

# Accounting for the Contextual Nature of Teachers' Beliefs in Considering Their Relationship to Practice

Kim Beswick

*University of Tasmania, Australia*

<Kim.Beswick@utas.edu.au>

Teacher beliefs research has promised much but delivered relatively little in terms of improvement in the teaching and learning of mathematics. This is due in part to insufficient account being taken of context. This paper examines literature that stresses the contextual nature of teachers' beliefs and in light of this examines studies reporting both consistency and inconsistency between teachers' beliefs and practice. In each case it is argued that appropriate consideration of context renders their findings highly predictable.

A fundamental premise of teacher beliefs research has been that an individual's behaviour is ultimately a product of his/her beliefs (Ajzen & Fishbein, 1980; Cooney, 2001; Pajares, 1992). Consequently, any attempt to change the practice of teachers must, of necessity, involve change in the beliefs of teachers. Teachers' beliefs have, therefore, long been regarded as critical to the reform of mathematics education (Anderson & Piazza, 1996; Battista, 1994; Cooney & Shealy, 1997). Despite this there is no agreed definition of the concept of beliefs (Pajares, 1992, White, 2002). It is thus the responsibility of researchers in the area to make clear the meaning that they attach to the term (Pajares, 1992). In this paper "beliefs" is used to mean anything that a person regards as true, and is essentially the meaning assigned to the word by Ajzen and Fishbein (1980).

In addition, the nature of the link between teachers' beliefs and their classroom practices remains controversial with some writers reporting consistency between beliefs and practice (Stipek, Givvin, Salmon, & MacGyvers, 2001; Thompson, 1984) and others inconsistency (Cooney, 1985; Shield, 1999). Indeed the direction of the beliefs practice connection has been questioned with Guskey (1986, cited in Cobb, Wood, & Yackel, 1990) arguing that rather than beliefs determining behaviour, change in teachers' beliefs follows from change in their behaviours. While acknowledging the merits of Guskey's (1986) arguments, Cobb et. al. (1990) conclude that the relationship is not linearly causal in either direction but rather beliefs and practice develop together and are interdependent. Others such as Askew, Brown, Rhodes, Johnson, and William (1997) and Carter and Norwood (1997) acknowledge the subtleties involved by referring to beliefs as *shaping* practice.

Nevertheless the fundamental premise remains, with its implicit corollary that teachers' beliefs influence student outcomes. Askew et. al. (1997) explain that teachers' beliefs influence their planning outside the classroom, and their interactions with students during lessons, both of which influence students' learning, and Carter and Norwood (1997) cite evidence that teachers' beliefs influence students' beliefs. Such connections have been acknowledged in recent policy documents including the Commonwealth Numeracy Policies for Australian Schools (DETYA, 2000). The study of teachers' beliefs and their impact on practice thus continues to promise much in terms of improving teaching and hence students' learning and this is rightly the aim of research efforts in mathematics education (Stigler & Hiebert, 1999). However, as White (2002) argues, ongoing controversy as to the consistency or otherwise of teachers' beliefs and practice does little to further this aim.

This paper presents theoretical understandings of context in relation to teachers' beliefs and goes on to critically analyse several studies reporting both consistency and inconsistency between teachers' beliefs and practice. It is argued that appropriate consideration of context renders the findings of such studies predictable and a more fruitful direction for teacher belief research is suggested.

## The Contextual Nature of Beliefs

Many researchers, particularly those whose focus has been on change in teachers' beliefs, have drawn upon aspects of Green's (1971) description of belief systems in explaining the relationship between teachers' beliefs and practice (Arvold & Albright, 1995; Becker & Pence, 1996; Cooney, Shealy, & Arvold, 1998; Mewborn, 2000; Shealy, 1994). Of particular relevance to a discussion of context is Green's (1971) assertion that beliefs are held in isolated clusters, thus preventing conflicting beliefs from being juxtaposed to reveal their inconsistency. Such clusters of beliefs can develop, and indeed are likely to, when they arise in independent contexts (Green, 1971).

