

“My Favourite Subject is Maths. For Some Reason No-one Really Agrees With Me”: What Year 6 Students Say About Mathematics

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As part of a qualitative longitudinal study on engagement in mathematics during the middle years, a group of twenty Year 6 students were asked to provide their views on mathematics teaching and learning. This paper explores their perspectives of mathematics, firstly drawing on current literature concerning issues of engagement in mathematics and some of the factors influencing students during the middle years of schooling. Students discussed the qualities of a ‘good’ mathematics teacher and these are examined in light of current teacher professional standards.

The levels of engagement in mathematics experienced by students during the middle years of schooling (Years 5 to 8 in New South Wales) has been of some concern in Australia for a considerable period of time. The recent National Numeracy Review (Commonwealth of Australia, 2008) reported that although the levels of mathematics achievement are quite good when compared to international standards, there is an unacceptable number of Australian students who do not achieve appropriate levels of proficiency. The report claims many students fail to enjoy or see the personal relevance of mathematics and few voluntarily continue its study. Although attitudes change throughout the school years, once formed, negative attitudes towards mathematics are difficult to change and can persist into adult life (Newstead, 1998). These findings have been reflected in research both in Australia and internationally (Anderman & Midgley, 1997; Leckey, 2000; State of Victoria Department of Education and Training, 2004; Sullivan, McDonough, & Harrison, 2004).

As part of a qualitative longitudinal study on engagement in mathematics during the middle years, a group of twenty Year 6 students were asked to provide their views on mathematics teaching and learning through individual interviews and focus group discussions. The students were also asked to discuss their favourite mathematics lesson and the qualities of a good mathematics teacher. This paper will explore their perspectives of mathematics, firstly drawing on current literature concerning issues of engagement in mathematics and some of the factors influencing students about to make the transition from primary to secondary schooling. A brief description of the methodology employed will be provided followed by a discussion of the findings.

Review of Literature

Engagement

The orientations of motivation and engagement are often closely associated. Motivation theorists make a distinction between cognition and engagement. Motivation is conceived as a set of beliefs whilst engagement involves the actual behaviours involved in the undertaking of schoolwork (Hufton, Elliott, & Illushin, 2002). The extent that changes in motivation lead to changes in academic engagement is unclear amongst researchers although they do have an effect on engagement and educational achievement. In summary,

motivations provide the reasons individuals have for behaving in a given manner in a given situation. Motivation determines whether or not one engages in a pursuit and is primarily an individual force (Middleton & Spanias, 1999).

So why is engagement in mathematics so crucial? It is claimed students who are engaged with school are more likely to learn, find the experience rewarding and to continue with higher education (Marks, 2000). Engagement in the classroom also contributes to students' social and cognitive development as well as academic achievement (Finn, 1993). Disengagement in mathematics leads to reducing the range of higher education courses available to students in addition to limiting their capacity to understand life experiences through a mathematical perspective (Sullivan, Mousley, & Zevenbergen, 2005).

Engagement has been defined as a deeper student relationship with classroom work, multi-faceted and operating at cognitive, affective and operative levels (Fair Go Team NSW Department of Education and Training, 2006; Fredricks, Blumenfeld, & Paris, 2004). Behavioural engagement encompasses the idea of active participation and involvement in academic and social activities, and is considered crucial for the achievement of positive academic outcomes. Emotional engagement includes students' reactions to school, teachers, peers and academics, influencing willingness to become involved in school work. Cognitive engagement involves the idea of investment, recognition of the value of learning and a willingness to go beyond the minimum requirements.

A framework that brings together a psychological perspective of motivation and a pedagogical perspective of engagement has been constructed by Munns and Martin (2005), viewing motivation at an individual level and requiring the student to act upon messages received through relationships with peers, teachers, curriculum and pedagogy (referred to as small 'e' engagement). The relational level of the MeE Framework concerns the relationships occurring within the teaching and learning context, relating to the most important means students have of connecting to the pedagogy within the classroom.

