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## **Engaged to learn - mathematics!**

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### **Background**

Student engagement and motivation in mathematics is a significant issue for education (McPhan, Morony, Pegg, Cooksey, & Lynch, 2008; Tytler, Osborne, Williams, Tytler, & Cripps Clark, 2008). Increasingly educational research is taking note of the characteristics and attributes of motivation and engagement on learning and the influence they have on achievement outcomes (Martin, 2008b). Recent government reports (McPhan et al., 2008; NCB, 2008) note concerns about the proportion of students achieving acceptable levels of proficiency in numeracy as well as student disengagement in mathematics. These reports go some way to identifying factors that influence engagement however, a thorough understanding of the relationship between engagement and achievement in mathematics is required.

Concerns regarding dips in mathematics achievement, particularly noted during the 'middle years', of schooling calls for greater understanding of the factors that impact on student learning as they make the transitions between primary and secondary school. Furthermore, establishing pedagogy reform for the effective teaching of mathematics to sustain engagement is required to provide educators with clear and practical ways to address concerns about student's engagement and achievement in mathematics.

### **Research Questions**

The Middle Years Transition, Engagement and Achievement in Mathematics or MYTEAM (Way, Bobis, Anderson, & Martin, 2008) is an Australian project funded in part by the Australian Research Council. The MYTEAM Project integrates 5 studies (2 quantitative, 2 qualitative and a teaching intervention) over three years with a key aim to improve academic engagement in mathematics

This paper reports on findings from the first qualitative study that is nested within the MYTEAM project. The study examines student motivation, engagement and achievement in mathematics during the crucial middle years of schooling (approximately 10 to 14 years of age). It does this through in-depth qualitative examination of factors contributing to shifts in student motivation, engagement and achievement in mathematics with a particular focus on the transition from primary to secondary school.

In relation to this study the following research questions are addressed:

1. How do individual, classroom and school-level factors influence middle year students' levels of engagement and achievement in mathematics?
2. How do students perceive teachers of mathematics and their practices and how does this affect their motivation, engagement and achievement?

### **Methods**

Participants in the MYTEAM project completed an instrument known as the Motivation and Engagement Survey (MES) (which included purpose selected items to ascertain students achievement in maths, educational aspirations, attitudes to school, classroom environment, mathematics self concept and motivation and engagement) in Time 1 and Time 2 (12 months apart). For this study, participants interviewed were identified as those students who recorded the most

significant shifts, both upward and downward, on items relevant to engagement and achievement scores on the MES between Grade 6 Time 1 (2008) and Grade 7 Time 2 (2009).

To capture a comprehensive understanding of factors affecting student engagement and motivation in mathematics irrespective of achievement levels, students were then categorised in the following ways: high ability engaged; high ability disengaged; low ability engaged; low ability disengaged. Approximately 10 students were interviewed from each category. The students interviewed were asked about teacher-student relationships, the learning environment, textbooks, syllabus content, homework, memories of primary school mathematics and their ability, likes and dislikes of mathematics.

Importantly, the teachers of each of these students were also interviewed and completed a survey of the identified students. Together the interviews and survey were able to elicit teachers' conceptions of mathematics, their teaching of it, their understandings of factors impacting on particular students' mathematical knowledge and how key pedagogical tools assist/hinder learning mathematics. Examining the research questions from two perspectives - the student and the teacher - allows for a deeper understanding of the issues and processes that influence students engagement and achievement in mathematics.

## **Frame**

Martin (2006) addresses the relationship between student engagement and achievement through a theoretical framework, known as The Motivation and Engagement Wheel (MEW) that examines multidimensional factors affecting motivation and engagement on both behavioural and cognitive constructs. The MEW is particularly relevant to educational settings and for this research.

Martin's framework (2006) proposes four broad aspects introduced as 'higher order groups'. Within the four 'higher order groups', eleven specific 'first order factors' have been identified from which aspects of motivation and engagement can be measured by student responses to questions in the Motivation and Engagement Survey (MES). Responses to items in the MES indicate a student's level of cognitive orientation (including their motivations and level of cognitive engagement) and behavioural orientation (behavioural engagement). The wheel framework has shown to be a reliable and valid means to assess students' engagement and motivation (Martin, 2006). For this research the questions in the MES were adapted to be content specific to mathematics and incorporated additional instruments (such as a maths quiz) thus making it particularly valuable for exploring factors impacting on student motivation, engagement and achievement.

## **Research findings**

Failing to engage students has clear implications for schools and school systems and necessitates an examination of teaching practices and the teaching and learning frameworks that guide those practices. Any examination of teacher pedagogy for mathematics must also consider affective dimensions such as engagement and motivation as these are intrinsically linked to the cognitive dimensions of learning.

Seeking clarity on apparently ambiguous aspects of student learning, such as why many students are disengaged and unmotivated by mathematics even when achieving well, the impact of achievement on the participation and future intentions of mathematics, understanding the causes for dips in achievement as students transit from primary to secondary schooling and examining the experiences and perceptions of mathematics for students in the middle years of schooling are important for teachers and educators to pursue.

The findings from this research provide insights to the complex interrelationships among motivation, engagement, achievement and pedagogy. A major outcome of the study is the development of clear guidelines for educators, to better understand types of engagement in the mathematics classroom and the relationship between student engagement and achievement in mathematics in the middle years.

