A Decade of MERGA Theses

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The MERGA website has a list of the titles of the last 10 years of Australasian mathematics education Masters and Doctoral theses, with linked abstracts. After a discussion about the socially-determined nature of document analysis, this paper reports the results of an interpretive document analysis of the web page and the pages of abstracts, with a focus on (a) numbers of theses, by year and by institution; (b) methodological approaches used; (c) countries where data were collected; and (d) theses topics. Begle's (1979) framework of mathematics education domains is used to categorise 3 descriptors for each thesis.

The Mathematics Education Group of Australia (MERGA) website page headed *Recent Australasian Theses in the Field of Mathematics Education* (MERGA, 2010) lists mathematics education Masters (by research), PhD, DPhil, and EdD theses written or supervised by Australians and New Zealanders from 2000 to 2009. This list is not a complete list, for reasons given below, but it gives a good sample—280 theses at the time this paper was written. The website includes theses by Australasians, no matter where they graduated, as well as those of international students enrolled in Australasian universities. While the majority of graduates listed are or were MERGA members, some are/were not; but an analysis of the titles and abstracts gives a general sense of the work of Australasian higher degree by research (HDR) students in the area of mathematics education. Such analysis helps to identify strengths and limitations of this aspect of the work of MERGA members and the broader mathematics education academic community.

Educational inquiry based on document analysis captures the individual, so its aim is to understand rather than to generalise or predict. The actions of members of a sub-set of society at a particular time are recognised as "objects" worth studying, rather than replicable phenomena. The result is usually categories of description that have common elements, often so interrelated that it is hard to discuss one without reference to others (Cope, 2000; Herbert & Pierce, 2009), but the categories give structure to reporting and discussion of the results (Akerlind, Bowden & Green, 2005).

Even though the resulting theory is "grounded" in the data (Glaser & Strauss, 1967), researchers involved in document analysis need to decide on what the categories will be— what to draw out of the raw data and how to group these phrases. Such decisions are socially constructed because understanding of aspects of documents is influenced by social contexts because the areas of interpretive focus and the ways data are manipulated are socially determined (Patton, 2002; Van Manen, 1990).

There are three reasons for my use of the seminal theoretical framework developed by Begle (1979) for this analysis of the MERGA webpage. First, Begle identified a range of critical variables for the teaching and learning of mathematics, specifically. He described five major domains: *Teachers*, *Curriculum*, *Students*, *Environment*, and the *Instructional process*, noting the extent to which each impacts on students' achievements in mathematics. Second, this framework seemed initially to provide a simple, yet all-encompassing, framework for analysis of mathematics thesis topics. Third, Begle's framework was used by Graham Jones (1987), a life member of MERGA, to show how Begle's work was relevant to the young MERGA community, so it seemed appropriate to use it for this HDR analysis many years later.

The Website and Methodology

The web page and its associated pages of abstracts were compiled by the author, using the online thesis lists of the Australian Council for Educational Research, via the Cunningham Library website (ACER, 2010); the Australasian Digital Thesis Program data base constructed by the Council of Australian University Librarians (CAUL, 2010); the data bases available via Royal Melbourne Institute of Technology Publishing's *Informit* service (RMIT, 2010); and details emailed to me by authors and supervisors.

For each of the 280 theses, the website lists author, title, and institution of enrolment—grouped by year of completion. Most titles are linked to electronic abstracts, and some abstracts have links to the full text of the relevant theses. Whether the title only, title and abstract, or full text are available depends mainly on the year of publication, because until 2004 many university libraries did not file electronic abstracts or full texts of theses. This practice is now almost universal for recent theses in both Australia and New Zealand.

However, the MERGA webpage does not contain a complete list of relevant theses. ACER, CAUL, and RMIT record details sent to them by university librarians and research officers, and some are better at doing this than others. They also trawl university sites for records. Further, while many MERGA members (supervisors or students) have noted missing theses and provided the relevant details, other mathematics educators have not. Thus the titles used—the 280 listed at the beginning of March 2010—could be considered a comprehensive sample that is representative of a larger body of work, but certainly not statistically representative. Other theses have been added since March, so this paper is a snapshot in time.