A joint effect of the individual and relational levels of the MeE Framework is what Munns and Martin term big 'E' engagement (2005). The 'coming together' of all three facets, leads to students feeling good, thinking hard and actively participating in school, leading to engagement with school. In terms of engagement in mathematics, small 'e' engagement can be seen when students are procedurally engaged within the classroom, participating in tasks and 'doing' the mathematics, where big 'E' engagement can be seen as the view that learning mathematics is worthwhile, valuable and useful both within and outside and beyond the classroom.

Some of the major factors that influence student engagement in mathematics during the middle years are the transition to secondary schooling, peer influence, the pedagogies employed in the mathematics classroom and the influence of teachers. It is suggested by Sullivan, Tobias and McDonough (2006) that the students who have the most to gain from active participation, or small 'e' engagement in schooling are sometimes those who are most difficult to engage, this phenomena becoming heightened during the upper primary and lower secondary years. The following is a brief discussion of some of the influences on student engagement during the early adolescent years.

Some Influences on Engagement in Mathematics

Peers

There are many challenges that typify the transition from childhood to adolescence including physical, cognitive, social and school changes. During this time adolescents are faced with decisions regarding their commitment to school and learning. As schools and classrooms are inherently social places, it is likely the peer group is a significant influence on adolescent achievements, beliefs and behaviours (Ryan, 2000).

In a study of students' perceptions of how their own efforts influence achievement at mathematics, Sullivan et al. (2006) found positive responses to school mathematics learning opportunities were inhibited by a combination of direct and indirect pressure from peers not to try hard in school, rather than lack of confidence or lack of success. The need for adolescents to feel a sense of belonging and acceptance can often lead to conforming to peer demands which censure achievement and success at school. Sullivan et al. believe classroom culture may be a much stronger determinant of engagement than the curriculum, pedagogy or teacher experience.

Mathematics Teachers and Pedagogy

In contrast to the beliefs of Sullivan et al. (2006), Hargreaves (1994) claims the kind of learning that young people experience is ultimately shaped by what teachers do at the classroom level, how they develop, define and reinterpret the curriculum. Middleton and Spanias (1999) believe if appropriate teaching practices are consistent over an extended period of time, children will learn to enjoy and value mathematics. Some responses to research into effective teaching of numeracy and recent concern about engagement in mathematics have been the formulation of teacher professional standards (Australian Association of Mathematics Teachers, 2006; NSW Institute of Teachers, 2004) and it has been recommended that the AAMT Standards of Excellence in Teaching Mathematics in Australia be utilised as a framework for the teaching of mathematics in the national numeracy teaching standards currently in development (Commonwealth of Australia, 2008).

A seminal study by Askew, Brown, Rhodes, Johnson and Wiliam (1997) found highly effective teachers of numeracy :

- promote the discussion of students' methods and reasoning, using this information as a tool for developing understanding and highlighting connections within mathematics;
- emphasise the importance of using the most efficient strategies for the problem at hand, whether they be mental, written or electronic;
- place strong emphasis on the development of mental computation;
- use a variety of words, symbols and diagrams to connect different mathematical ideas and make different representations of each idea;
- incorporate the use of higher order questions to promote thought rather than practice;
- emphasise, through dialogue, the meanings and connections between mathematical ideas and contexts;
- provide opportunity for collaborative problem solving; and
- encourage students to develop their own ideas and methods.

The findings of Askew et al. (1997) resonate well with several other bodies of research into effective teaching of mathematics (Lappan & Ferrini-Mundy, 1993; Martin, 2006; Sullivan et al., 2004).

Parental Influence

Another significant factor impacting on student engagement in mathematics is parental influence. Although this influence tends to lessen as students progress through the middle years and begin to develop independence as they progress through the adolescent years. The National Numeracy Review reports that connecting families to schools and informing them of the ways they can support the learning of numeracy can be of benefit to students (Commonwealth of Australia, 2008).

The following is a brief description of the research design and a discussion of Year 6 student perceptions of mathematics teaching and learning.

