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Published

2003

Conference Title

Proceedings of the 27th conference of the International Group for the Psychology of Mathematics Education

Version

Version of Record (VoR)

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THE AFFECTIVE VIEWS OF PRIMARY SCHOOL CHILDREN

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This paper documents a study concerned with examining the affective response to mathematics among 45 primary school students. The study sought to examine how the children's emerging beliefs, attitudes and feelings about mathematics impacted on their learning of the subject. A particular finding was that these beliefs, attitudes and feelings were shaped around a narrow conception of mathematics primarily restricted to number concepts and arithmetic.

INTRODUCTION

In 1992, McLeod commented that research into the affective dimension of mathematics education was limited and marginalized, but in recent years there has been a growing awareness of beliefs, values, attitudes and emotions as they relate to mathematics teaching and learning. Studies have been undertaken into the affective views of many particular groups including women (e.g., Buerk, 1985), pre-service and in-service teachers (e.g., Bishop, FitzSimons, Seah, & Clarkson, 2001; Grootenboer, 2002), school children (e.g., McDonough, 2002) and the general public (e.g., Lim, 1999). There seems to be a general consensus in the literature that affective factors have a significant influence with many writers reporting that their participants had debilitating views of mathematics. Indeed, it has been suggested that the beliefs, attitudes and feelings that individuals develop through their schooling considerably limit their ability to use or understand mathematics throughout their life (Schuck, 1997).

While the number of studies in this area has been growing, there appears to be only a few that address the affective views of primary children. The study reported in this paper was an initial investigation into the views and feelings that a group of children had about mathematics and learning mathematics. The children were placed in small groups and asked to talk and write about their thoughts on the nature and purpose of mathematics and how they saw themselves as learners of mathematics.

LITERATURE REVIEW

The relationship between affective factors and achievement in mathematics education has been debated and researched over the last 50 years (Aitken, 1970; Antonnen, 1969; Dutton, 1954; McDonough & Clarke, 1994; McDonough, 2002). Furthermore, there was a perception that students who liked mathematics would also be successful in learning it (Garden, 1997). While this may well be a sound proposition, it seems to underestimate the symbiotic and complex relationship between affect and achievement, as it seems at least feasible that for many students, they like mathematics because they are successful in learning it. Nevertheless, in reviewing the performance of New Zealand students in the Third International Mathematics and Science Study (TIMSS), Garden (1997) reported:

While a majority of students have positive attitudes to learning mathematics ... it appears that from a fairly young age there is an increasing proportion of students having lost interest in the subject, with a concomitant decline in their achievement. (p. 252)

Studies of children's beliefs about mathematics have reported that their views tend to be narrow focusing primarily on counting and number operations (Cotton, 1993; Frank, 1988; Garafolo, 1989). In their study of the beliefs of 1202 primary school children, McDonald & Kouba (1986) found that the students had a limited conception of mathematics that included little beyond numeracy and arithmetic. Moreover, other studies revealed that students seemed to perceive the mathematics they experienced at school as being characterized by the memorization of formulae and the completion of routine exercises (Garafolo, 1989; Schoenfeld, 1992). More recently, McDonough (2002) studied the beliefs primary school children held about mathematics and found that they were diverse, complex and at times idiosyncratic. She suggested that "beliefs may impact upon children's reactions to, or interpretations of, what is stated, performed or produced in a mathematics learning situation and may affect many aspects of their learning ..." (p. 455).

It seems clear from a number of studies that have explored the affective views of adults that many of their beliefs, attitudes and feelings about the subject developed as a school student (e.g., Carroll, 1998). Unfortunately, the general consensus seems to be that the affective views they developed were negative and debilitating, rendering many anxious about mathematics and active in avoiding it (McLeod, 1992). The two aspects of this negative perception of mathematics appear to be beliefs that mathematics is infallible and absolute, and feelings of fear, hatred and boredom about the subject (Mayers, 1994). Given these concerns it seemed appropriate to investigate the affective views of school children as the central focus of this study.

THE STUDY

The study was qualitative in nature and employed research methods that included both oral and written responses to a small range of relatively open questions and prompts. The participants were drawn from three Year five and six classrooms in a suburban New Zealand school. The school is situated in a middle-class suburb and it has received praise for its innovative approach to teaching and learning. Over the last two years the school has been involved in government sponsored initiatives that have sought to improve the numeracy levels of the students. In all, 45 children aged between nine and twelve were involved in the study.

Method

The study was designed to explore the students' personal experiences of mathematics and their perceptions of those experiences. In particular, it sought to understand some of the children's beliefs about mathematics, their attitude towards the subject and their associated feelings and emotions. Given these parameters, a phenomenological framework was appropriate as it encompassed a holistic, human perspective that gave precedence to perception, sense impressions, emotion and experience (Cohen, Manion & Morrison, 2000, Cresswell, 1998).