In their theory of planned behaviour, Ajzen and Fishbein (1980) emphasise the context specificity of beliefs. They stress that beliefs are specific with respect to all of context (i.e. place, action or behaviour, time and subject) and illustrate this with the example of a person's intention to vote in a non-compulsory election. Specifically, their intention to vote (an action) may be dependent upon the particular polling booth (place), the candidates to choose from (object) and the date of the election (time). Each possible variation of each of the four variables has the potential to elicit quite different beliefs. Thus, in order to predict behaviour, beliefs must be specified in relation to each of these aspects of context. Green (1971) also asserts the relevance of context to the enactment of beliefs, suggesting that the relative strength with which various beliefs are held is dependent upon the particular context.

Contextual constraints have also been recognised as exerting significant influence on the relationship between beliefs and practice (Sullivan & Mousley, 2001). In fact Sullivan and Mousley (2001) depict the relationship between beliefs, practice and constraints as a triangle with two-way interactions between each pair of elements and, in her meta-analysis of case-studies on the relationship between teachers' beliefs and practice, Hoyles (1992) describes all beliefs as situated. That is, all of a teacher's beliefs are constructed as a result of experiences which necessarily occur in contexts. Hoyles (1992) argues that it is thus meaningless to distinguish between espoused and enacted beliefs or to examine the transfer of beliefs between contexts since differing contexts will, by definition, elicit different beliefs. Thus, rather than contextual factors constraining teachers from implementing certain of their beliefs, such factors in fact give rise different sets of beliefs which are indeed enacted. Such a view is consistent with that of Ajzen and Fishbein (1980). Pajares (1992) also stresses the contextual nature of beliefs and the implications of their being held, not as isolated entities, but as part of belief systems as described by Green (1971).

Context is thus relevant to both the development and the enactment of teachers' beliefs, as well as to the particular beliefs that are relevant (and hence likely to be espoused and/or enacted) in a given situation. The studies examined in the following section illustrate that findings of consistency or otherwise between teachers' beliefs and practice are to a

large extent a function of the methods and interpretation of the researcher, and that a comparison of the respective contexts in which beliefs and practice are considered renders the findings both predictable and consistent with the scarcely recent theories of both Ajzen and Fishbein (1980) and Green (1971).

### Studies of Teachers' Beliefs and Practice

The studies described here are illustrative of studies that have reported either consistency or inconsistency between teachers' beliefs and practice, and also of the variety of methodologies that have been employed in such studies. They highlight the importance of appropriately accounting for context in the interpretation of such studies.

#### *Studies Reporting Consistency Between Beliefs and Practice*

Thompson (1984) conducted three consecutive case studies that involved daily observations of teaching of a particular mathematics class over a four-week period. During the second two weeks, the subjects were interviewed with questions relating to specific events in that day's lesson, and the researcher's inferences as to the subject's beliefs. During this period the teachers were also asked to complete a number of tasks aimed at providing further insights into their beliefs about mathematics and mathematics teaching.

The three teachers in Thompson's (1984) study held beliefs that formed three distinct and essentially coherent views of mathematics and its teaching. Thompson (1984) also reports that the teachers' views of mathematics and its teaching were indeed consistently related, albeit in complex and subtle ways, to their classroom practice, and she acknowledged the relevance of context both in discerning teachers' beliefs and in influencing their translation into practice. Among factors that influence the translation of a teacher's beliefs into practice Thompson (1984) includes beliefs about teaching more generally than just mathematics, and the social and emotional characteristics of the students in the class. In addition she uses Rokeach's (1960) notion of isolation of beliefs, which is similar to that of Green (1971), to explain the rather less integrated nature of the beliefs of one of her subjects. Thompson (1984) also identifies the degree to which a teacher reflects upon their practice and its impacts on student learning, in the light of their consciously held beliefs, as relevant to the extent to which the teacher's beliefs are coherent and enacted.

In her study of the influences on the content taught in fourth grade mathematics classes Barr (1988) found that teachers' beliefs about the structure of the content in any subject area influenced the degree to which they followed the textbook sequence in presenting that content. In addition she found that fourth grade teachers who regarded certain mathematics topics as less important either failed to introduce those topics, or covered them only superficially. Importantly, in the case of each of these findings the specific belief and practice are close to one another in terms of the context in which teachers are likely to consider them. That is, teachers may well consider the sequencing of topics in a textbook when considering the structure of the content they are planning to teach, and similarly, judgements of the relative importance of various topics are likely to be made in the context of teachers planning their teaching, including the amounts of time to devote to each topic.

