Focusing on individuals: an investigation of student engagement

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Abstract

The *Middle Years Transition, Engagement and Achievement in Mathematics* (MYTEAM) project investigated the decline in mathematics engagement and achievement in Australian middle-years students using a series of quantitative and qualitative studies. This paper and presentation tracks one investigative pathway through the five studies with the purpose of highlighting the critical role of individual student differences in determining levels of engagement with mathematics education.

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Introduction

The MYTEAM research project responded to widespread concern over student under-achievement in mathematics (Thomson & Flemming, 2004), the perceived middle-years dip in engagement and performance (Brown, Brown, & Bibby, 2008; Witby & Lord, 2006), and the declining numbers of students studying higher levels of mathematics (Barrington, 2011). Engaging students to learn has been identified as a critical issue in improving educational outcomes (Lawson & Lawson, 2013; NCTM, 2000, 2014).

The major aims of the MYTEAM project were to gain a deeper understanding of changes in motivation and engagement of Australian students across the transition from elementary school to secondary school and determine effective strategies for improving students' engagement, achievement and aspirations for further study in mathematics. The project consisted of five studies over a period of three years, each study informing the next. The purpose of this presentation is to illustrate one investigative pathway through the sequence of five studies, beginning with two large-scale quantitative studies, moving to closer examination of teachers, classrooms and students, and concluding with a focused professional development intervention with a small group of teachers. One important finding from the quantitative data was the significance of individual student differences in determining levels of engagement with mathematics learning. The five studies yielded a wealth of information about the nature of student engagement, however, in this paper and presentation, the particular theme of student difference is explored and amplified through the three qualitative studies. Although analysis and dissemination of finding is still in progress, at least one peer-reviewed publication has already been produced for each study. Therefore, only a very brief account of each study is reported here with the purpose of highlighting the importance of attending to individual students in order to promote engagement with learning mathematics.

Theoretical perspective

We interpret 'engagement' as a multi-dimensional construct broadly composed of three main components – behavioral, cognitive and emotional engagement (Fredricks, Blumenfeld, & Paris, 2004). Behavioral engagement manifests in observable actions such as staying on task or listening to the teacher. Emotional engagement refers to interest and enjoyment of the learning experiences. Cognitive engagement is perhaps the least observable as it involves thinking,

perseverance with challenging tasks and a focus on learning. While recognizing the distinctiveness of these three types of engagement, as suggested by Reschly and Christenson (2012), we also acknowledge the inter-relatedness of the types.

Although usage and definition engagement and motivation often overlap, we distinguish between the two, using motivation to refer to an individual's intention or willingness to act, and engagement as the actual involvement (Gettinger & Walter, 2012). To capture the range of interrelated engagement and motivation sub-constructs the MYTEAM project utilized the multi-dimensional motivation and engagement framework, referred to as the *Motivation and Engagement Wheel* (Martin, 2007), as the theoretical basis for the research (See Figure 1). In the framework, the 11 sub-constructs are categorized as either *adaptive* (leading to positive or increased motivation and engagement) or *maladaptive* (leading to declined motivation and possible disengagement). The sub-constructs are further organized into four quadrants: a) Adaptive cognition (self-belief, valuing school, learning focus); b) Adaptive behavior (persistence, planning, task management); c) Impeding/Maladaptive cognition (anxiety, failure avoidance, uncertain control); d) Maladaptive behavior (self-handicapping, disengagement) (Bobis, Martin, Anderson, & Way, 2011).