The web-page details for each thesis (year, title, and institution) were extracted from the MERGA webpage and entered into a spreadsheet. From this record, the numbers of thesis completions from each country, for each year, and for each institution were determined. With a focus on research topics, the titles and abstracts were then scanned visually for key words that were entered into the spreadsheet—3 per thesis. The 840 descriptors were then grouped according to Begle's (1979) five domains, and some sub-domains, for discussion. The level of schooling involved and the broad methodological approaches (such as quantitative, qualitative, action research) were then recorded—often necessitating access to the full text if this were available. No attempts were made to decipher the types of qualitative research into categories such as phenomenology, hermeneutics, existentialism, etc., although "case study" was such a common descriptor that its use was noted separately. If a title or abstract indicated that a graduate was from a country other than Australia of New Zealand, this was also recorded.

By counting the number of words or phrases in each category and sub-category the details available were converted to the numbers reported below. While there is some discussion of phenomena across factors, these were merely observations that I found interesting and I made no systematic attempt to undertake a cross-factorial analysis. Access to the full texts of the theses would be needed for a thorough cross analysis and it would be appropriate to use analyses of variance measures of significance.

Results and Discussion

This section focuses first on changes in the numbers of theses recorded, by year and then by institution. The second focus is on research approaches used to collect thesis data, and the third on levels of mathematics education, followed by a short account of countries where data were collected. The topics of the theses are then allocated to Begle's domains.

Numbers of Theses

While acknowledging that the sample is not a complete list, especially for 2009 which is waiting on notifications for the last half of 2009, it is interesting to note the number of theses recorded, for Australia and New Zealand institutions from 2000 to 2009 (see Figure 1). It seems that there was a major decrease between 2002-3 and 2005-6 in Australian theses, but that can be explained by the federal government initiative in mid-2001 that tied both funding and the numbers of future funded HDR places to thesis completion rather than research training (thesis supervision). In 2002 and 2003, many HDR students—and particularly part timers—were pressured and supported to complete and submit theses, resulting in an artificial bulge in 2002 and 2003. In fact, analysis shows that most of the bulge came mainly from 2 institutions (see Figure 2). On the other hand, the New Zealand figures have been comparatively steady, with between 3 and 6 completions being recorded annually since NZ university libraries joined the CAUL reporting process in 2002.
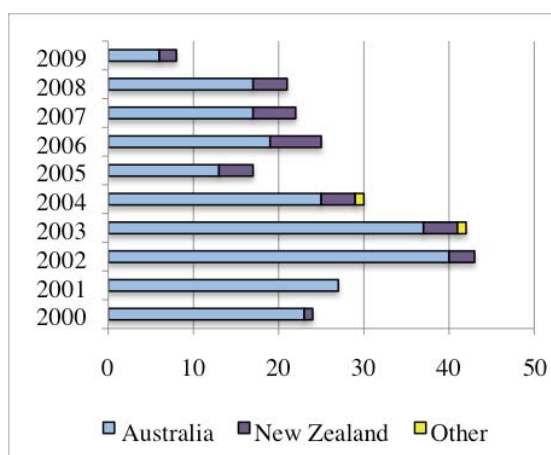

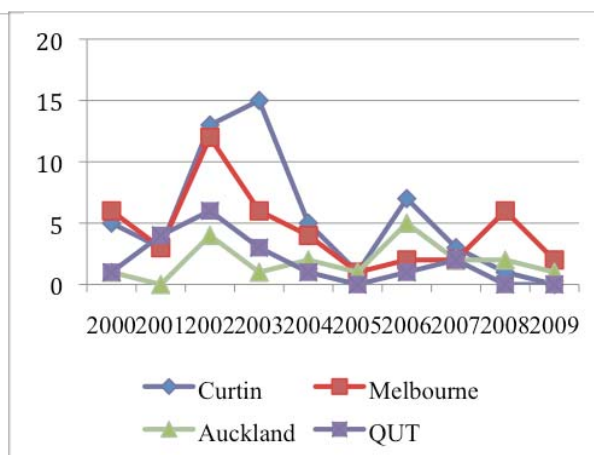*Figure 1:* Numbers of theses listed from 2000 to 2009, by country.