Peterson, Fennema, Carpenter and Loef (1989) examined the relationship between 39 teachers' pedagogical content beliefs in addition and subtraction, and their grade one

students' achievement in addition and subtraction. They inferred the teachers' beliefs from a Likert style questionnaire and a structured interview. In the interview, teachers were asked not only to describe what they believed about the content and appropriate pedagogy for teaching addition and subtraction, but also to describe their own particular objectives with respect to these areas of the curriculum, and what they believed to be appropriate roles for the students, and for themselves as teachers, in the context of teaching addition and subtraction in grade one. The responses of the teachers were used to assess the extent to which their beliefs aligned with a cognitively based perspective of teaching and learning. Peterson et. al. (1989) found that students in classes taught by teachers whose perspectives were more cognitively based performed better on solving word problems involving addition and subtraction than those whose teachers had less cognitively based perspectives, and that this finding was in line with the greater emphasis on word problems that was reported by teachers whose perspectives were more cognitively based. Again, the specificity and close correspondence between the contexts in which these teachers' beliefs and practice were considered renders the consistency unsurprising.

These studies indicate that consistency between beliefs and practice is likely to be observed when either, the relationship between beliefs and practice is considered in terms of broad, essentially integrated sets of beliefs that define a conception or philosophy, and overall characteristic patterns of behaviour, or when particular beliefs are specified in terms of a very particular context, which corresponds closely with the context in which specific behaviours are examined. The former condition applies to Thompson's (1984) groundbreaking study while the latter applies to Barr's (1988) and Peterson et.al.'s (1989) studies. It should also be noted that the specificity and correspondence of contexts in the second case represent conditions close to those required by Ajzen and Fishbein (1980) in their theory of planned behaviour. The findings of these studies are thus entirely consistent with the theoretical literature.

### *Studies Reporting Inconsistency Between Beliefs and Practice*

Such studies include Cooney (1985) who describes the difficulties experienced by a beginning secondary mathematics teacher in implementing the beliefs he had espoused as a pre-service teacher. Specifically, Fred had indicated that he believed that problem solving was central to the very nature of mathematics and that teaching heuristics was central to teaching problem solving. However, Fred found that the majority of his students were less interested and motivated than him, by what he perceived to be interesting problems and his teaching style belied the beliefs that he had expressed earlier. Rather than teaching heuristics and involving students in solving problems, he used problems as interest generating preludes to rather traditional algorithmic teaching. His teaching practice suggested that he in fact believed that rather than being integral to mathematics, problem solving is a significant but distinct part of mathematics. With regard to teaching style, Fred appeared to believe that a problem solving approach was inherently in conflict with an authoritative style and was unable to conceive of other alternatives.

This study differs from those reporting consistency between beliefs and practice in important ways, chief amongst which is the fact that Cooney (1985) was considering the relationship between the beliefs that Fred held at one time, that is, while he was still at

University, with his practice at another, namely during his first few months as a qualified teacher. Although the actual time difference was not great, other concomitant changes were enormous and not limited to those associated with his now being a full time teacher with all of the associated responsibilities, workload, new relationships and culture that that entailed. Cooney (1985) also indicated that Fred and his wife experienced the arrival of their first child in the time between Fred's completion of his studies and the commencement of his teaching career. In view of the literature (Ajzen & Fishbein, 1980; Green, 1971; Hoyles, 1992) such disparate contexts make the inconsistency Cooney (1985) found almost inevitable.

More recently, Frykholm (1999) reported inconsistency between the beliefs and practice of 63 pre-service secondary mathematics teachers engaged in practice teaching. According to Frykholm (1999), the teachers demonstrated sound and comprehensive knowledge of the standards documents produced by the National Council of Mathematics Teachers, (NCTM), which were a major focus of the mathematics curriculum methods courses that the students were involved in between practice teaching experiences. In addition to knowing about these documents, the teachers in Frykholm's (1999) study expressed varying degrees of belief in their worth, and commitment to implementing them in their own teaching. In spite of this, many of the teachers failed to do this, and expressed doubt as to the feasibility of teaching in ways consistent with the standards given the constraints of real classrooms and real schools (Frykholm, 1999). Many seemed to imitate the traditional practice of their cooperating teachers or to rely on models of teaching with which they were familiar from their own experiences as students (Frykholm, 1999). Frykholm (1999) stresses that these students continued to express a desire to teach in ways consistent with the standards and were both acutely aware of and frustrated by the discrepancy between their beliefs and practice.

