

MATHEMATICS EDUCATION UNIT

2007-2009 POSTGRADUATE HANDBOOK



THE UNIVERSITY
OF AUCKLAND

FACULTY OF SCIENCE



Celebrate
THINKING

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COVER PHOTO

Mathematics students next to a mathematical artwork, near the Science Centre at The University of Auckland.
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Important Dates

2007

Summer School begins	4 January
Summer School ends	14 February
Semester 1 begins	26 February
Semester 1 ends	25 June
Semester 2 begins	16 July
Semester 2 ends	12 November

2008

Summer School begins	5 January
Summer School ends	20 February
Semester 1 begins	3 March
Semester 1 ends	30 June
Semester 2 begins	21 July
Semester 2 ends	17 November

2009

Summer School begins	6 January
Summer School ends	18 February
Semester 1 begins	2 March
Semester 1 ends	29 June
Semester 2 begins	17 July
Semester 2 ends	16 November

Welcome to the Mathematics Education Unit (MEU)

Formation

The Mathematics Education Unit (MEU) arose from increasing mathematics education activity within the Department of Mathematics in the late 1980s. A proposal for a Mathematics Education Unit within the Department was finally made in 1991 and the MEU was established on February 1992.

Current State

The MEU now consists of seven permanent staff, five contract staff, two active retired members, and four associated members of the Departments of Mathematics and Statistics. The MEU occupies offices within the Department of Mathematics at the University of Auckland.

The MEU staff all teach undergraduate mathematics or statistics as well as mathematics education, and function as members of the Departments of Mathematics and/or Statistics. The MEU is responsible for foundation and undergraduate courses in mathematics and mathematics education within the mathematics schedule. It offers a suite of graduate courses that can be taken either as part of an MSc, MA or MEd programme. It is also responsible for secondary teacher pre-service courses in mathematics.

Members of the MEU have research interests in mathematics education and attend conferences in this field. All have an active publication record, and the MEU has attracted research funding from government and private sources. There is an active seminar programme, a graduate support network, regular outreach activity into schools and the New Zealand mathematics education community, and links with overseas institutions.

Contacting Us

Further information about postgraduate study in the Mathematics Education Unit, including specific admission requirements and current courses, is available on the Department website (www.math.auckland.ac.nz).

The general contact details for the Mathematics Education Unit are given below. Phone extension numbers and email addresses for specific staff members are on the next page.

Mathematics Education Unit
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Albert Park, adjacent to the University, looking towards the city.

Supervisory Staff Members

Dr Hannah Bartholomew

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Associate Professor Bill Barton

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Dr Maxine Pfannkuch

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Professor Ivan Reilly

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Associate Professor Mike Thomas

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From L to R: Bill Barton, Ivan Reilly, Maxine Pfannkuch, Mike Thomas and Hannah Bartholomew.

Dr Hannah Bartholomew

Hannah Bartholomew graduated with a BSc (Hons) in mathematics, an MSc in pure mathematics and a PhD in mathematics education, and has been involved in a range of research projects in mathematics education. Her research interests are broadly sociological, and include gender issues in mathematics education; the formation of students' identities as learners of mathematics; the impact of grouping students by ability;



and the ways in which these issues intersect with the types of understandings that students develop in and about mathematics. Hannah lives in Titirangi with her partner Vic.

Current and Recent Research Projects:

Mathematics Enhancement Project. This is a large project working with teachers and students in low decile schools, and I have been concerned with engaging teachers in research as a means of professional development. Through my involvement in this project, I have become particularly interested in the role that emotions play in shaping teachers' professional identities.

Pangarau AIM (Achieving in Mathematics). This longitudinal study will follow the progress and feelings about maths of a group of Maori students as they move through High School. The students were all doing well at maths at intermediate school, and the project will investigate the social, emotional and educational factors which have an impact on their choices regarding mathematics.

Recent Publications:

Rodd, M. & Bartholomew, H. (2006). Invisible and Special: Young women's experiences as undergraduate mathematics students. *Gender and Education*, 18(1), 35-50.

Bartholomew, H. (2005). Top Set Identities and the Marginalisation of Girls. *Proceedings of 4th International Mathematics Education & Society Conference*, Gold Coast, Australia, July, 2005.

Barton, B., Paterson, J., Kensington-Miller, B., & Bartholomew, H. (2005). Dodging the Dragon: Strategies for Mathematics Professional Development in Low Socio-Economic Areas. *Proceedings of 4th International Mathematics Education & Society Conference*, Gold Coast, Australia, July, 2005.

William, D., Bartholomew, H. & Reay, D. (2004). Assessment, Learning and Identity, in P. Valero and R. Zevenbergen (Eds) *Researching the socio-political dimensions of mathematics education: Issues of power in theory and methodology*, Kluwer Academic Press.

William, D & Bartholomew, H. (2004). It's not which school but which set you're in that matters: The influence of ability-grouping practices on student progress in mathematics. *British Educational Research Journal*, 30(2), 279-294.

Bartholomew, H. (2004). Equity and Empowerment in Mathematics: Some lessons from the secondary classroom. *Proceedings of the 27th Annual Conference of the Mathematics Education Research Group of Australasia*, 1, 71-78.



Associate Professor Bill Barton

Bill Barton graduated with an MSc in mathematics, an MPhil in Education and a PhD in mathematics education with a dissertation on Ethnomathematics. He has taught mathematics in Africa, and in NZ secondary schools, including bilingual (Maori/English) teaching. In the early 1980s he made two series of television programmes on mathematics. His research interests are in the connections between mathematics and culture (especially language). He

has written extensively in this area of culture and mathematics, is Associate Editor of *Educational Studies in Mathematics*, and is Vice-President of the Executive of the International Commission on Mathematical Instruction. Bill lives on Waiheke Island with his wife, Pip.