Figure 2: Theses listed from 2000 to 2009: 4 most productive institutions.

A point that really must be stressed here is that high numbers of completions do not correlate with high quality theses, the hours spent on supervision, or the nature and quality of the student experience or the thesis. The number of completions per institution (see Figure 3 below) is a product of many factors including previous completion numbers, HECS scholarships other funds and subsidies, student choice based on facilities, part time work availability, or more ephemeral aspects such as universities' and supervisors' reputation. The nature of the local and student populations are also relevant, with some universities typically attracting more international students, people willing to study at a distance, and/or students from specific countries.

The establishment of the funded national centre also had long-term effects on student numbers at Curtin University, although staff needed to work hard to establish and maintain a strong research student base and reputation. Staff also make a difference, especially when they attract external funding that can be applied to research training and part time tutoring or when they have developed a strong and appealing research agenda. Further, I noted a number of MERGA members from New Zealand and the Pacific Islands who had studied in Australia, so this would have lessened potential numbers of completions for New Zealand institutions.
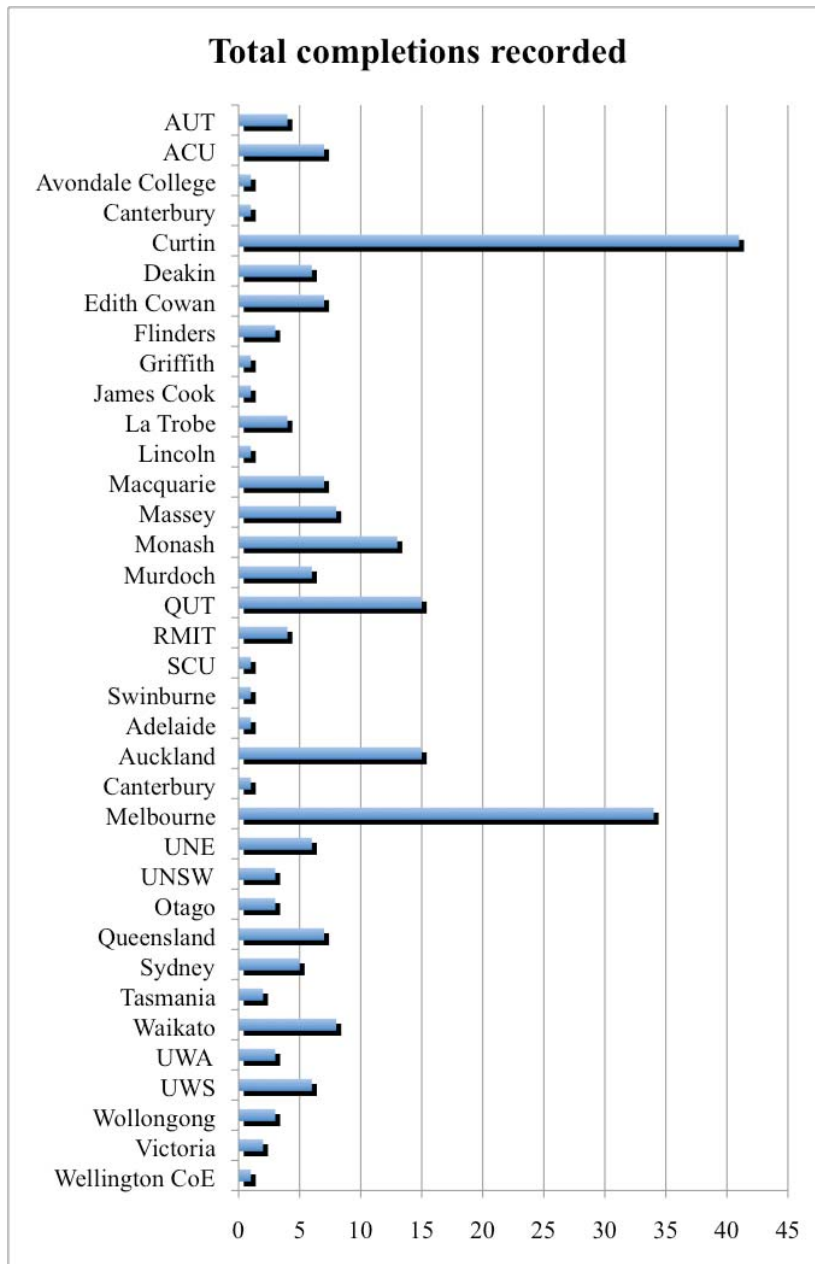
Figure 3: Theses listed, by institution.