While the beginning of teachers' careers has been identified as a unique period during which their beliefs may be particularly volatile (Schuck, 1999; Shealy, 1994), and Frykholm (1999) acknowledges this, the notion of context is also relevant. Even though the entirety of Frykholm's (1999) study was conducted while the participants were pre-service teachers, the contexts in which their beliefs and practices were discerned differed, with the former being inferred from conferences held following each of the three or four lessons observed for each teacher, and survey responses and seminar comments made on campus and subsequent to the teaching experience. In addition, the relevant beliefs related specifically to reform oriented instruction as embodied in the NCTM's standards, and not to specific lesson content and teaching situations. Thus the contexts differed in terms of time, place and subject. Furthermore, the post-lesson conferences included encouragement for the teachers "to reflect on their classroom practices and their beliefs about mathematics instruction" (Frykholm, 1999). This is precisely the kind of activity that has been shown to assist teachers to become aware of their beliefs and possible inconsistencies with practice (Andrews & Hatch, 1999; Cooney & Shealy, 1997) so it is unsurprising that the teachers were aware of the discrepancies described. Regardless of this, the apparent discrepancies can be explained in terms of Green's (1971) notion of clustered beliefs, particularly his contention that beliefs can form isolated clusters when they arise in independent contexts as was likely the case for these pre-service teachers who studied the

NCTM standards and related ideas at University and practiced teaching in secondary school classrooms.

In contrast to Cooney's (1985) novice teacher, Shield's (1999) study involved a secondary mathematics teacher, Ken, with 22 years of experience. Shield (1999) inferred Ken's beliefs from a questionnaire, classroom observations, and interviews. Ken's responses to both the questionnaire and the interview suggested that his beliefs about mathematics were broadly consistent with Ernest's (1989) problem solving view and he espoused beliefs regarding the teaching of mathematics that were consistent with such a view. Shield (1999) reports that many of Ken's lessons were also consistent with the beliefs he expressed, but that some were not. These incongruous lessons involved Ken telling the students how to perform a procedure and emphasising correct setting out and accurate use of mathematical language. Ken acknowledged that he experienced some tension between the way in which he believed it was best to teach and the way that he sometimes felt compelled to teach because of perceived expectations, in terms of procedural efficiency, of teachers who would meet his students in subsequent years. Shield (1999) also speculates that the time requirements of preparing less traditional lessons may also have constrained Ken from consistently acting in accordance with his espoused beliefs.

However, a closer look at Shield's (1999) findings reveals that rather than their being in conflict with his espoused beliefs, Ken's actions were indeed consistent with them. Shield (1999) notes that Ken often qualified his interview responses in terms of the constraints within which he was working and even mentioned that some rote-learning was inevitable, but fails to take such qualifications into account when comparing Ken's beliefs and practice. Rather than regarding the occasional traditional lesson as demonstrations of these, perhaps less central beliefs, he focuses on Ken's broad problem solving view of mathematics and mathematics teaching and then highlights specific classroom episodes as contrary to it. In fact it appears that the degree of integration of Ken's beliefs and practice is comparable to that of teacher in Thompson's (1984) study who showed the greatest degree of consistency. What differs is the way in which the data have been interpreted. This difference is particularly striking given the dates of the two studies and the research and theoretical development that occurred in the interval.

Perhaps even more worrying is Sosniak, Ethington and Varelas' (1991) finding, based on data from the Second International Study of Mathematics (SIMS), of complete incoherence among the beliefs of 144 grade eight mathematics teachers. Specifically, when correlations between responses to pairs of survey items that reflected opposite views were examined, no significant relationships were evident. Sosniak et. al. (1991) acknowledge that their findings may have been influenced by the abstract and potentially ambiguous wording of many of the items and also cite Thompson (1984) as stressing the need for in-depth case study approaches in inferring teachers' beliefs. Furthermore, they concede that context is somewhat relevant, in that the distance of various items from the classroom context appeared to influence the likelihood that teachers would report beliefs that could be broadly characterised as traditional or progressive, but nevertheless maintain that the teachers' views were incoherent. This interpretation would be viable in light of Green's (1971) ideas if teachers' beliefs about the nature of mathematics and mathematics teaching developed contemporaneously in disparate contexts and were consequently held in isolated

