

A Mathematics Teacher Educator's Perspective of Building Connections between Research, Theory, and Practice¹

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In the short time available I wish to make the following points:

- Most of our student teachers entering teacher education are not confident in mathematics
- As teacher educators we need to consider how best we can increase students' confidence in both mathematical content and in pedagogical knowledge
- Students and teachers need to be introduced to both theory and research in order to change their teaching practices
- An effective understanding of both theory and research requires classroom teaching experience
- Teachers need to be supported with ongoing professional development in order to improve their content and pedagogical knowledge in mathematics
- Engaging in their own classroom based research is an effective way to bring about changes in teachers' pedagogical practices and understanding of mathematics

Shulman (1987) stresses a necessity for teachers to have three knowledge domains: content knowledge, pedagogical content knowledge, and curriculum knowledge. That is, teachers need to be confident in understanding the content of mathematics, in their ability to teach mathematics content, as well as in understanding the curriculum if they are to meet the mathematical needs of their learners (Britt, Irwin, Ellis & Ritchie, 1993). However many students enter their teacher education being unconfident in their knowledge of mathematics (MOE, 1997). Teachers who are insecure about their mathematics knowledge lack confidence in encouraging the ideas of their learners (Thomas, 1999).

Teachers with limited mathematics knowledge “will depend on the text for content, de-emphasise interactive discourse in favour of seatwork assignments, and in general, portray the subject as a collection of static factual knowledge” (Brophy, 1991, p. 1). But even when beginning teachers are confident in teaching mathematics evidence suggests that they take on the teaching practices of their colleagues rather than the pedagogical approaches they are taught in their teacher education. Social cognitive learning theorists (McInerney & McInerney, 1998) allege that we learn through observation and modelling. It would therefore follow that student teachers would teach the way they learnt mathematics, what they observed and had modelled to them for many years rather than using a problem solving or social constructivist approach.

Thomas (1999) argues that a sustained level of professional development is needed if there is to be improvement in the teaching of mathematics because there is

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“as much to unlearn as to learn” (p. 9). However there is evidence that teachers with limited subject knowledge are less likely to benefit from professional development (Britt et al., 1993). It is not enough to model for your students how you believe they ought to teach, expecting them to be active learners and problem solvers (Thomas, 1999). What is necessary is to have your students reflect on these experiences so they do not merely imitate your practices.

Traditionally research has been carried out by an ‘expert’ or academic researcher. There has been some shift in more recent years to teachers engaging in research. Begg (1999) advocates teachers as practitioner researchers who are engaged in changing a situation in his/her own context are more likely to take cognisance of the research of others. Reading studies by teachers whose voices appear “real, credible and accessible” encourage other teachers to improve their own teaching practice (Hughes & Petersen, 2003, p. 450). This is supported by the work of Atweh and Ochoa (2001) who argue that research and professional development models that engage teachers as active participants tend to result in effective and continuous change in school mathematics and empower teachers.

Indigenous Teacher Educators

My work in teacher education at the undergraduate level is with Māori speaking indigenous student teachers, many of whom are second chance learners. National Education Monitoring Reports (NEMP) suggest that there are areas in the achievement of learners from Māori immersion education contexts where Maori are achieving the same as or are exceeding learners in English medium contexts. However reports show there are some areas where Māori learners are not achieving as well as their peers (Crooks & Flockton, 2002; MOE, 2003). There are some mitigating factors for Māori medium contexts, which include a shortage of competent Māori speaking teachers, resources, and a greater need for Professional Development with the Maori medium curriculum because of linguistic issues and new mathematics vocabulary in te reo Māori (McMurchy-Pilkington, 2004). A state Professional Development initiative to strengthen the teaching and learning of numeracy for practising Māori teachers in New Zealand is *Poutama Tou*. This project is parallel to the Early Numeracy Project (MOE, 2001) for mainstream or English medium teachers. Our student teachers are introduced to *Poutama Tou* during their second and third years.