Research Methods

Of the 280 theses listed on the website, 18 (6%) used quantitative methods only; 218 (78%) used qualitative methods only, including 37 (21%) that were described as case studies; 11 (4%) used a combination of quantitative and qualitative methods; and 7 (2%) used action or participatory research. The methods were unclear from the abstracts of 41 theses (14.64%).

I noted that Melbourne University had a higher percentage of quantitative studies than other universities that had 3 or more completions, while Curtin University had a relatively high percentage of case studies.

Country of Data Collection

I was interested to note that HDR data had been collected in at least 25 non-Australasian countries, because supervision of higher degrees is one way for Australians and New Zealanders to have an impact on mathematics education research and teaching in other countries, particularly in developing regions.

The 46 theses involved included 17 (37% of the 46) for the S.E. Asian region and 16 (35%) in Africa and Mauritius. For single countries, South Africa headed the list (9, or 20%), followed by Indonesia, Malawi, and Singapore (5, or 11% each).

Levels of Mathematics Education

The majority of theses were about teaching mathematics, as expected, but many of their titles and abstracts did not give information about the level of schooling. It was very clear, though, that where the level *was* specified (225 theses) there were many more where the researchers had attended to secondary education than to any other level (see Figure 4).
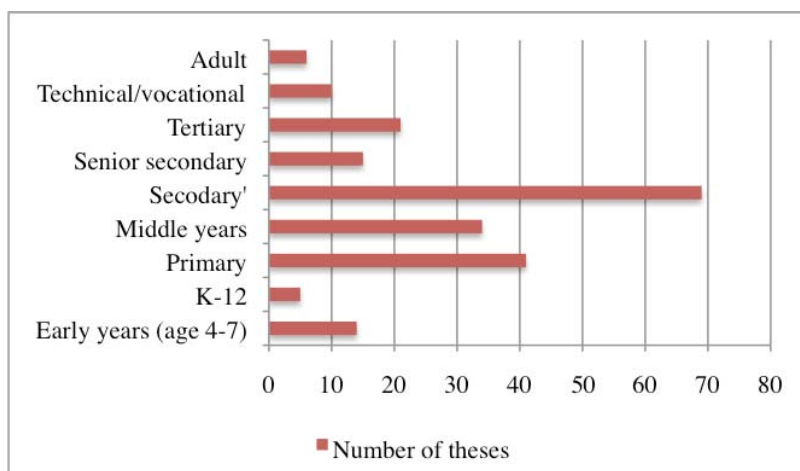