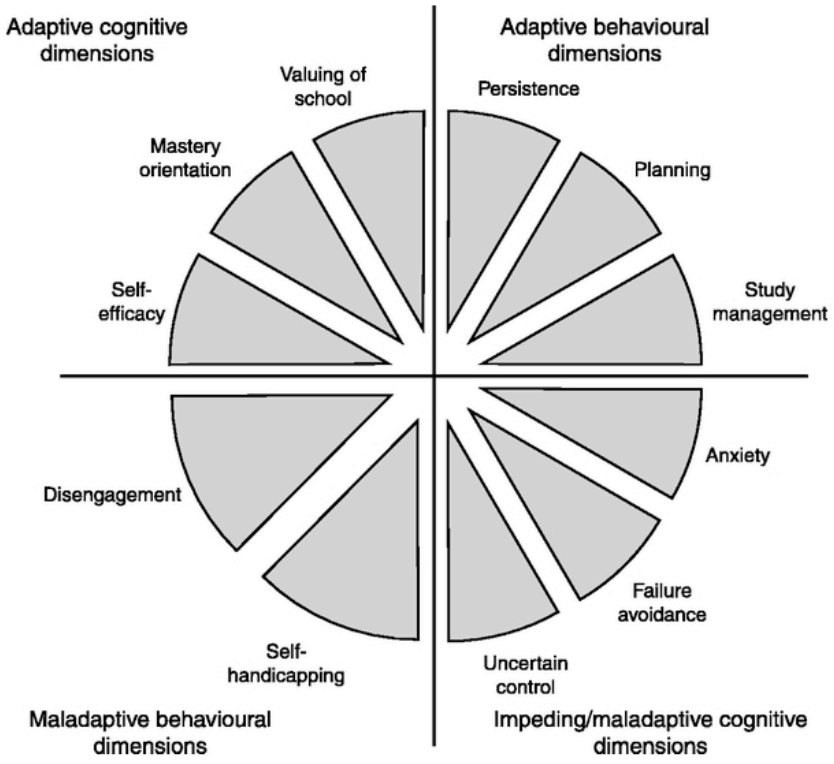

Figure 1. Motivation and Engagement Wheel (reproduced with permission from Lifelong Achievement Group (www.lifelongachievement.com) and Martin, 2010, p. 9.

Imbedded within these cognitive and behavioral sub-constructs are various emotional aspects of student engagement. To allow the assessment of student motivation and engagement levels, the Motivation and Engagement Scale (MES) was developed as a validated

survey instrument with four items for each of the 11 sub-constructs (Martin, 2007). For the MYTEAM project, the original MES survey was adapted to focus specifically on mathematics education.

Project design

The overall methodological approach for the MYTEAM project was Multiphase Mixed Methods (Creswell & Plano Clarke, 2011). The five studies were conducted in sequence, each with its own data collection methods and analysis techniques, yet each study informing the next (particularly regarding participant selection) and each contributing to the overall goals of the project. Studies 1 and 2 were quantitative, Study 3 was mixed methods, and Studies 4 and 5 were qualitative (See Figure 2).

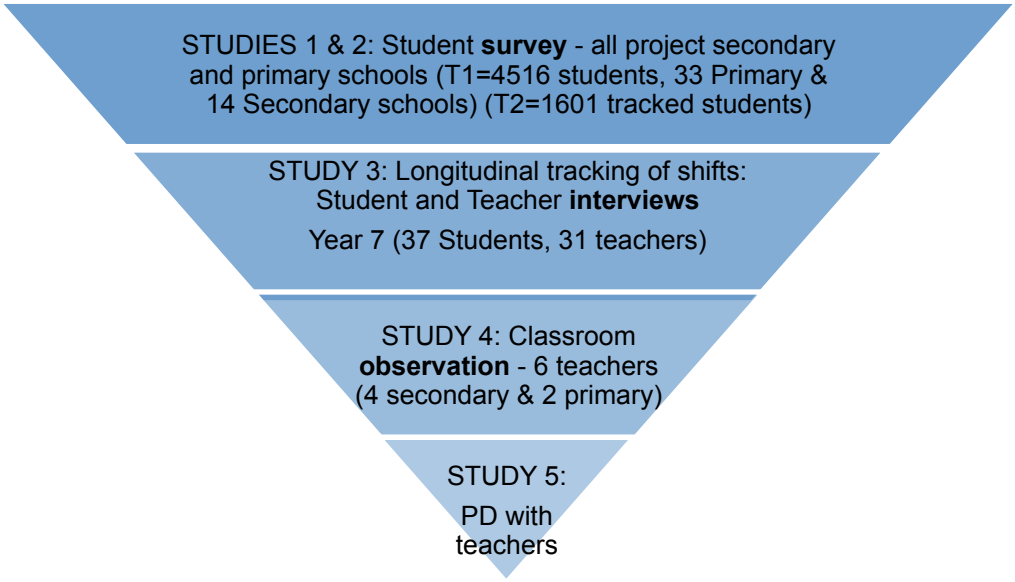

Figure 2: Overview of the five MYTEAM studies.

