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New Zealand pre-service teachers' enjoyment of mathematics and their attitudes towards teaching mathematics

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Background

The affective domain of mathematics learning has been the focus of considerable research over the past three decades. Writers have distinguished between different aspects of the domain, including beliefs, values, attitudes, and emotions/feelings. Jo Boaler's recent book, *What's math got to do with it?: Helping children learn to love their most hated subject—and why it's important for America*, provides a powerful argument for the urgent need to address this issue. Primary teachers are important role models in the lives of their pupils. However, past research indicates that the primary teaching profession has tended to attract people who did not excel in mathematics at secondary school, and consequently lack confidence in their own mathematics. For some, the negativity they feel towards mathematics makes it extremely difficult for them to develop the mathematics proficiency needed to teach mathematics effectively.

Many Western education systems now make literacy and numeracy/mathematics their highest priority. The mathematics education reforms of the past two decades stress the importance of conceptual understanding over procedural knowledge. This puts pre-service teachers under considerable pressure to develop content knowledge and pedagogical content knowledge (PCK) in mathematics. In New Zealand, there is no formal curriculum for initial teacher education and the standards for graduating primary teachers are more a reflection of the aspirations of the profession than requirements that teachers must meet before graduating. Hence it is vital to explore how pre-service teachers feel about mathematics and how this is related to their attitudes towards teaching maths and their conceptual understanding.

Research Questions

This study set out to investigate the attitudes of pre-service primary teachers (in their final year) towards: mathematics; the prospect of teaching mathematics; and their preparedness to teach mathematics. The teachers were also given tasks to assess their understanding of mathematics. The primary purpose of the mathematics tasks (which included questions ranging from open-ended problems requiring detailed explanations, to multi-choice questions) was to provide them with the experience of different item types within a written test, as part of a paper focused on curriculum and assessment. No warning was given in advance of this assessment. A secondary purpose was to explore teachers' affective responses and their understanding of mathematics. Teachers were asked to consent to their data being used for research purposes. Of the 170 teachers who were given the opportunity to complete the mathematical tasks and the attitude questions, 125 gave consent for their data to be included in the research. The data was gathered during a lecture early in the paper. A five-point Likert scale was used for the three questions used to explore affective responses. The question about attitude towards mathematics asked teachers to mark the scale according to "how much you enjoy maths". Possible responses ranged from "1 love maths" to "5 hate maths". Underneath the rating scale, teachers were asked to explain why they had given that particular rating. A similar structure was used for the question about attitude towards teaching mathematics/numeracy ("how much are you looking forward to teaching maths/numeracy in the future?", with possible responses ranging from "1 very positive re teaching maths" to "5 very apprehensive re teaching maths"). The question about preparedness to teach mathematics/numeracy asked teachers about "how well prepared do you think you are to teach maths/numeracy next year?" (with responses ranging from "1 very well prepared to teach maths" to "5 very unprepared to teach maths").

Methods

Both quantitative and qualitative data analysis were used, including correlations, cross-tabulation of frequencies for aggregated groups, analysis of means and standard deviations, and content analysis of the teachers' written explanations. Teachers were aggregated into three groups based on their response to the question about enjoyment of mathematics (those on the "love" or "like" side of the mid-point formed one group, those on the "hate" or "dislike" side of the mid-point formed another group, and those choosing the mid-point constituted the third group). Analysis was also undertaken of teachers' responses to tasks used to assess mathematics.

Frame

Research literature argues for the importance of taking into account the affective as well as the cognitive domain in investigations of mathematics learning. Socio-cultural models of learning recognise the importance of social processes for mathematics learning. Enculturation provides the means by which learners come to understand what is expected and valued by the community to which they belong. Nowhere is this more true than in the primary school classroom where the teacher has the responsibility for establishing the norms for mathematics learning.

Research findings

Just over half (57%) of the teachers in the study either liked or loved maths. One sixth (17%) of the teachers either disliked or hated maths, and just over a quarter (27%) chose the mid-point of the scale (neutral/OK). The teachers' reasons for liking or disliking maths were often related to their own experiences of learning maths at school. However, some of those who disliked maths were very positive about the prospect of teaching maths (20%), and some felt well prepared to teach maths (10%). Several teachers in the negative and neutral groups commented on their wish to provide their future students with more satisfactory maths teaching than they had experienced themselves. Many teachers mentioned the importance of having a good understanding maths to be able to teach maths. The teachers who enjoyed maths tended also to be positive about the prospect of teaching maths (82%) and perceived that they were well (or very well) prepared for this (64%).

Teachers' enjoyment of mathematics was moderately related to their total score on tasks used to assess their conceptual understanding ($r = -0.50$), perhaps because those who were positive worked more quickly and were able to complete more tasks in the limited time available. Mathematics enjoyment was also related to attitude towards teaching maths ($r = 0.50$), and perception of preparedness to teach maths ($r = 0.42$). The strongest relationship was between attitude towards teaching maths and perception of preparedness to teach maths ($r = 0.59$).

This study has some important implications for initial teacher education. Many teachers expressed a wish to have a greater understanding of mathematics. This finding is consistent with the current emphasis on conceptual understanding as part of mathematics reforms. Only two mathematics education papers (totalling 72 hours of class time) were compulsory for these teachers. Hence the challenge was to inspire as many as possible to continue their mathematics learning voluntarily. It is hoped that the difficulties some had experienced in the past may help prepare them to support their own students in the future.