Students' Experiences of Mathematics and How They Affect Further Engagement with Mathematics

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Abstract

The aim of this research was to investigate what factors affect senior secondary school students' attitudes towards mathematics, intentions to continue studying mathematics and mathematical literacy. In particular, this research was primarily interested in what happens "inside the classroom" and what effects this can have on students. The research was focused on the behaviours and practices of mathematics teachers and students in the classroom - how they teach, learn and interact.

The research involved Year 10 and Year 11 students in mathematics classes from a range of schools across Adelaide, South Australia. This group was the focus of the research because they are nearing the end of their compulsory mathematics education, making substantive decisions about their future education and considering pathways to further study and careers. This is can be crucial turning point for many students, so we must understand what influences them.

In Australia and internationally, there are persistent and wide-spread concerns about students' engagement in mathematics at all levels of education. These concerns are often prompted by declining rates of enrolment in mathematics, particularly at the senior secondary school level where advanced mathematics subjects are part of an important pathway into further education. This research is a response to those concerns and an attempt to find out in which areas we can improve mathematics education to engage and retain more students.

However, the study of mathematics is not just for those with plans to become mathematicians or engineers. There is a growing need for mathematical literacy throughout society, so that we are prepared to engage in critical thought and debates and interact with an increasingly technological world. This research has been borne out of a personal

appreciation of mathematics and a desire to spread this appreciation more widely.

The primary data collection tools for this research were participant observation of mathematics classes, a survey questionnaire and a mathematics test. The participant observation was used to investigate classroom behaviours and practices to inform the development of the survey. The survey and the test were used together to measure students' attitude towards mathematics, their intentions to continue studying mathematics, how often they and their teachers did certain things in their classes and their mathematical literacy.

A combination of analysis of variance, logistic regression and hierarchical linear modelling techniques were used to investigate what factors significantly affected attitudes towards mathematics, future intentions and mathematical literacy. In particular, logistic regressions and hierarchical linear models were used to develop models that sought to explain the variance in students' attitude, intentions and literacy.

For mathematical literacy, the analysis indicates that some of the most important factors were country of birth, educational expectations, parental education, attitudes towards mathematics, the use of technology in the classroom and being assigned mathematics projects. This indicates that factors both "inside" (e.g. teachers' use of technology) and "outside" the class (e.g. students' background) are important to students' mathematical literacy.

For attitudes towards mathematics, the analysis indicates that some of the most important factors were sex, language spoken at home, educational expectations, teachers, roaming the class, doing work from the textbook with and without other students. This again points to the importance of what happens inside and outside of the classroom.

For intentions to study mathematics, the analysis indicates that some of the most important factors were the perceived value of mathematics, attitudes towards mathematics, university entrance and prerequisites, interest in mathematics and the advice of teachers. These results highlight the importance of student attitudes towards mathematics and its general perception as a useful and necessary subject.

One of the most significant conclusions from this research is the importance of what happens inside and outside the classroom.

Students bring with them to their mathematics classes a lot more than a pencil case, textbook and exercise book. Students bring with them certain values, beliefs and perceptions about mathematics that they have learned and digested outside the classroom (and in previous classrooms) that affect their engagement with mathematics.

At the same time, what happens inside the classroom can and does make a difference to students and their engagement with mathematics. Above all, this research points to the fact that any interventions or initiatives should not ignore what happens inside the classroom nor what happens outside the classroom. Both aspects, and their complex and changing interactions, must be considered.

The results and process of this research suggests many avenues for future investigation and study. Future analyses should consider the multi-level and hierarchical nature of school education, the change in students' engagement with mathematics over time and how best to capture the frequency of teacher and student practices in useful scales.

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