Studies 1 and 2: Identifying Trends and Predictors

Study 1 and Study 2 gathered data from Australian middle school students from 200 classrooms in 44 schools in the metropolitan area of a major city, and tracked student transitions from Grades 5 through to Grade 8 (That is, the last two years of elementary school and first two years of secondary school). The main instrument was the MES (Mathematics) survey, together with a basic mathematics achievement test. The Time 1 survey collected data from 4516 students. The Time 2 survey was conducted one-year later, with 1601 students completing both surveys. Applying concepts from Bronfenbrenner's (1992) ecological framework, the study statistically modeled factors within an educational ecology comprising student, home, classroom, and school factors in predicting shifts in mathematics engagement (See Martin, Bobis, Anderson, Way, & Vellar, 2012).

The anticipated general decline in engagement and achievement was confirmed, however the multi-factor and multi-level analyses revealed that the shifts were not well explained by the often-blamed transition/development factors. Rather, the strongest predictor of variance (>85%) in mathematics engagement and motivation for continued mathematics study resided at the student level, with a further 10%–12% variance explained at classroom and school levels. In particular, a student's mathematics self-efficacy and valuing were consistent predictors of mathematics engagement shifts, with higher self-efficacy and valuing associated with increases in engagement. These factors were also influenced by a student's perception of the classroom learning environment and their own achievement levels in relation to their classmates'. Interestingly, whereas higher individual mathematics achievement predicted upward shifts on some engagement measures, class-average mathematics achievement predicted downward shifts in mathematics engagement – calling into question the practice of ability grouping the middle years of schooling (See Martin, Way, Bobis, & Anderson, 2015). For this presentation, the important implication for these finding is that any classroom interventions intended to improve engagement must attend to individual student differences.

Study 3 – Investigation Individual Student Shifts

In Study 3, the MES and achievement test data from Studies 1 and 2 were compared to reveal four distinct groupings of students – high engagement/high achievement, low engagement/low achievement, high engagement/low achievement, and low engagement/high achievement. It was found that, although high levels of achievement and high levels of motivation and engagement are often associated, one is not necessarily a predictor of the other. Of particular concern is the group of students who are achieving well in mathematics but have declining levels of engagement that often go unnoticed by the teacher.

Thirty-seven students with notable upward or downward shifts in motivation and engagement from the final year of elementary school (Grade 6) to the first year of secondary school (Grade 7) were identified from the Study 1 & 2 data. These students, from 10 schools, and their teachers (31) were interviewed to explore the possible causes of the shifts. Thematic analysis of student interviews produced three strong categories: individualized emotional responses to mathematics, thoughts about their mathematical abilities and their teachers' instruction methods, and their behavioral responses (Skilling, 2013). The teacher interviews revealed the impact of teacher perceptions of individual students' mathematical abilities and levels of motivation and engagement on their teaching practices, and subsequently on student motivation and engagement. Student engagement levels were found to be dynamic rather than static, with variation in duration, according the mathematics topic and with the influence of achievement. We argue that it is important to consider engagement as a spectrum or range, rather than the dichotomy of engaged/disengaged. A key finding from this study was the need

for teachers to understand the types of engagement (cognitive, emotional, behavioral), as behavioral cues were often misunderstood.

Study 4 – Exploring Teacher Practice

Although the previous studies established that different students react differently to the same classroom environment, the data from Studies 1 & 2 also identified some classes with elevated proportions of students exhibiting high or increasing levels of engagement. Therefore, Study 4 focused on the classroom practices of two elementary and four secondary teachers with the purpose of identifying specific teaching strategies that appeared to promote adaptive thoughts & behaviors and reduce the likelihood of maladaptive thoughts and behaviors. One or two lessons were observed and videoed and the teachers interviewed before and after the lesson. A systematic cross-case analysis is currently underway, however, an initial single case study of one teacher was conducted immediately.