Research Design

Prospective participants from a Year 6 cohort in a Western Sydney Catholic school were administered with the Motivation and Engagement Scale (High School) (MES-HS) (Martin, 2008) to allow the researcher to differentiate between highly motivated and engaged students from those who showed low levels in engagement in mathematics. Twenty students, all of whom would eventually be attending the same secondary school, became the project participants. The students invited to participate were those who, according to the MES-HS, showed strong levels of motivation and engagement towards mathematics.

Participants were interviewed individually and then took part in focus group discussions, based on the following set of discussion points/questions:

- Tell me about school
- Let's talk about maths
- Tell me about a fun maths lesson that you remember well
- When it was fun, what was the teacher doing?
- What do people you know say about maths?

Students were divided into three focus groups consisting of a female group, a male group and a mixed gender group. As part of the larger, longitudinal study other data were gathered from the students' teacher and a number of participants' parents, who were interviewed with regard to the students' attitudes towards and abilities in mathematics. Several classroom observations were also made, the focus of which were the pedagogies employed by the participants' teacher and the interactions between the teacher and students during mathematics lessons. The following discussion is focussed on the data collected from student interviews and focus group discussions.

The qualitative data gathered was transcribed and analysed using NVivo software as a tool to assist coding into themes. For the purpose of this paper, three themes will be discussed: the influences on mathematics learning, good mathematics lessons, and the qualities of a good mathematics teacher.

Results and Discussion

Influences on Mathematics Learning

Throughout the discussions and interviews the predominant influences on students appeared to be their peers, parents, the teacher, and the pedagogies experienced within the mathematics classroom. A recurring theme amongst all of the students was a strong awareness of their own learning and how 'others' served as distractions to their learning.

It is distracting because whenever we're trying to learn or listen to the teacher there's always at least one person talking and it's always the same group of people.

It's like they don't even want to learn.

The participants were able to articulate that those students who constantly distracted the class and were behaviour problems for the teacher were those who perhaps did not 'get' or value the mathematics being taught - in other words, those students who were disengaged from mathematics. The students showed further insight by discussing possible reasons for their peers' negative behaviour during mathematics lessons.

They think they're going to get it wrong so they don't participate or they will try and miss out on it so they don't get it wrong, and...it's like they don't care about school. They just talk and talk and talk.

Normally, kids when they don't like, when they find things hard they don't really like it.

Contradicting research into peer influence (Ryan, 2000), the participants appeared not to be negatively influenced by those that were disengaged although this could be due to their age and stage of schooling and may change as they further develop as adolescents. The girls' group showed some awareness of peer pressure.

Some people don't like it because they don't think it's cool.

It might be 'cause they don't want to be the nerd of the class or the nerd of the school. They don't want to be called the Brainy Bunch or the Cool/Uncool Nerds.

Although it appeared the students were not swayed by such negativity towards mathematics, this could have been an effect of having the researcher present during the discussions and a need to 'please the teacher', as is common with young children. Another, perhaps more significant influence at this point in their development, is that of their parents. The majority of participants claimed parents valued mathematics education yet not all parents liked doing mathematics.

When we get homework and I get stuck on a question for math, my mum doesn't really like me asking her because she thinks she doesn't have a maths brain.

Conversely, other parents appear to have displayed enthusiasm towards mathematics and have instilled in their children a belief that mathematics is valuable, particularly for future employment. More male than female participants seemed concerned that without a sound knowledge of and success in school mathematics they would not be able to secure a 'good' job in the future. As the students enter secondary education the influence of parents may lessen as it has been documented that around this age, most students begin to seek self-identity and independence from their parents (Erikson, 1963).

Good Maths Lessons

When asked to recall a 'fun' maths lesson the majority of students were able to quickly recall a lesson. Most of the lessons or activities cited as being a favourite or the most fun were those that included physical activity, active learning situations involving concrete material, or games. A particular activity that was discussed by several of the male participants required the students to design a floor plan for a dream home. Students were to incorporate perimeters and areas of various rooms in order that their understanding of those measurement concepts could be assessed.