In order to collect the data the participants were organized into groups of about four or five where they were given the opportunity to both discuss and record their thoughts and ideas. Each child was given a copy of the open-ended questionnaire which they completed both during and after discussing their responses with one another. The student's classroom teacher monitored the group and kept the discussion open, on-task and flowing while reassuring the children that their honest and sincere responses were desired. The questionnaire consisted of three sections, the first focusing on their beliefs about the nature and substance of mathematics (e.g., What do you think maths is about?), the second on their experiences and views on learning mathematics (e.g., Describe your best maths lesson), and the third explored their feelings about the subject (e.g., How do you feel about maths?). While the participants' discussions were rich and insightful, it was not possible to record and therefore, only the data recorded by the participants on their questionnaire sheets was captured for the study.

Phenomenological techniques were utilized for data analysis which initially involved the researcher in reflectively considering and noting any preconceptions (Moustakas, 1994). The data was then read through several times so a general initial sense of the phenomena could be perceived. Coding was used to identify key themes across the data which were then used to try and describe the phenomenon as it was presented in the participants' descriptions. These descriptions are reported in the following section.

FINDINGS

Overall, the students were able to lucidly and succinctly write about their mathematical experiences and their associated feelings and perceptions of mathematics. All of the participants in the study had studied mathematics at school for at least five years and they seemed to draw on the fullness of their experiences in responding to the questions. Three key themes emerged from the data, the first being the nature of mathematics. The second was a significant dimension of the first theme relating to the prominence of times-tables, and the third was the student's feelings about mathematics and learning mathematics. These will now be outlined in turn. While I will endeavor to use the participants' own words to illustrate the themes (spelling and grammar corrected if necessary), for the sake of parsimony only a few lines of transcript will be used.

The Nature of Mathematics

Throughout all the participants responses the common perception was that mathematics is about numbers and arithmetic. In fact, very few of the students mentioned any other aspects of mathematics such as algebra, geometry, statistics or measurement. The following exemplify the participants' comments:

Andrew: Maths is about numbers and \div , \times , $+$, $-$.

Emily: I think maths is about doing sums and learning your numbers and how to use numbers. You need to learn your numbers because it is important to be good at them.

Furthermore, when commenting on what they thought was important in learning mathematics the participants again almost exclusively noted skills and concepts related to numeracy and arithmetic. They mentioned things like times-tables, division and long division specifically, counting, addition, subtraction, fractions and multiplication.

In addition to the common perceptions noted above, a small number (13%) of students indicated that mathematics was also about strategies and problem solving, as illustrated below:

Hannah: It [mathematics] is about problem solving and finding strategies to work out things.

Brienne: It is important to know different ways to solve problems.

Interestingly, the small group of students who identified this dimension of mathematics were all identified by their teachers as being the more able children in the class.

About one third of the participants wrote further comments about mathematics that didn't relate to the skills or concepts of mathematics, but rather to how they perceived the subject. In general, these students were not the high achievers in the class and their comments suggested that mathematics was difficult and hard-work:

Sharee: Maths is about thinking and learning, using your brain. It is a brainy subject and you have to think hard with your brain.

The common thread to these participants' comments was that mathematics is arduous and not easy, and success in mastering it required perseverance and "brain power" (Bradley). One student advised:

Kirsten: Maths is not as easy as it looks. You have to work hard and learn your times-tables and tidy numbers. Maths can be a bit confusing at times but you may as well learn it now or you'll have trouble later.

Kirsten's comment also highlights the significance the participants placed on times-tables.

Times-tables

The second theme that emerged was the prominence of times-tables in the participants' perceptions of mathematics. While this dimension was really a sub-set of the first theme discussed above, the striking status of times-tables in their annotations required separate comment. Nearly 70% of the student-participants thought that times-tables were the most important thing they had learned in mathematics, and almost all the others listed them as being very important. Some of the reasons the children gave are recorded below:

Jason: Times-tables [are the most important aspect], because if you can do times-tables you can do just about anything.

Caitlin: I think the most important thing is your times-tables. They help you with long division and other things.

Zhan: The brainy kids are good at [times]-tables.

Chris: Times-tables, because if you know your tables then you will get a good job.

The sense of the data was that it was important to have memorized your times-tables and be able to recite them quickly. It seemed as if the children who could do this were regarded as the best mathematics students and they were perceived as being "brainy". Times-tables also featured as a factor in the student's discussion about their feelings about mathematics.

Feelings about Mathematics and Learning Mathematics

In discussing their feelings about learning mathematics, times-tables emerged as a characteristic of unpleasant lessons for many of the students. Of the 42% of the students who mentioned times-tables here, they noted in particular writing out their tables, repetitively singing their tables and times-table tests. Other factors that seemed to contribute to unpleasant mathematical experiences were bookwork that was dull and repetitive, content that was perceived as too easy or too difficult, and public humiliation or embarrassment.

