

Positive learning dispositions in mathematics

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This paper addresses the concept of 'enjoyment' in New Zealand's mathematics programmes. It discusses the relationship between enjoyment and emotions, and focuses on enjoyment as a positive learning disposition. This disposition will be related to the learner, the tasks and teacher-implementation, in the intermediate school classroom. It establishes reasons why enjoyment is an important concept in promoting higher self-esteem for young intermediate students in their mathematics education.

Introduction

It is common knowledge that many of New Zealand's students are falling behind in mathematics (Barton, 1995; Walker & Chamberlain, 1999) and this would seem to be most apparent in the so-called 'low decile' intermediate schools in South Auckland. Having recently moved into the intermediate school system, after spending my previous teaching career in the primary area, I have noted considerable differences in teaching styles and have detected low self-esteem in students in regard to mathematics. Intermediate students often believe that mathematics is a subject to be endured while at school and do not see it as a rich, enjoyable and worth while experience. Why? This paper sets out to examine this and argues that through generating enjoyment a teacher can cultivate positive learning dispositions towards mathematics.

Aitken (2000: 5) states that the evaluations of the Education Review Office, in regard to school performances, are based primarily on two questions: "what do we expect the students in this school to learn, to achieve and to enjoy in the time that they are with you?" and "how do we know when this has happened?" If the evaluations of schools and their students are based on these questions, then a further question arises: how do teachers know when the students are enjoying a mathematics problem or task?

Enjoyment

Enjoyment is an emotion. According to the dictionary, emotion is triggered by stimulus, it is an instinctive or intuitive feeling as distinguished from reasoning or knowledge. If enjoyment is established as an emotional response to a stimulus, must students show an emotional response to mathematics experiences and if so, what are these responses? How can teachers know when a student is actually enjoying mathematics? Is it laughter or perseverance such as continuing with a course of action in spite of difficulty, or exhibiting motivation, enthusiasm, interest, curiosity, or even inspiration to begin or to complete a task? (Carr, 1997). Some classroom experiences may not seem particularly enjoyable or exciting for the learner, but they too can be found to be meaningful and worthwhile (Brophy, 1983). So how can teachers decide if a student is enjoying a mathematics task? Carr (1997), Lane (1999), and Le Seuer (1994) generally agree that dispositions such as motivation, curiosity and perseverance can be recognised when students persist at difficult tasks, take risks and exhibit open mindedness. These dispositions are definitely evident when students are enjoying mathematics learning. Can enjoyment therefore be classed as a disposition? I would like to suggest that it can. Katz (1993, cited in Carr, 1997: 10) believes that there is one key disposition and that is "the disposition to go on learning". Katz adds "... any educational approach that undermines this is miseducation." Dispositions are highly valued in the eyes of educational theorists, so surely if teachers are aware of these positive learning dispositions, including enjoyment, and incorporate them into their mathematics programmes, the advantages for the students should speak for themselves.

Disposition according to Perkins, Jay, and Tishman (1993: 4), consists of a triad of interacting elements, these being: inclination, which is how a learner feels towards a task; sensitivity towards an occasion or the learners alertness towards a task; and lastly ability, this being the learner's ability to follow through and complete an actual task. Therefore if enjoyment is a disposition, it must also be made up of these elements having an inclination element, a sensitivity element and an ability element. Using this

framework, a description can be developed in relation to enjoying mathematics. With inclination a student will be drawn or motivated towards a mathematics task, with sensitivity a student may feel that doing this task is worth their while, and with ability the student will persevere and see this task through. Are these elements present in the teaching of mathematics at intermediate schools?

In early childhood education the document *Te Whaariki* (Ministry of Education, 1996) addresses the development of positive dispositions and Carr (1998) uses observation in the form of learning stories which link these dispositions to the strands of the document:

Well being - being involved

Belonging - taking an interest

Contribution - taking responsibility

Communication - expressing a point of view or feeling

Exploration - persisting with difficulty.

Aitken (2000) reminds us how these dispositions can be used as a framework for assessment in early childhood settings but stresses that difficulties can arise in observing dispositions. However my experiences in the lower primary area indicated that younger students thrive on mathematics and exhibit openly these dispositions mentioned above. As they progress through the year levels, why does this change?

