from recapping of previous day's work, providing relevant examples and lots of exercises. Pre-service teachers' descriptions, in varying degrees, included a number of characteristics described above.

My best teacher was in Form 7. He was the best because he was well prepared. He could answer any question from the first till the last topic. He kept the class lively and included everyone in the discussion. He comes to the class, recaps the last class, then marks homework questions, introduces the new topic with real life examples, writes a few notes, and does examples...(male, 14).

Another theme which came out quiet strongly in this section of the reflections was to do with passing examination. Since majority of the pre-service teachers recalled their upper secondary school experiences, a high number of these pre-service teachers saw their best teachers as those who worked towards helping students score good marks in the external examination at either form 6 or form 7 levels. Some of the actions judged suitable in the teacher reflections included giving short tests on a regular basis, providing extra help for examinations such as taking evening lessons or Saturday classes, providing appropriate revision materials which often included past year examination questions, and giving tips on how to write good examinations. This meant that best teachers were finally judged by the marks their students scored on national examinations. Since all the participants in this study were taking mathematics as one of their majors of their undergraduate degree, it is assumed that these teachers had all scored good marks in their external examinations. This could be one of the reasons why teachers in this study saw examination scores as linked to good teaching. The following provides a glimpse of the situation.

My best teacher was my School Principal...he impressed me in his teaching. For example, before the final examination, he gave us mock exams around 3 or 4 times based on past year exam papers...he also gave us tests at the end of each week and put the top 10 students name on the notice board... (male, 19).

Another aspect of best teachers was their ability to use different teaching methods and to create student-centered lessons. This included provide challenging activities, organizing group activities or games such as poster competition, giving real life examples or relating classroom mathematics to real life situations. This, however, was mentioned by only a few pre-service teachers.

I had a pleasant time learning mathematics because I had excellent mathematics teachers. The teacher I most admired was the one who took me through forms 5 to 7. She was well organized. She used positive reinforcements and gave formative feedback. She involved us a lot in games and activities, for example, poster competitions. She tried to make her lessons student centered (male, 15).

### *Worst Teachers*

The third question in the self-reflection asked the pre-service teachers to identify their worst mathematics teachers. Almost one-third of the pre-service teachers said that it was a difficult question to respond to. In other words, this group of pre-service teachers said that they had not come across one teacher who could be described as a worst teacher, although

some teachers had occasionally shown qualities which were not good. Most of the responses in this group were short like:

Some teachers are frustrating at times but we must understand the workload they have (male, 16).

I never came across any teacher who could be called worst. However, I did experience teachers who needed improvement. These are the teachers who teach to complete the syllabus and are not worried about what students learn (male, 1).

As noted earlier, the pre-service teachers were all good in mathematics during their school days. Doing well would mean that their experiences with mathematics teachers were mostly positive ones. Another reason for pre-service teachers not wanting to elaborate further on bad qualities would be related to their own image as prospective mathematics teachers. Many pre-service mathematics teachers, especially the ones who are about to complete their initial teacher training would start putting themselves in the shoes of full-time mathematics teachers and hence would not prefer labeling mathematics teachers as bad or ineffective.

On the contrary, a good number of pre-service teachers in this study were able to recollect their memories of bad mathematics teachers. These memories on most occasions were opposite of what has been discussed under the sub-heading of good teachers. The bad qualities included teachers not knowing their subject well. Students were able to realize this when teachers could not answer student questions. Some identified qualities such as teachers not being well prepared and almost duplicating the text book notes, examples and exercises. Pre-service teachers also identified communication factors such as poor language skills and affective factors such as not being helpful, or favoring the smart students only, as qualities of their bad mathematics teachers. The pre-service teachers generally agreed that these qualities must be avoided.

### *Reasons for Wanting to be a Mathematics Teacher*

The final question in the reflective exercise asked pre-service teachers to state reasons for wanting to become a mathematics teacher. Again, majority of the answers related to affective reasons. For example, many said that they loved mathematics and wanted to make a positive difference in future learners, while others said that they enjoyed learning mathematics and would also enjoy teaching it one day. Some had this choice as their childhood dream and some were inspired by their own mathematics teachers or other important people in their lives. A few teachers also noted the very nature of the subject which made it exciting, challenging and enjoyable to teach. Although a varied category of reasons were cited for choosing to become a mathematics teacher, most of the reasons were affective in nature. Not all teachers enrolled in this course for the affective reasons stated above. Three of the pre-service teachers said that they took up mathematics teaching because they were offered scholarships to study mathematics.

## Summary and Implications

This research utilized written reflections by pre-service teachers to study their views on what constitutes good and bad mathematics teaching. One of the aims of this exercise was to allow teachers to reflect on some of the practices they would want to use in their own teaching because they themselves have found this worthwhile. Another aim was to see if teachers could classify what constituted worst mathematics teaching, and possibly avoid such behaviors in their own teaching, simply because if they had not liked it at all, it is highly likely that their students in future would do the same. As argued by Brown et al.

(1999), pre-service teachers can correct perceived failures of mathematics teachers by engaging in reflective practices. Analysis of teacher reflections revealed a lot about teachers perceptions. As revealed by Prescott & Cavanagh (2006), majority of the pre-service teachers in this study had little difficulty recalling their high school mathematical experiences. Majority of the pre-service teachers had good ability in mathematics, and in most cases, this was linked to hard work on their part or their teachers' part. Pre-service teachers gave higher value to affective teacher qualities and supported qualities which lead to them scoring better results on external examinations. This could mean a lot of drill and practice with examination type questions, similar to findings of the study by Ewing (2005).

In another set of findings, pre-service teachers found it hard to describe their worst teachers. One of the reasons could be the use of the term 'worst' as it denotes something extreme. Of those who did identify their worst teachers, many of them used the term 'bad' in their descriptions. Cultural barriers could be another reason for pre-service teachers not wanting to write openly about their mathematics teachers. This is likely to be true in the Pacific setting where teachers are still regarded as most knowledgeable and given a higher rank in their society.

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