Nomination for the MERGA Research Award

I wish to nominate the Early Numeracy Research Project (ENRP) research team for the MERGA Research Award.

The team includes Doug Clarke, Jill Cheeseman, Barbara Clarke, Ann Gervasoni, Donna Gronn, Pam Hammond, Marj Horne, Andrea McDonough, Pam Montgomery, Anne Roche, Glenn Rowley, Peter Sullivan, Ann Downton, Annie Mitchell, Rhonda Faragher, and Linda Parish.

ENRP research project work is on-going, and the main focus of this nomination of the research team is activity from 2008–2010. My nomination is based on the ENRP team's outstanding research activity that brings much credit to many MERGA members and the Australasian mathematics education community.

Judy Mousley

Recent Developments in the Early Numeracy Research Project

The ENRP is a research development project that commenced in 1999. Its initial aim was to seek to identify processes for supporting and enhancing mathematics learning in the early years of school, but it has developed into a network of research and development projects that have had a significant impact on research and publication, assessment intervention and teaching in schools, and professional development at pre-service and postgraduate levels.

Background

The initial funded work (1999-2002) involved five main components:

- the development and refinement of a set of research-based "growth points" in mathematical understanding in various mathematical domains;
- the creation and use of a one-to-one, task-based assessment interview implemented with all children involved in the project twice a year;
- a multi-level professional development program;
- a study of the teaching practices of particularly effective teachers; and
- a structured intervention program for students requiring additional assistance.

This initial research involved 70 schools (government, Catholic, independent), and 353 teachers participated. Around 11,000 students were interviewed several times using the project-developed *Early Numeracy Interview* — a total of around 36,000 interviews. Altogether, 323 children were interviewed from the time they arrived at school until the end of their primary years (on 9 occasions altogether), providing a very important picture of student achievement across the primary years. This resulted in high quality data on, and norm referencing of, the mathematical understanding of thousands of children, from the time they commenced schooling until the end of the early years.

Recent research

(Criterion 1: The nominee's research represents outstanding achievement in mathematics education research within the previous 3 years.)

Some extra researchers have joined the original team (see Appendix A), and all continue to make valuable contributions to mathematics education research through the ENRP.

The research agenda is currently ongoing, still drawing on the methods, data, and/or outcomes and products arising from the initial research. Recently, the scope of data collection and analysis, with development of appropriate interview questions, materials and professional development content has extended the project work from the early years through to upper primary and junior secondary content and students.

The majority of research and development in the last 3 years has been undertaken in relation to the following.

- Extending Mathematical Understanding (EMU) focuses on the early years of schooling with intensive 30-minute daily sessions for small groups of children over a period of 10–20 weeks. The EMU Program has been shown by detailed research to improve children's learning and confidence with mathematics. There has been a recent move into programs for Years 3-6. Nearly 1000 teachers around Australia are trained as EMU Specialist Teachers qualified to use the intervention program arising from this research. The EMU work is also the basis of the current *Bridging the Numeracy Gap in Low SES and Indigenous Communities* project, in the Kimberly's, and several Victorian Catholic Dioceses. (Gervasoni with Downton and Parish)
- In response to teacher requests for an interview suitable for upper primary and junior secondary, the *Rational Number Interview* was developed, assessing student understanding in fractions, decimals, and percentages. (Clarke, Mitchell, Roche)
- The Number section of the interview is currently being revised, as a result of experience with implementation of the interview and recognition of some gaps and weaknesses (Gervasoni) and to incorporate research findings from the last 10 years (e.g., Downton)
- Studying the practice of teachers identified as highly effective during the ENRP: Challenging children to think: An investigation of the behaviours of highly effective teachers that stimulate children to examine their mathematical understandings (Cheeseman).
- The Measurement and Space sections of the ENRP interview are being revised in conjunction with colleagues in Germany from Kassel University and the University of Oldenburg. (McDonough, B. Clarke, Clarkson, Horne, Downton, D. Clarke)
- Research has taken place into the use of the interview to assess the mathematical understanding of children with Down Syndrome, leading to a range of adjustments for curriculum and teaching for that context. (Farragher, B. Clarke)
- A study of the role of Numeracy Coordinators in Victorian schools, using the instrument developed for the ENRP (Cheeseman)
- The findings of the Effective Teaching study from ENRP are the basis of a professional development and research program, conducted in Adelaide, Northern Territory, Perth, and the Kimberly's. The Leading Aligned Numeracy Development project (LAND), attempts to link leaders with classroom teachers in a joint focus on good practice.
- *Contemporary Teaching and Learning of Mathematics* (CTLM) makes use of and builds on data showing what students know and can do as well as findings on the characteristics of effective teachers. This work is supported by a prestigious grant of over $1m funded by Catholic Education Office, Melbourne. (D. Clarke, with Brown, Clarkson, Downton, Horne, McDonough, Roche, Scott, Sexton)
- Completed and current PhD research (Cheeseman, Sexton, Downton)

