

**SUBMISSION FROM KAYE STACEY IN SUPPORT OF COMMENTS MADE TO
INQUIRY ON 7 JUNE 2005**

The problem

There is long standing concern with the capacity of primary teachers in Australia to teach mathematics and numeracy well, evident in government inquiries over several decades. It is too often the case that poor teaching of mathematics in primary school leads to a poor mathematical preparation for students, which leads to their subsequent underachievement and poor attitudes towards mathematics throughout schooling and into the workforce. This document makes several recommendations which might act to break this vicious cycle.

Thorough preparation of primary teachers in mathematics requires ensuring that primary teachers have two inter-related sets of skills:

- (i) PEDAGOGICAL CONTENT KNOWLEDGE - an excellent preparation for teaching mathematics, including understanding of children's mathematical thinking, stages of learning, curriculum issues, teaching methodologies, effective pedagogy;
- (ii) CONTENT KNOWLEDGE - a strong understanding of the mathematics that they will teach.

Pedagogical content knowledge

Pedagogical content knowledge is the specialist knowledge required by teachers. It is properly the province of university education, and should be informed by current research and scholarship.

At the University of Melbourne, we have a mathematics education subject in each of the four years of the BEd(P)* course (amounting to the equivalent of half a year of full time study). We believe that this provides an excellent preparation for primary teachers, and that *all* teacher education courses should have a similarly strong strand. However, compromises need to be made for shorter courses, such as our 2-year BTeach* for graduate entry.

There is currently a shortage of suitably qualified lecturers to conduct mathematics education courses in universities. This is especially noticeable in rural universities. Lecturers moving from a school teaching position to the university need special support, which is not available for those who work in small departments. These new lecturers need training, teaching materials, and access to on-going support. A national approach is recommended.

Recommendations:

1. *That primary teacher education courses should contain at least one eighth of total credit in mathematics education subjects.*
2. *That a national project be established to (i) develop world-class mathematics teacher education materials for use around Australia and (ii) to train and support newly appointed mathematics teacher educators.*

Content knowledge

All teacher education courses should ensure that their graduates have a strong understanding of the mathematics that they will teach. One part of this is to ensure competence in basic numeracy. At the University of Melbourne, we conduct hurdle tests in first and second year checking ability to carry out primary school mathematical calculations with students in BEd(P)*, BECE* and BTeach*. Students are given several opportunities to pass each test. Passing the tests is a requirement for a pass in the mathematics education subjects: it does not carry any credit.

We need to provide additional classes for students to assist them preparing for the basic skills tests. This is not funded by the university and represents a considerable additional load on mathematics education staff.

Recommendation:

3. All teacher education courses should ensure that all graduates have reached an excellent level of proficiency in primary school mathematics. This is likely to involve explicit testing.

It is important to recognise that the ability to do primary school mathematics successfully is, nevertheless, only a small part of the ability to teach mathematics successfully, just as the ability to read at a primary school level is only a small part of the ability to teach reading successfully. However, when primary teacher education students have inadequate mathematical skills, filling the gaps takes an enormous effort by teacher educators (unfunded!) and detracts from building the pedagogical content knowledge that should be the main focus of the course. In the course of building pedagogical content knowledge, there are many opportunities for teacher education students to deepen their own understanding of mathematics, but to capitalise on these opportunities, students must have basic competence in numeracy on entrance (or at least within a few months of beginning their course). What, then, is an appropriate entry standard or pre-requisite?

Mathematics pre-requisites for entry to primary teacher education

At the University of Melbourne, there is a formal pre-requisite of Year 11 mathematics for BEd(P)* and for BECE*. The lowest level Year 11 subject in Victoria, *Foundation Mathematics*, does not meet this requirement. Almost all students in Victoria do a Year 11 mathematics subject. Around half do a Year 12 mathematics subject. There is no formal pre-requisite mathematics qualification for the graduates entering BTeach*.

About four years ago, we examined the possibility of increasing the pre-requisite from Year 11 to Year 12 mathematics. However, we found that this would result in the loss of half of the currently accepted applicants, and the lost applicants would be evenly distributed along the ability range (e.g. we would lose 50% of students with ENTER over 95, as well as 50% near the cut-off ENTER). Since the content of Year 12 mathematics is NOT directly relevant to teaching primary school mathematics, there is little justification for imposing the pre-requisite. It would not result in us having better applicants.

We have evidence that there are considerably fewer problems with basic numeracy of pre-service teachers when there is a higher cut-off ENTER for entrance to the course. We have observed this as the ENTER for BEd(P)* has risen by approximately 10 points over the past decade. Today's Melbourne cohort with an ENTER cut-off of 85 have fewer problems with basic numeracy than earlier cohorts. We also observe this by comparing results of our current BEd(P) cohort with our current BECE* cohort (2004 cut-off score 75), who undertake the same basic numeracy test and same first year mathematics education subject. BECE students have approximately twice the failure rate on both the basic numeracy test and in the mathematics education subject as a whole. We conclude that it is better to select the academically best qualified applicants in the normal way, give them adequate opportunity to improve their basic numeracy skills and to test their achievement during the course, rather than to insist on Year 12 mathematics.

Dr Vicki Steinle, from my department, is exploring, with ACER, the possibility of a "Tertiary Education Mathematics Test" (TEMT) that would provide an *alternative* to Year 11 or Year 12 mathematics pre-requisites and could be used, for example, for BTeach graduate entry. Dr Steinle is gathering data on how such a test would impact on our teacher preparation course, by looking first at whether a pass on the test is likely to predict success in our first year mathematics education subject, and the relationship of failure in the test to failure on our current basic numeracy tests. It is important to note that TEMT would be a test of mathematical skills, which are necessary but not sufficient for success in mathematics education subjects. It would in no way remove the need for a strong mathematics education component in teacher education courses, but would make students better prepared for it. Initial data from 2004 gave a moderate correlation of 0.54 between score on TEMT and final score in the first year mathematics education subject. Students with both high and low TEMT scores failed the university subject, for a variety of reasons. However, amongst students with a very low TEMT score (score less than 40%, the lowest quarter of our students), the failure rate in the university subject was about 50%. The initial data therefore suggests that a refined TEMT could be used as a screening device. Further investigation is required.

Recommendations:

4. Specific Year 12 mathematics pre-requisites should not be set for primary teacher education courses.

5. A funded study should be conducted to determine the feasibility of providing a test of basic mathematical skills, to be used as an *alternative* to a formal school qualification in mathematics for entrance to primary teacher education courses, including graduate courses.

***Note:**

Primary Teacher Preparation qualifications offered at University of Melbourne

Bachelor of Education (Primary) (BEd(P)) :

4 year post-Year 12 course for teaching in primary schools

Bachelor of Early Childhood Education (BECE):

4 year post-Year 12 course for working in early childhood or primary schools

Bachelor of Teaching (BTeach):

2 year course for graduates in any field for teaching in primary schools

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