Although our Māori students have limited confidence when they enter their teacher education, by their third year they believe they have “gone a little” further in their knowledge and feel “okay” about teaching the junior levels. However they would like to see more content knowledge taught to them, especially in their early years of teacher education. We believe we need to expose them to content but this needs to be within a pedagogy of mathematics, that includes what and how children learn mathematics. There is a danger that if we as teacher educators teach them solely content they will model at the expense of processes in their own teaching.

In their observations on practicum our student teachers do not think mathematics is taught well out in schools, certainly “its not what we are exposed to in here”. In their opinion “many teachers are behind what we are taught”, there is more “rote learning” rather than problem solving in classrooms. Some of them suggest there is too much content and not enough focus on the processes of mathematics, like problem solving. Further some of the teachers they have worked with, especially at the upper levels of primary, before entry into secondary school, recognise there are gaps in the children’s learning but they “keep teaching regardless”. That is, it appears the teachers

are expected to have covered certain topic areas before their pupils arrive at secondary school (year 9) and they teach these despite the actual level of their pupils.

When asked about their reading or knowledge of research in mathematics some of our student teachers said it might help as it would prepare them for the issues they may meet in teaching. Others said they would “rather be hands on and learn how to do it”, that they needed to be upskilled in mathematics first. All agreed they needed ongoing professional development when they begin teaching.

We have a new initiative at our university that began two years ago and is financed by the Ministry of Education. The initiative called *Whakapiki Pangarau* (*Strengthening Mathematics*) is for Māori (indigenous) teachers who teach in total immersion settings. The full time one semester course in the Māori language is for practising teachers, and the salary for a reliever for the successful applicants is provided by the state. This course arises out of a concern for the underachievement of Māori children in schools, particularly in mathematics. A further rationale for the course is to support Māori speaking teachers to learn the complexity of the Māori language and linguistic structures associated with the Māori medium national mathematics curriculum published in 1996 (Te Tahuhu o te Matauranga, 1996). Ministry of Education resources have been previously targeted at lifting the proficiency of teachers’ Māori language, but language proficiency alone is not a prerequisite to being a good mathematics teacher. Māori language of the curriculum needs to be learnt along with the mathematics content and pedagogical knowledge.

In discussions with the Māori teachers on the *Whakapiki Pangarau* course they all state they are being exposed to a different pedagogy. They are not learning mathematics in linear steps, nor is this being modelled to them pedagogically. They are focusing not only on the language of mathematics (in Māori) but also on mathematics processes like problem solving, and relevant contexts in which to teach mathematics to Māori children. During this process they are well exposed to content as well as research. They find the readings about research and issues in the teaching and learning of mathematics challenging but very useful in “exposing” them and “bringing to the forefront” aspects they need to consider and reflect on in order to be effective mathematics teachers. We believe that readings and research are very useful for these teachers as they are exposed to the thinking and issues behind the learning and teaching of mathematics and of the complexity of mathematics. Some of the readings help them to “get into the mind of the kids” and “how complex the learning of the concepts are for the kids”.

However they all agree that in order to make sense of the readings they needed to have some prior teaching experience. They doubted if the readings would have a lot of relevance to them if they were student teachers without sustained periods of practice to scaffold their reading and understanding. Besides connecting with many of the readings, because of the teaching experience that each brought to the course, they were able to learn off each other. They agreed there are large gaps between what they were taught in their initial teacher education, what they read about, and how they now feel confident and capable in teaching mathematics.

Sparrow and Frid (2002) suggest teacher educators need to examine this gap between what is promoted in their mathematics education sessions and the reality out in classrooms and schools. Ways of drawing this gap closer together are to encourage teachers to become reflective practitioners, to encourage teachers to mentor other teachers, especially beginning teachers, and for teachers to engage in research on their own practice. Further, in an ideal world all teachers would have the right to six months ‘sabbatical’ after several years of teaching, whereby they engaged in

professional development on a full time basis, with time to reflect on their teaching and the issues that confront them in their day to day lives in the classroom.

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