clusters. However, as Carter and Norwood (1997) point out, teachers existing beliefs also constitute part of the context in which new beliefs about the teaching and learning of mathematics form. Thus, teachers' beliefs about the nature of mathematics are likely to form part of the context in which teachers develop and refine their beliefs about mathematics teaching and so, while the differing contexts evoked by the items are almost certainly relevant, the apparent incoherence of the teachers' beliefs is more likely to reflect inadequacies in the research methodology (as acknowledged by Sosniak et. al. (1991) in their reference to Thompson (1984)). In addition, Sosniak et. al. (1991) equate coherence with a one to one correspondence between beliefs expressed in relation to differing contexts and do not take into account the likely presence of other highly relevant and context specific beliefs that formed part of the teachers' belief systems. Their study thus appears to exemplify Munby's (1982) assertion that apparent inconsistencies result from incomplete understanding of the subject's belief system.

## Conclusion

The importance of context in relation to teachers' beliefs cannot be over emphasised. Consistency cannot be expected when the contexts in which the teachers' beliefs are considered and their practices observed are not closely matched (Ajzen & Fishbein, 1980; Hoyles, 1992; Pajares, 1992). Such context matching must include correspondence between the degree of generality of the beliefs and practice being considered. That is, if one considers broad collections of beliefs that are not closely linked with a specific context, then it is unreasonable to expect consistency with practice that is not described in equally broad, contextually independent terms, and conversely if one is interested in specific aspects of teachers' classroom practice then the relevant beliefs must be defined in terms of the same context with equal specificity.

Since context is also relevant to the formation of teachers' beliefs (Green, 1971), it deserves the ongoing attention of mathematics educators in a position to influence the beliefs of both pre-service and in-service teachers. There are also implications for methodologies employed in the study of teachers' beliefs. Specifically the contexts evoked by particular survey items and interview questions and tasks must be considered. Similarly, the degree of specificity of the focus of classroom observations needs to be chosen in order to identify behaviours that are associated with particular beliefs of a similar level of generality.

Cooney (1999) identifies two broad types of beliefs that appear to be held by significant numbers of pre-service secondary teachers and that influence their practice in fundamental ways. Further research aimed at identifying similarly specific yet generalisable beliefs that are relevant to broad patterns of the teaching practice of this and other groups of teachers would be useful. Such knowledge would allow reform efforts aimed at facilitating change in the beliefs and practices of teachers to target specific key beliefs and would therefore be likely to increase their effectiveness. The ultimate beneficiaries would be mathematics students.