Use by systems and schools

(Criterion 2: The nominee's research has the potential to make an impact)

It is clear that the ENRP and Rational Number interview protocols are valued by a number of school systems. Recent use and research by systems and school regions include:

- An adaptation of the interview is used in Contemporary Teaching and Learning of Mathematics, sponsored by the Catholic Education Office, Melbourne, targeting underperforming schools. CTLM involves research in schools as well as professional development for teachers.
- In 3 other Victorian dioceses, all teachers in primary schools are using the interview each year. As with several other systems, the interview is being used across all primary years.
- The Victorian Education Department urges teachers use the Early Numeracy Interview, and the Fractions and Decimals interview has been put on the DET website with middle school teachers being strongly encouraged to use it.
- The Tasmania CEO is sponsoring research in low SES schools, involving monitoring the effects of professional development programs, using the Early Numeracy Interview.
- The Early Numeracy Interview was published by the Victorian Department of Education and is now used in the majority of schools in Victoria on a regular basis. Following the conclusion of the ENRP, an online version of the interview was established by the Victorian Education Department, so that teachers in government schools could enter the interview data directly onto the computer, while conducting the interview, then compile and print results. The resource includes links from the interview to the Mathematics Developmental Continuum and to the Victorian Essential Learning Standards.
- The Victorian Education Department has similarly published the Fractions and Decimals interview as Fractions and Decimals Online. This resource also has classroom activities and specific strategies used by students and teachers.
- A variety of teachers in other Australian states and territories also use the interview to identify young children's strengths and weaknesses upon school entry and to map their progress across the early years.
- The Early Numeracy Interview is in use by systems, e.g., the Catholic Education Office Melbourne, and the Association of Independent schools South Australia, as a measure of growth in student understanding over time, thereby providing a measure of the impact of a variety of research and professional development projects.
- The Early Numeracy Interview is being used in the ARC grant, *Enhancing mathematical learning for Indigenous students in remote communities* (Sullivan, Zevenbergen/Jorgensen).
- With its emphasis on additional assistance in areas of need, EMU is also in use in many Victorian and Western Australian schools, and is expanding to NSW in 2011.

Professional development and school visits

Pre-service teacher education

Here I can give an account of my personal experience with the use of the ENRP in research-based tasks by pre-service students at Deakin University. The students carry out a set of early years interviews, enter the data into a spreadsheet, then plan and justify lessons and further assessment activities for a (virtual) class.

Personally, I know that the ENRP interview is also use with pre-service students of ACU, RMIT and Monash, although I have not asked colleagues from other teacher education institutions if it is used elsewhere.

Postgraduate studies and professional development

Use of the interview is a form of professional development for practising teachers, but in various projects, parallel professional development is provided by the research team. In particular, CTLM involves a significant program of professional development and school visits.

The 25 characteristics of effective teaching of mathematics are used in several professional learning programs (e.g., LAND project in South Australia, Northern Territory, and Western Australia) and preservice programs, in encouraging teachers to reflect on their current practice, and to identify areas on which to focus in the future.

Members of the research team are asked regularly to give presentations in relation to the research, and the CTLM includes parent information evenings in schools.

Use in other countries

The interview has been used, translated as needed, and further developed for use in other countries. In the last 3 years, these include:

- the USA (D. Clarke)
- Canada (Horne & McDonough)
- East Timor (Gervasoni)
- Sweden (Horne)
- Germany (with Bernd Wollring and Andrea Peter-Koop)
- South Africa (via Peter-Koop)

Contributions to academic development and to the mathematics education community
(*Criterion 3: There is evidence of dissemination of this research using scholarly and/or professional avenues)*

It should be noted that this major development in mathematics education (incorporating a task-based assessment interview, research on effective teaching, appropriate intervention strategies, and insights into the role of the mathematics coordinator) has been a truly collaborative effort involving a large number of MERGA members and their colleagues. At the time of the initial project, many were inexperienced with research processes and writing for publication but most have now developed group and individual projects and papers/chapters in their own right.

