Executive Summary

This report describes a study into the factors associated with effective mathematics teaching.

The study aimed to assess a range of factors that were theorised to be associated with effective mathematics teaching. These included:

1. The knowledge, beliefs, understandings and practices of teachers;
2. Teacher qualifications and educational background; and
3. The extent and quality of professional development experienced by the teachers.

These factors, and others identified by a literature review were organised into a theory which in broad outline proposed that:

1. Effective teachers had a positive effect on a range of student outcomes;
2. Teacher practices in the classroom directly affect student outcomes;
3. Teacher practices in the classroom are directly affected by the capacity of the teacher – the quality and field(s) of their training and qualifications; and
4. Teacher capacity is directly affected – amplified or muted – by conditions within the school. In particular, the school’s professional community was theorised to be of prime importance.

Data were collected from Principals, teachers and students. The Principals completed a questionnaire about enabling conditions in the school and the wider community in which the school was located. Teachers completed a questionnaire which provided information about their gender, educational background, their experiences of professional development and of teaching. Teachers were also asked to complete a set of classroom ‘scenarios’ that provided a measure of their mathematical content and pedagogical knowledge. These scenarios were designed so that teachers were required to complete mathematical tasks, and to identify and generalise student errors. These scenarios should be seen as a significant outcome of this study. Students were asked to complete a questionnaire and a PATMaths test. These were administered at two different times. The student questionnaire administered at Time 1 aimed to provide measures of various affective (and related) outcomes of mathematics teaching including: perceived effort, ability, task load, utility of mathematics, self efficacy, enjoyment, motivation, and the quality of their learning environment. The student questionnaire administered at Time 2 included the same set of items as at Time 1, but it also included an additional set of items asking them to report on aspects of their mathematics teacher’s classroom practice. These practices were identified by reference to the standards developed by Monash University and the Australian Association of Mathematics Teachers (AAMT). Some of the variables constructed from these items proved to be strongly associated with effective mathematics teaching.

Interviews were also conducted at a small number of schools. Principals, Heads of Departments and teachers were interviewed.

A total of 50 schools agreed to participate in the study. Around half of these schools had participated in the Organisation for Economic Co-operation and Development’s (OECD) Program for International Student Assessment (PISA) study in 2000 (Lokan, Greenwood, & Cresswell, 2001). Data from this study were used to identify those schools with a high average score in mathematical literacy, and those schools with a low average score. Thus, a wide spread of school contexts was sampled for the study. A total of 206 teachers provided data for the study. At Time 1, 7709 students (2663 at Year 8, 2562 at Year 9 and 2484 at Year 10) were surveyed and tested. At Time 2, 2684 (1123 at Year 8, 1028 at Year 9 and 533 at Year 10) were surveyed and tested. There was an average of 123 calendar days (not ‘school’ days) between Time 1 and Time 2.

The main findings of the study were:
1. Teaching practice (as defined by standards identified by Monash University and the AAMT) reported by students has a consistently important effect on affective outcomes of mathematics teaching;

2. Teacher knowledge and educational background is positively, but weakly related to teacher effectiveness. The more this education has to do with mathematical content and pedagogy, the more likely it is that teachers will be effective; and

3. The effectiveness of mathematics teaching in a school is related to the strength of professional community in the school's mathematics departments.