Figure 4: Levels of schooling

Topics of Theses

I experienced no problems allocating each of the 840 descriptors to one of the domains used by Begle (1979). The result is shown in Figure 5.
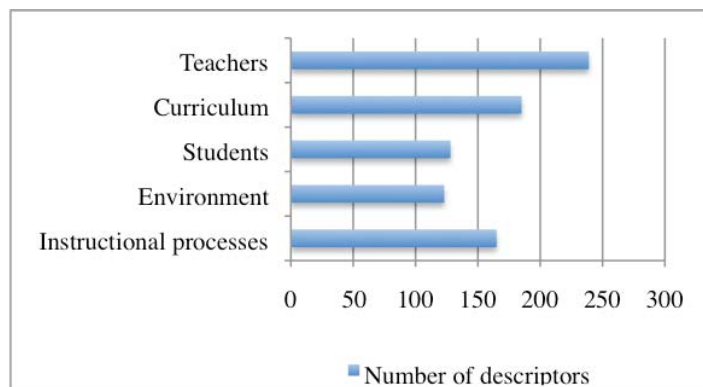

Figure 5: Descriptors allocated to Begle's 5 domains of mathematics education

Teachers. There were 239 theses that focused on teachers. The major category was teacher development, which included professional development (50, 20% of the *Teachers* category) and pre-service teacher education (42, or 18%). Teachers' beliefs and values were a focus in 49 theses (20%). Teachers' knowledge was a topic of 47 theses (20%), including 23 theses that focused on pedagogical content knowledge. Planning, mentoring and interpersonal skills were the foci of smaller numbers of theses about teachers.

Curriculum. Of the 185 *Curriculum* entries, 105 focused on content areas, as shown in Figure 6, below. Because of the large number of theses about rational number (15, or 15% of the *Curriculum* entries, including 7 on decimal fractions), these were not included with other Number entries that were mainly about computational processes and thinking.
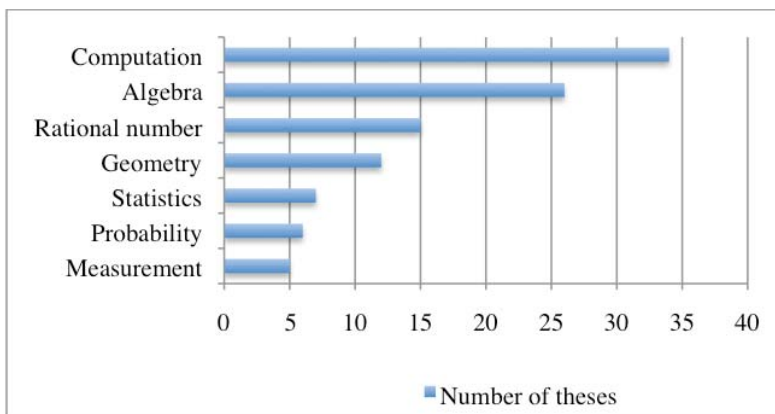

Figure 6. Content areas that were the focus of theses.

Theses referring to non-content aspects of the curriculum numbered 80. These included curriculum reform and politics (25, or 43% of *Curriculum*), problem solving (25, 14%), developing number sense (12, 6%) and integrated curriculum (10, 5%).

Students. There were 128 theses that focused on students (15%). This category included 44 (34% of the *Students* category) about affective factors and students' perceptions of mathematics and maths classes. The other *Students* categories were family/SES factors (28, 21%), language/NESB (25, 20%), knowledge/ability (18, 14%), and gender-focused studies (13, 10%).

The Educational Environment. A total of 123 studies referred to the educational environment (15% of all descriptors). External factors included policy and standards (6, or 5% of the *Environment* category). School and social factors accounted for 16 descriptors recorded (13%). The classroom climate was a popular topic (27, 21%), as was collaboration and peer interactions (31, 25%), which Begle (1979) included in *Educational Environment*. The major descriptor in this category, however, was assessment (33, 27%), including only 3 theses that focused on broad-based (state or national) assessment.