The extensive list of the project's 1999-2007 publications is appended (see Appendix B). The publications list for the last 3 years only (see Appendix C) gives a good indication of the range of research and development during this period. It includes:

- 9 papers delivered at MERGA conferences and accepted for publication in the proceedings
- 6 papers delivered at PME and other major academic conferences and symposia, published in proceedings
- 11 articles published in refereed journals
- 8 articles published in other professional journals and proceedings
- 3 plenary or invited papers at ICME, plus 3 topic and discussion groups at ICME
- 4 chapters/articles in books
- 1 thesis
- 2 other publications

In summary, it is clear that over the past 3 years, the ENRP research team has continued to make a very significant contribution to the mathematics education literature as well as to professional development for primary and secondary teachers, curriculum development and resources for mathematics teachers, and the broader mathematics education community's knowledge of young children's understanding of mathematical concepts. The project has had a significant impact on systems and schools in Australia and in other countries from its instigation, and in recent years it has continued to make major contributions to the mathematics education community. Clearly,
Criterion 4: The nominee's career has involved research-related contributions to MERGA over a period of time.

Thus I am very pleased to be able to nominate the Early Numeracy Research Project team for the MERGA Research Award.

Appendix A: ENRP Researchers

Key original team members:

Doug Clarke (Team leader)
Jill Cheeseman, Barbara Clarke, Ann Gervasoni, Donna Gronn, Pam Hammond, Marj Horne, Andrea McDonough, Pam Montgomery, Anne Roche, Glenn Rowley, Peter Sullivan.

Additional researchers involved in more recent work:

Ann Downton, Annie Mitchell, Rhonda Faragher, Linda Parish.

Appendix B: ENRP Publications 1999-2007

Clarke, D. M. (1999). An Australian project which links mathematics assessment and teaching in grades K-2. In A. Rogerson (Ed.), *Proceedings of the international conference on mathematics education into the 21st century: Societal challenges, issues and approaches* (Vol. I, pp. 132-137). Cairo, Egypt: Third World Forum.

Clarke, D. M. (1999). Linking assessment and teaching: Building on what children know and can do. In Early Years of Schooling (Eds.), *Targeting excellence: Continuing the journey* (Proceedings of the 1999 Early Years of Schooling P-4 Conference, pp. 8-12). Victoria: Department of Education.

Gervasoni, A. (1999). Children learning number. *Targeting excellence* (Proceedings of the Early Years of Schooling P-4 Conference, Melbourne Convention Centre 25-26 July, pp. 20-24). Melbourne: Department of Education, Employment and Training. [5 pages].

McDonough, A. (1999). Teaching the big ideas in measurement. In *Targetting excellence: Continuing the journey* (Proceedings of the 1999 Early Years of Schooling P-4 Conference, pp. 43-50). Early Years of Schooling P-4 Conference, November.

Clarke, D. M. (2000). Building on what children know and can do: Some messages for the future from the Early Numeracy Research Project. In J. Wakefield (Ed.), *Mathematics: Shaping the future* (Proceedings of the 37th Annual Conference of the Mathematical Association of Victoria, pp. 13-24). Brunswick, Victoria: MAV.

Clarke, D. M. (2000). The Early Numeracy Research Project: Some insights from an eliciting first year. In Department of Education, Employment and Training. (Eds.), *High expectations: Outstanding achievement* (Proceedings of the early years of schooling P-4 conference, CD-ROM). Melbourne: DEET.

Clarke, D. M. (2000, December). *The Early Numeracy Research Project: Understanding, assessing and developing young children's mathematical strategies*. Paper presented to the Annual Conference of the Australian Association for Research in Education Annual Conference, Sydney University, New South Wales.

Clarke, D. M., & Cheeseman, J. (2000). Some insights from the first year of the Early Numeracy Research Project. In *Improving numeracy learning: What does research tell us?* (Conference Proceedings of the Improving Numeracy Learning: What Does Research Tell Us? Conference, pp. 6-10). Brisbane: ACER.

Clarke, D. M., Sullivan, P., Cheeseman, J., & Clarke, B. A. (2000). The Early Numeracy Research Project: Developing a framework for describing early numeracy learning. In J. Bana & A. Chapman (Eds.), *Mathematics education beyond 2000* (Proceedings of the 23rd annual conference of the Mathematics Education Research Group of Australasia, pp. 180-187). Fremantle, Western Australia: MERGA.

Clarke, D., Gervasoni, A., & Sullivan, P. (2000). *The Early Numeracy Research Project: understanding, assessing and developing young children's mathematical strategies.* Paper presented at Australian Association for Research in Education Annual Conference, University of Sydney, 4-7 December, 2000. [11 pages].

Clarke, D., Sullivan, P., Cheeseman, J., & Clarke, B. (2000). The Early Numeracy Research Project: Developing a framework for describing early numeracy learning. In J. Bana & A. Chapman (Eds.) *Mathematics Education and Beyond. Proceeding of the 23rd annual conference of the Mathematics Education Research Group of Australasia* (pp. 180-188). Fremantle.