It is interesting to note that more tests tend to be given as a child progresses through school. Can there be a link between testing and the development of negative attitudes? Furthermore where does knowledge come into this? For example, a child may possess all the 'good dispositions' when presented with a highly enjoyable and motivating mathematics task but not have knowledge or ability to divide or multiply for instance. Carr (1997) believes that while dispositions are different from knowledge and skills they are often the product of a knowledge/skills combination.

Nathan & McMurchy-Pilkington (1997: 19) define a triangular model of mathematical learning where the components of learner, task and teacher ideally work together towards a common goal. I will use this model to explore possible tensions between these three components in the New Zealand intermediate setting, in terms of disposition towards mathematics.

The learners

Several studies (Lane, 2000; Perkins, Jay, & Tishman, 1993) show that dispositions are closely linked to an individual's beliefs, attitudes and values. Raymond (1997) and Barton (1993) both believe that cultural background, home environment and socio-economic status, parental beliefs about their children and mathematics learning, and the students own beliefs about mathematics, all influence the way students perceive and learn mathematics. Many students at intermediate schools in South Auckland are of Maori and Pacific Island descent therefore the cultural aspect of these students must be addressed.

Ohia (1993) discusses that in New Zealand mathematics has been targeted towards dominant English traditions and suggests that indigenous people learn from what they know and accordingly teachers should support learner-centred, holistic and contextual learning. Begg (1999: 8) says "the curriculum needs to be developed with familiar contexts to which students are able to make links", and should "take account of the range of interests in our students." The national document, *Mathematics in the New Zealand Curriculum* (Ministry of Education, 1992), does acknowledge that background experiences are very important to the learner, particularly Maori students, and teachers must acknowledge these experiences in their implementation of the curriculum. However, Ohia (1993) believes that the national curriculum's present mathematics contexts are irrelevant and inappropriate for the needs of the Maori students and exacerbate the existing negative dispositions that are already entrenched. There is a tendency to believe that if the value placed on learning mathematics at school and at home is not similar then students are not likely to be as successful (Good & Brophy, 1984; Zevenbergen, 1997). For example, when a highly-motivated

student wishing to complete mathematical tasks at home finds that home circumstances and commitments prohibit their continuation of school work, the enjoyment and motivation often evaporates. For the student this can result in a negative disposition toward mathematics and teachers then have a difficult task ahead of them if the negative disposition becomes heavily entrenched. If enjoyment of mathematics is the goal, teachers need to be very aware of these sensitivities and challenges and set strategies in place to deal with them.

Tasks and programmes of teaching

Numerous mathematics learning experiences articulated by teachers and educationalists promote the development of positive dispositions in mathematics. Many of these activities suggest that they have their roots in the philosophies of constructivism. Begg (1999: 7) states that good learning activities arouse interest and curiosity and that teachers should use strategies that elicit ideas from the students. Many of these quality learning experiences are suggested throughout the national curriculum and are supported by Barton (1995) as key strategies to cater for the needs of our Maori and Pacific Island students. If the teachers use such examples and incorporate the mathematical processes mentioned in the national curriculum - problem solving, developing logic and reasoning and communicating mathematical ideas - why are these students in intermediate schools still failing?

Boaler (1993: 17) believes that the role of context within learning experiences plays a major role in the development of positive dispositions in mathematics. Therefore in considering this, if the students' cultural and social values are valued in the mathematics classroom, through the use of appropriate contexts, then their learning will have more meaning for them. But in reality it has been observed that many of the teaching staff, particularly in intermediate schools in South Auckland, are transient travellers from overseas or teachers who have recently immigrated. These teachers are not aware of the cultural needs of New Zealand students or the culturally rich activities that could provide a basis for interesting and enjoyable learning experiences in mathematics. Neyland (1994: 64) suggests that activities should be tailor-made to

suit the needs of the learner. He states that "the teacher needs to take an active role in curriculum development at the classroom level and cannot be driven by externally prescribed curriculum documents." Unfortunately, the present national curriculum with its levels-structure, together with a school's assessment policy, can lead to a more traditionalist approach to teaching (Begg, 1999; Haynes, 2000; Nathan & McMurchy-Pilkington, 1997).