Instructional Process. This category was noted 165 times (20% of all descriptors), and 3 sub-categories were noted. First, tools (textbooks, manipulatives, games, and technology) had the majority of mentions (99, or 60% of the *Instructional processes* category—see Figure 7). A break-down of the technology entries is shown in Figure 8.
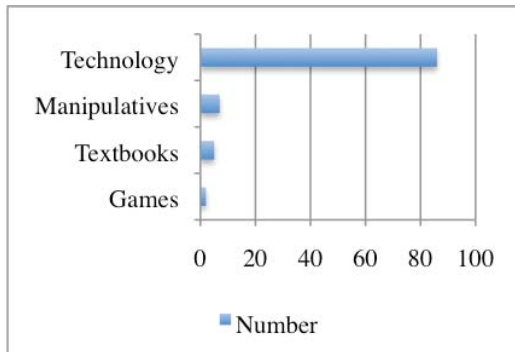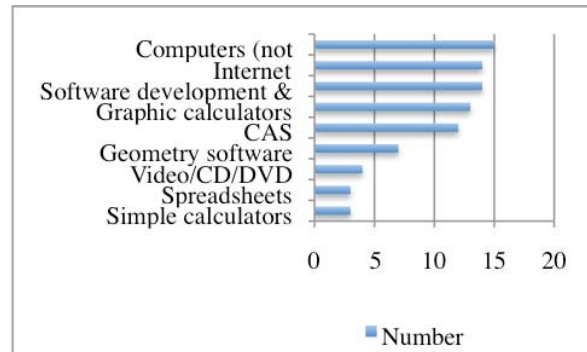
Figure 7: Sub-categories of *Tools.*

Figure 8: The *Technology* entries.

The second sub-category of *Instructional processes* was used when authors referred to specific theories of learning (40 entries, or 24% of this category), as shown in Figure 9. The final sub-category in *Instructional processes* was for teaching approaches (26 entries, or 16% of this category), as illustrated in Figure 10.
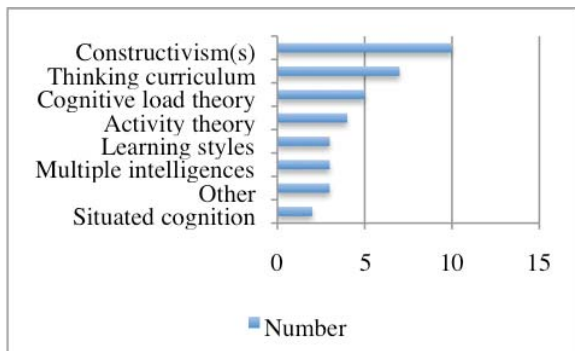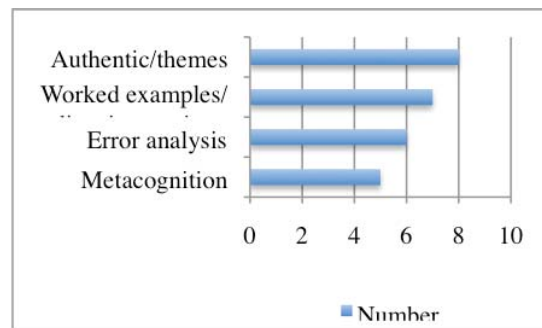

Figure 9: Learning theories entries.

Figure 10: Teaching approaches entries.

Conclusion

The analysis is a snapshot of two aspects of the scholarship of MERGA members and the broader mathematics education community over the past decade—the completion and supervision of higher degrees by research theses. In summary, one could note:

- a fairly steady (except for an artificial bulge) number of thesis completions in mathematics education in Australasia;
- a rate of completions that seems to have fallen off in the last few years;
- major differences between institutions in numbers of thesis completion;
- about 12 times as many qualitative studies as quantitative studies;
- a wide range of countries being sites for data collection, with potential for major contributions to local mathematics education research communities;
- a heavy focus on the "Number and algebra" strand(s) of national curricula;
- many theses examining the use of a range of technologies; and
- application of a number of learning theories.

One could also note a wide variety of thesis topics, spread relatively evenly over the 5 domains of Begle's (1979) framework, which proved to be a useful and inclusive set of categories and sub-categories for sorting the thesis descriptors, despite that fact that it was created 30 years ago.

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