I thought it was really good because you could use your imagination and make up whatever you wanted so you were almost making your own maths tasks.

'Cause you got to make your own rooms, got to put a pool in the backyard and it was also fun measuring the perimeter and the area.

The students found the task engaging because they were given some control over the final product, providing them with a sense of ownership. They were given the choice to either work independently or cooperatively with a peer and were able to extend the task, with two boys utilising Sketchup software to incorporate the use of technology. All of these aspects of the task correspond with the findings of Askew et al. (1997) and the recommendations of the AAMT standards (2006). The students were provided with some flexibility within the task to allow for self-directed learning as described in Domain 3 of the AAMT standards.

Other popular lessons incorporated the use of games which allowed the students to interact with other students whilst practicing a learned skill or concept. The inclusion of games in mathematics lessons appears to be particularly motivating for this group of students as the social element of learning is documented as critical to students in the middle years (Boaler, 2000). Another aspect of the 'fun' lessons appears to have been the links made between 'real' life and mathematics. The incorporation of tasks that mirrored real situations appears to have been a strong factor in engaging students in mathematics tasks as were the tasks that required the students to take the mathematics out of the classroom and into the school playground.

Although all of the lessons described by the students were engaging and memorable to some degree it is not possible to gauge the learning that occurred as a result of the activities. In the report by Askew et al. (1997), effective teachers focus on students' mathematical learning rather than providing a 'pleasant' classroom experience. The following is a discussion on the students' views of the skills a 'good' mathematics teacher should have.

A 'good' Mathematics Teacher

A good maths teacher makes sure that everyone has a fair go.

She knows the people that do get it.

Someone that knows maths.

When asked about the qualities of a good mathematics teacher, the students' responses were strongly focussed on the following points. A good teacher:

- is passionate about mathematics;
- 'knows' children;
- explains things well;
- provides assistance by scaffolding rather than providing answers;
- encourages the students to have positive attitudes towards mathematics; and
- shows an awareness of each students' prior knowledge.

The students discussed instances of having to sit through mathematics lessons that covered previously learned concepts and expressed feelings of frustration as a result of this. Another source of frustration was the length of time they were required to sit and listen at the start of each lesson. Sousa (2008) claims the first ten to fifteen minutes of a mathematics lesson is 'Prime Time', following which the students' attention levels lessen.

The students in this study had experienced significantly longer periods of time in which they were required to sit on the floor and listen during episodes of direct instruction.

The qualities of a 'good' mathematics teacher as identified by the students strongly reflect several of the attributes described in the AAMT Standards (2006). Although the students did not necessarily always experience good teaching, their negative experiences resulted in an awareness of what good teaching should look like, inferring that as children mature they become more critical of their learning experiences and this could be a contributing factor of lower levels of engagement with mathematics.

Implications

Students in the later years of primary education begin to develop a critical awareness of their own learning styles and preferences. Although the students in this study were able to articulate both positive and negative aspects of their own experiences in the mathematics classroom they continue to show signs of an overall level of big 'E' engagement with school in general. This may be contributing to their engagement in mathematics despite some negative experiences and negative attitudes displayed by peers. Although this group of students are currently showing signs of engagement in mathematics it remains to be seen if this will be maintained as they transit to a new school setting with new expectations and experiences and perhaps an increase in peer pressure.

Although research cites many influences on student engagement including that of peers and family, teachers still remain a strong influence over student attitudes towards and engagement in mathematics. It is critical that teachers in the middle years address the specific needs of students during this transitional period. Students in this study showed preferences for tasks that required active learning, elements of choice and the option of self-directed activities. Identification of student preferences is one way that tasks can be tailored to the needs of students.

Many of the elements that the students claimed make a 'good' mathematics teacher are reflected in the AAMT's Standards for Excellence (2006) and the NSW Institute of Teacher's Professional Teaching Standards (2004) indicating the need for teachers to become familiar with and utilise these documents as a benchmark for quality teaching.

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