A common feeling associated with bookwork and learning content that was seen as too easy or repetitive was one of boredom, as illustrated below:

- Casey: The worst lessons were when we did lots of writing in our maths book for the whole time. That was a boring way to learn.
- Michael: I get bored when we learn something we already know and we get those revision worksheets.

Comments like Michael's tended to come from the students who were more successful in their mathematics learning, whereas a number of the less successful students expressed feelings of confusion and bewilderment about their experiences in trying to come to terms with difficult and unfamiliar material:

- Steven: My worst maths lesson was when I was 9 and I had to figure out six hard maths equations. I didn't get it and I couldn't do it and no one was allowed to help me because it was problem solving.

Another small group (9%) of children who had struggled in their school mathematics education recorded some sad memories of their mathematical experiences, and their comments recorded below speak for themselves:

- Nadine: My worst lessons are when people laugh at me when I get things wrong.
- Neal: When I couldn't do take-aways and the whole class laughed at me. Then I had to stay in all of interval while the others were outside playing and laughing at me.
- Rachel: I was stuck in a group with the good people and they knew all the answers and I didn't understand and couldn't keep up so I got really behind. I didn't understand the progress or the answers but then I had to report to the class. In front of everyone I cried.

Indeed, these quotations reflect the worst experiences of the participants, and while they are significant, the majority of the students expressed more positive feelings towards mathematics.

In responding to questions about how they felt about mathematics, most (over 90%) of the children expressed feelings that were not negative, with nearly 50 percent overtly positive, for example:

- Deborah: Maths is cool! I love it more than any of my other subjects.
- Samuel: I think [mathematics] is 'primo' and I can't think of anything bad about it.

Furthermore, all of the students felt that mathematics was important. Four main reasons were given for their responses: (1) you need it later in life in general (32%); (2) specifically, you need it for your future job (42%); (3) you need it at high school (10%); and (4) you use it all the time (13%). For example, some of their comments were:

- Liam: I think it is important to do maths because otherwise you won't get anywhere in life because you won't get a good job so I think everyone should know their maths.
- Alison: If you know your maths then you can work at a bank or a shop counting the money.
- Grace: Yes, because you need it at high school.
- Tim: You need to do maths because you use it all the time.
- Brady: Maths is important but I don't know why!

The underlying theme in their responses was that mathematics is important because it will be useful in the future.

DISCUSSION AND CONCLUDING COMMENTS

The findings presented in the previous section highlight a number of issues, but here the discussion will be limited to a few key ones. Firstly, the focus will be on the student's narrow and limited perception of mathematics including the privileged status of times-tables, followed by a brief discussion of their feelings about mathematics. Finally, possible implications for mathematics education are explored in the light of the study's findings.

It was clear that the children in the study associated mathematics primarily with number and arithmetic, which was consistent with other studies reported in the literature. In New Zealand the government has placed far greater emphasis on numeracy in the primary school curriculum through specially funded programs (e.g., The Early Numeracy Project) and legislation. While few would question the need for children to be numerate and arithmetically strong, it is also desirable that children have a well-rounded mathematics education including aspects such as geometry, measurement, algebra, statistics, problem solving and mathematical processes. Certainly the children in the study would have been taught these other dimensions of mathematics (as they are fundamental strands of the New Zealand mathematics curriculum), but clearly they were not overtly recognized in their conceptions of the subject. Interestingly, this narrow conception may indeed heighten the mathematics anxiety of some, as possibly the more enjoyable aspects (e.g., geometry) are not included in their definition of what mathematics is really about.

Allied to this was their perception of the ultimate value of times-tables in mathematics - a view that from anecdotal evidence would probably be shared by their parents and the community at large. For a number of the participants times-tables were the most fundamental aspect of mathematics, while also being the dimension they really disliked. It seems that generally times-tables are taught and learned in a rote fashion with the emphasis being on quick and accurate recall. This is a process that does not appear to be particularly mathematical, and yet the students who are able to memorize and quickly recall their tables are seen as the best and most competent mathematics students - "the

brainy ones"! Certainly one could probably make a good case for the inclusion of times-tables in a well-rounded mathematics curriculum, but it seems unlikely that they should be placed at the pinnacle of mathematical learning, so it would appear necessary for this prevailing view to be challenged amongst students, teachers, and the community at large.

One of the interesting things to emerge was that the students' views of mathematics seemed to be firmly grounded in their school experiences. If this is indeed the case generally, then it would seem important that teachers are well aware of the affective lessons their students are learning as they experience the mathematics curriculum in their classrooms. While the children in the present study seemed to generally enjoy mathematics, the literature and conventional wisdom seems to suggest that for many adults this is not the case (Carroll, 1998). It therefore, seems important that mathematics educators and teachers explore ways to build more positive perceptions of the subject so children, like the ones in this study, can maintain their optimistic disposition. This would need to include both a broader perspective of the nature of mathematics and positive attitudes and feelings towards its content and application.

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