## References

- Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behaviour*. Englewood Cliffs, NJ: Prentice-Hall.
- Anderson, D., & Piazza, J. (1996). Changing beliefs: Teaching and learning mathematics in constructivist preservice classrooms. *Action in Teacher Education*, 18(2), 51–62.
- Andrews, P., & Hatch, G. (1999). A new look at secondary teachers' conceptions of mathematics and its teaching. *British Educational Research Journal*, 25(2), 203–223.
- Arvold, B., & Albright, M. (1995). *Tensions and struggles: Prospective secondary mathematics teachers confronting the unfamiliar*. Paper presented at the 17th Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education, Columbus, OH.
- Askew, M., Brown, M., Rhodes, V., Johnson, D., & William, D. (1997). *Effective teachers of numeracy*. London: School of Education, King's College.
- Barr, R. (1988). Conditions influencing content taught in nine fourth-grade mathematics classrooms. *Elementary School Journal*, 88(4), 387–411.
- Battista, M. T. (1994). Teachers' beliefs and the reform movement in mathematics education. *Phi Delta Kappan*, 75(6), 462–470.
- Becker, J. R., & Pence, B. J. (1996). Mathematics teacher development: connections to change in teachers' beliefs and practices. In L. Puig & A. Gutierrez (Eds.), *Proceedings of the Twentieth Conference of the International Group for the Psychology of Mathematics Education* (pp. 103–117). Valencia, Spain: PME.
- Carter, G., & Norwood, K. S. (1997). The relationship between teacher and student beliefs about mathematics. *School Science and Mathematics*, 99(2), 62–67.
- Cobb, P., Wood, T., & Yackel, E. (1990). Classrooms as learning environments for teachers and researchers. In R. B. Davis & C. A. Maher & N. Noddings (Eds.), *Constructivist views on the teaching and learning of mathematics* (pp. 125–146). Reston, VA: NCTM.
- Cooney, T. J. (1985). A beginning teacher's view of problem solving. *Journal for Research in Mathematics Education*, 16(5), 324–326.
- Cooney, T. J. (2001). Considering the paradoxes, perils, and purposes of conceptualising teacher development. In F. L. Lin (Ed.), *Making sense of mathematics teacher education* (pp. 9–31). Dordrecht: Kluwer Academic Publishers.
- Cooney, T. J., & Shealy, B. E. (1997). On understanding the structure of teachers' beliefs and their relationship to change. In E. Fennema & B. Nelson (Eds.), *Mathematics teachers in transmission* (pp. 87–109). Mahwah, NJ: Lawrence Erlbaum.
- Cooney, T. J., Shealy, B. E., & Arvold, B. (1998). Conceptualising belief structures of preservice secondary mathematics teachers. *Journal for Research in Mathematics Education*, 29, 306–333.
- Ernest, P. (1989). The impact of beliefs on the teaching of mathematics. In P. Ernest (Ed.), *Mathematics Teaching: The State of the Art* (pp. 249–253). New York: Falmer.
- Frykholm, J. A. (1999). The impact of reform: Challenges for mathematics teacher preparation. *Journal of Mathematics Teacher Education*, 2, 79–105.
- Green, T. F. (1971). *The Activities of Teaching*. New York: McGraw-Hill.
- Hoyles, C. (1992). Mathematics teaching and mathematics teachers: A meta-case study. *For the Learning of Mathematics*, 12(3), 32–44.
- Mewborn, D. S. (2000, April). *Changing actions vs. changing beliefs: what is the goal of mathematics teacher education*. Paper presented at the Annual Meeting of the American Educational Research Association, New Orleans, LA.
- Munby, H. (1982). The place of teachers' beliefs in research on teacher thinking and decision making, and an alternative methodology. *Instructional Science*, 11, 201–225.
- Pajares, M. F. (1992). Teachers' beliefs and educational research: cleaning up a messy construct. *Review of Educational Research*, 62(3), 307–332.
- Peterson, P. L., Fennema, E., Carpenter, T. P., & Loef, M. (1989). Teachers' pedagogical content beliefs in mathematics. *Cognition and Instruction*, 6(1), 1–40.
- Rokeach, M. (1960). *The open and closed mind*. New York: Basic Books Inc.
- Schuck, S. (1999). Teaching mathematics: A brightly wrapped but empty gift box. *Mathematics Education Research Journal*, 11(2), 109–123.
- Shealy, B. E. (1994). *Authority and relativism "in the trenches": A case study of teacher development*. Paper presented at the Annual meeting of the Northeastern Educational Research Association, Ellenville, NY.
- Shield, M. (1999). The conflict between teachers' beliefs and classroom practices. In J. M. Truran & K. M. Truran (Eds.), *Making the difference* (pp. 439–445). Sydney: MERGA.



- Sosniak, L. A., Ethington, C. A., & Varelas, M. (1991). Teaching mathematics without a coherent point of view: Findings from the IEA Second International Mathematics Study. *Journal of Curriculum Studies*, 23(2), 199–131.
- Stigler, J. W., & Hiebert, J. (1999). *The teaching gap*. New York: The Free Press.
- Stipek, D. J., Givvin, K. B., Salmon, J. M., & MacGyvers, V. L. (2001). Teacher's beliefs and practices related to mathematics instruction. *Teaching and Teacher Education*, 17, 213–226.
- Sullivan, P., & Mousley, J. (2001). Thinking teaching: Seeing mathematics teachers as active decision makers. In F. L. Lin & T. J. Cooney (Eds.), *Making sense of mathematics teacher education* (pp. 147-163). Dordrecht: Kluwer.
- Thompson, A. G. (1984). The relationship of teachers' conceptions of mathematics and mathematics teaching to instructional practice. *Educational Studies in Mathematics*, 15, 105–127.
- White, A. L. (2002). Research into teachers' beliefs: Can the past stop endless repetition? In B. Barton & K. Irwin & M. Pfannkuch & M. Thomas (Eds.), *Mathematics education in the South Pacific* (pp. 690-697). Sydney: MERGA.