Reported in this presentation is one case study of a Grade 6 classroom in which the individual teacher/student interactions were closely examined (Reece, 2010). The teacher was highly aware of the need to address student engagement and made deliberate use of one-to-one interactions with students during a workshop style lesson to support learning. The teacher constantly moved around the class as the children worked on problem-solving tasks, speaking quietly to individuals. The interpretations of observed strategies were cross-checked with the pre and post lesson teacher interview data, and specific statements and questions grouped according to similarity of intent. Comparison of these groupings to the Motivation and Engagement Wheel sub-constructs revealed a close alignment. For example, the teacher purposefully used the interactions to monitor individual progress and provide empowering feedback, to help students stay focused on their mathematical thinking and understanding, and to encourage self-regulation and self-assessment.

Study 5 – Enhancing Motivation and Engagement

The results from Studies 1 and 2 were used to identify an elementary school whose students had relatively high mathematics achievement levels but relatively low and declining motivation and engagement levels. Five Grade 5 and 6 teachers participated in an *action learning* style 10-week intervention consisting of four workshops with the researchers, interspersed with teaching 'experiments' (See Bobis, Way, Anderson, & Martin, 2015). The focus was on changing teachers' beliefs about teaching and learning, specifically relating to student engagement in mathematics. In the first workshop the MES results previously collected from their students were used to identify the need to work on promoting a focus on student understanding, persistence on mathematical tasks and student autonomy (feeling in control).

Other workshop activities included instruction on the nature of motivation and engagement (Motivation and Engagement Wheel), tasks to expose and challenge their own beliefs about student characteristics, demonstration and discussion of strategies intended to enhance student engagement (informed by Studies 3 and 4), scaffolding of lesson planning, and sharing the outcomes of their teaching experiments. The teachers completed a pre/post questionnaire designed to elicit their views about mathematics and their instructional beliefs. Pre/post semi-structured interviews were also employed, supplemented by workshop observations and artifacts.

As anticipated, individual teachers reacted differently to the intervention, however notable shifts occurred in the teachers' understanding of types of student engagement (from predominantly a behavioral to cognitive view), a strengthening of reform-oriented instructional beliefs and acceptance of the responsibility of the teacher to shape student engagement through deliberate strategies (Bobis, Way, Anderson, & Martin, 2015). Both the teachers' own monitoring of the students and a final application of the MES survey with the students, showed overall increases in student motivation and engagement at the end of the intervention.

Implications and Conclusion

This presentation/paper has tracked one investigative pathway through the five studies of a mixed methods project and highlighted the critical role of individual student differences in determining levels of engagement with mathematics education. From a methodological perspective it has illustrated the potential of mixed methods research to produce a comprehensive and robust evidence base for such conclusions. We are aware that the paper lacks a thorough discussion of other research in this area, and for this we refer readers to the published works cited in each section. However, our assertion that teachers who have sufficient understanding of appropriate teaching strategies can enhance student engagement resonates well with other recent research in Australia. For example, Attard (2013) refers to the influence of 'pedagogical relationships' between teacher and student on the fluctuations in engagement of a cohort of students as they moved from elementary school, through the first two years of secondary school. Like us, Attard (2013) noted the importance of teachers focusing on all three types of engagement – cognitive, behavioral and emotional. In emphasizing the importance of 'pedagogy for engagement' we do not discount the importance of a teacher's pedagogical content knowledge in promoting student learning – which has been the focus of a great deal of recent research. Rather, we advocate that the topic of student engagement is an essential complementary ingredient in teacher education and professional development programs.

The middle-years 'dip' in mathematics engagement and performance is a real and persistent issue. Efforts to counteract the decline must focus on the dispositions and learning needs of

individual students and recognize the dynamic nature of engagement levels. Despite the complexity of other influences and of individualized student reactions, teachers can have a positive influence on engagement levels. Teachers need to possess sufficient knowledge about the nature of motivation and engagement, have reliable strategies for assessing their students' levels of engagement and be willing to develop appropriate pedagogy. These findings have direct implications for both pre-service and in-service teacher education as they suggest that attention to pedagogical content knowledge alone may not be sufficient to bring about the desired improvements in student achievement.

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