Teachers of mathematics

So how can teachers motivate their students to enjoy mathematics, and how can they make mathematics worthwhile to the learner? The majority of teachers do recognise that 'good learning' dispositions can be cultivated in their students by establishing rich and rewarding mathematical experiences and programmes and they have known for a long time that ignoring dispositions in the learner can be detrimental (Barton, 1993). Raymond (1997) suggests that teachers' own personal philosophies in regard to teaching mathematics can be easily overshadowed by classroom management. Meanwhile Good and Brophy (1984) believe that behaviour management is related to motivation, implying that students who are motivated and enjoying mathematics rarely exhibit problem behaviours.

Teachers must feel confident using mathematics themselves. I believe that at the intermediate level there are teachers who feel threatened by the apparent enormity and complexity of the mathematics strands at levels three and four, and because of this they tend to clutch at textbooks for survival purposes. Davis (1996, cited in Begg, 1999: 13) suggests that teachers should "anticipate different ways a lesson might move in response to the students' interactions, while still linking with the major ideas that underpin the curriculum." In order to do this, teachers must have an extremely good knowledge of the curriculum and possess positive dispositions themselves.

Time constraints for teaching mathematics are becoming increasingly more complex in New Zealand's intermediate schools. As well as juggling with cultural and sporting activities, many schools are now modelling themselves on the secondary school

system of subject specialisation and this can leave little or no integration of mathematics into other subjects. In addition there are school policies which tend to reflect the need for a more linear or behaviourist approach to teaching, one example of which is assessment procedures (Begg, 1999). Planning is yet another issue: the question all teachers ask when writing long-term plans is "what do I want the students to achieve by the end of this time?" Perhaps by changing this question to one similar to Aitken's (2000) as quoted earlier 'what do we expect the students to learn, to achieve and to enjoy by the end of this lesson?' teachers may have more chance of influencing the students' enjoyment of mathematics.

One aspect of the *New Zealand Curriculum Framework* (Ministry of Education, 1993) that tends to be richer with respect to the affective domain is the area of essential skills. Perhaps, in order to cater for students who are failing in mathematics by providing a disposition-rich learning environment, intermediate teachers should be using the essential skills as their learning objectives. Maybe to achieve a more holistic approach they should be addressing the principles of *Te Whaariki* (Ministry of Education, 1996) as in early childhood education.

Nathan & McMurchy-Pilkington (1997) identify that teachers' beliefs play a major role in the teaching of mathematics. They write of how teachers are influenced by their own personal experiences as learners of mathematics. Their study of Maori pre-service teachers showed that by continued supportive encouragement, and by sensitivity to their cultural needs, mathematics confidence was established with the teachers gaining a more positive attitude towards the subject. *Te Whaariki* (Ministry of Education, 1996) states that if students are surrounded by adults who are themselves curious about the world around them, then this disposition will ultimately influence the students. This is emphasised by Haynes (2000: 101) who writes

It is essential that teachers enjoy mathematical activity for themselves and feel confident to plan effectively for children through the provision of appropriate materials and thoughtful dialogue. It is the personal knowledge

and disposition of the teachers which enables them to take a "national curriculum and turn it into a child's curriculum. (citing Malaty, 1996).

Teachers therefore must also have a positive disposition about mathematics in order to establish a classroom climate which cultivates positive dispositions in their students.

Conclusion

In their learning and teaching model Nathan & McMurchy-Pilkington (1997) suggest that the learners, the tasks and the teachers are held together by "constructive tensions" where a change in one component shifts the equilibrium causing the other components to change, possibly to their detriment. To keep these tensions constructive teachers need to remain aware that the learning activities continue to address the needs of the learners and arouse their interest and curiosity. However teachers are constrained by the realities of the profession, the expectations of set policies within which they must tailor their mathematics programmes and their personal beliefs and attitudes that may have taken shape during their own formative years. This paper acknowledges the importance which disposition plays in mathematics. Maybe disposition cannot be easily assessed but it does belong, and is intrinsically related, to learning. I believe that teachers in intermediate schools can assist students' mathematical competency through incorporating an enjoyment disposition into their programmes, by taking a keen interest in the culture of the students and by providing richly motivating and worthwhile tasks. In this way, maybe the cycle of negativity in some students' mathematical learning can be broken and all students may come to regard mathematics as an enjoyable and worthwhile part of their lives.

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