Clarke, D., Sullivan, P., Cheeseman, J., & Clarke, B. (2000). The Early Numeracy Research Project: Developing a framework for describing early numeracy learning. In J. Bana & A. Chapman (Eds.) *Mathematics Education and Beyond. Proceeding of the 23rd annual conference of the Mathematics Education Research Group of Australasia* (pp. 180-188). Fremantle.

Gervasoni, A. & McDonough, A. (2000). Addition and subtraction in the early years of schooling. In J. Wakefield (Ed.), *Mathematics: Shaping the future* (pp. 363-372*)*. Brunswick, Victoria: Mathematical Association of Victoria. [10 pages].

Sullivan, P., Cheeseman, J., Clarke, B. A., Clarke, D. M., Gervasoni, A., Gronn, D., Horne, M., McDonough, A., & Montgomery, P. (2000). Using learning growth points to help structure numeracy teaching. *Australian Primary Classroom, 5*(1), 4-8.

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Clarke, D. M. (2001). Challenging and enjoyable mathematics for young children: A classroom story. *Australian Primary Mathematics Classroom, 6*(1), 20-25.

Clarke, D. M. (2001). Classroom focused research. In A. Rogerson (Ed.), *New ideas in mathematics education* (Proceedings of the International Conference of the Mathematics Education into the 21st Century Project, pp. 47-55). Palm Cove, Queensland: Mathematics Education into the 21st Century.

Clarke, D. M. (2001). Understanding, assessing and developing young children's mathematical thinking: Research as powerful tool for professional growth. In J. Bobis, B. Perry, & M. Mitchelmore (Eds.), *Numeracy and beyond* (Proceedings of the 24th Annual Conference of the Mathematics Education Research Group of Australasia, Vol. 1, pp. 9-26). Sydney: MERGA.

Gervasoni, A. (2001). Specialised programs for students who are low attaining in mathematics: Do they help? In J. Bobis, M. Mitchelmore, & B. Perry (Eds.), *Numeracy and beyond (Proceedings of the 24th Annual Conference of the Mathematics Education Research Group of Australasia*, pp. 249-256). Sydney: MERGA. [8 pages].

McDonough, A. (2001). Developing measurement concepts in P-2 through the use of engaging activities. In C. Vale, J. Horwood, & J. Roumeliotis (Eds.), 2001 *A mathematical odyssey* (pp. 45-52). Brunswick, Victoria: Mathematical Association of Victoria.

McDonough, A., & Oliver, B. (2001). The early numeracy interview and where to from here? With a focus on measurement. *Early Years of Schooling P-4 Conference*.

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Sullivan, P., Clarke, D., Cheeseman, J., & Mulligan, J. (2001). Moving beyond physical models in learning multiplicative reasoning. In M. van den Heuvel-Panhuizen (Ed.), *Proceedings of the 25th annual conference of the International Group for the Psychology of Mathematics Education* (pp. 4.233-241). Utrecht: PME.

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Sullivan, P., Clarke, D. M., Cheeseman, J., & Mulligan, J. (2001). Moving beyond physical models in learning multiplicative reasoning. In M. van den Heuvel-Panhuizen (Ed.). *Proceedings of the 25th annual conference of the International Group for the Psychology of Mathematics Education* (Vol. 4, pp. 233-240).

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Clarke, B. A., & Clarke, D. M. (2002). Matematik steg for steg. *Namnaren*, *29*(4), 32-33.

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Clarke, B., McDonough, A., & Sullivan, P. (2002). Measuring and describing learning: The Early Numeracy Research Project. In A. D. Cockburn & E. Nardi (Eds.), *Proceedings of the 26th Conference of the International Group for the Psychology of Mathematics Education* (Vol. 1, pp. 181-185). Norwich, United Kingdom: School of Education and Professional Development, University of East Anglia.

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Clarke, D. M. (2003). Using a children's storybook as a springboard for exciting measurement activities in the early years of school. *Pythagoras, 57*, 6-10.

Clarke, D. M., & Clarke, B. A. (2003). Encouraging perseverance in K-2 mathematics: The tale of two problems. *Teaching Children Mathematics*, *10*(4), 204-217.

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Gervasoni, A. (2003). *Using Open Tasks and Investigations in Middle Years Mathematics*. Paper presented at the Partners in Learning: Early & Middle Years Achieving Together Department of Education and Training Central Highlands Wimmera Region Conference, 16 April 2003, Ballarat.

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