Current and Recent Research Projects:

Language and Mathematics: Is mathematics the same when it is undertaken in different languages? A Marsden-funded project addressing this question in research mathematics is in its final stages, and a book on investigations using indigenous languages is in press. A joint project with University of Sao Paulo and University of British Columbia with indigenous mathematics teachers is in process.

Mathematics Enhancement Project: A multi-faceted project in low-decile schools in Manukau with the aim of enhancing achievement and participation in mathematics for senior students. The current focus of this project (and subject of joint work with Oxford University and University of Michigan) is mathematical knowledge for teaching.

Recent Publications:

- Alekseev, V., Barton, B., & Knijnik, G. (2006). Other Conventions in Mathematics and Mathematics Education. In F. Leung, K. Graf, & F Lopez-Real (ed.), *Mathematics Education in Different Cultural Traditions: A Comparative Study of East Asia and the West*. The 13th ICMI Study, (pp 567-580). New York, Springer Science and Business Media.,
- Barton, B., Lichtenberk, F., & Reilly, I. (2005). The Language of Topology: A Turkish Case Study. *Applied General Topology*, 6(2), 107-117. <http://at.yorku.ca/i/a/a/k/24.htm>
- Barton, B., Chan, R., King, C., Neville-Barton, P., & Sneddon, J. (2005). EAL Undergraduates Learning Mathematics. *International Journal of Mathematical Education in Science and Technology*, 36(7), 721-729.
- Barton, B., Paterson, J., Kensington-Miller, B., & Bartholomew, H. (2005). Dodging the Dragon: Strategies for Mathematics Professional Development in Low Socio-Economic Areas. Goos, M., Kanes, C., & Brown, R. (Eds.), *Proceedings of the 4th International Mathematics, Education and Society Conference* (pp. 78-87). Gold Coast, Australia, July 4 - July 6, 2005.
- Barton, B. (2004) Mathematical Discourse in Different Languages: Implications for Mathematics Teachers. In Clarke, B., Clarke, D.M., Emanuelsson, G., Johansson, B., Lambdin, D.V., Lester, F.K., Wallby, A., & Wallby, K. (Eds.) *International Perspectives on Learning and Teaching Mathematics Proceedings of the Midsummer World Mathematics Education Conference*. (pp. 365-378). Göteborg, Sweden: National Centre for Mathematics Education (NCM).
- Barton, B. (2004). Dando sentido à etnomatemática: etnomatemática fazendo sentido. In J. Ribeiro, Ma. Domite, & R. Ferreira (Eds.) *Etnomatemática: papel, valor e significado*. São Paulo, Brazil: Zouk, 39-74. (A translation of "Making Sense of Ethnomathematics: Ethnomathematics is Making Sense", *Educational Studies in Mathematics*, 31(12), 201-233.

Dr Maxine Pfannkuch

Maxine Pfannkuch has been involved in mathematics education in New Zealand for about 30 years. After graduating with an MSc in mathematics, she trained as a secondary teacher and then taught at that level. She has been Head of Department of mathematics at Avondale College, mathematics adviser for the Northern region and a senior lecturer at the Auckland College of Education where she was in charge of secondary mathematics teacher training. Currently Maxine is a senior lecturer in the



Mathematics Education Unit at The University of Auckland where she completed a doctorate in statistics education. Her main research area is focussed upon the development of students' statistical thinking. She is an Associate Editor of the *Statistics Education Research Journal* and was convenor for SRTL-4, an international forum on Statistical Reasoning, Thinking and Literacy. Maxine is currently involved in the development of the school statistics curriculum. Maxine lives in the City with her husband Kurt.

Current and Recent Research Projects:

School Project – **Developing students' statistical thinking**

This ongoing project combines teacher development with studies on the development of Year 10 to 13 students' statistical thinking in schools.

University Project – **Developing students' statistical literacy**

This project involved designing teaching units specifically aimed at developing Stage One statistics students' statistical literacy and then assessing their effectiveness.

Recent Publications:

- Pfannkuch, M. (2006). Comparing box plot distributions: A teacher's reasoning. *Statistics Education Research Journal*, 5(2), 2006, <http://www.stat.auckland.ac.nz/serj>
- Pfannkuch, M. (2005). Characterizing Year 11 students' evaluation of a statistical process. *Statistics Education Research Journal*, 4(2), 5-26. <http://www.stat.auckland.ac.nz/serj>
- Pfannkuch, M. (2005). Probability and statistical inference: How can teachers enable learners to make the connection? In G. Jones (Ed.), *Exploring probability in school: Challenges for teaching and learning* (pp. 267-294). New York, Kluwer/Springer Academic Publishers.
- Pfannkuch, M. & Wild, C. (2004). Towards an understanding of statistical thinking, In D. Ben-Zvi and J. Garfield (Eds.), *The Challenge of Developing Statistical Literacy, Reasoning and Thinking* (pp. 17-46). Dordrecht, The Netherlands: Kluwer Academic Publishers.
- Pfannkuch, M. & Wild, C. (2000). Statistical Thinking and Statistical Practice: Themes Gleaned from Professional Statisticians. *Statistical Science*, 15(2), 132-152.
- Wild, C. & Pfannkuch, M. (1999). Statistical thinking in empirical enquiry (with discussion). *International Statistical Review* 67(3), 223-265.



Professor Ivan Reilly

Ivan Reilly is Professor of Mathematics and Mathematics Education in the Department of Mathematics at the University of Auckland, where he has been teaching for about 35 years. He graduated MSc in Mathematics and BA in Geography at Victoria University of Wellington (VUW), and AM, PhD in Mathematics at the University of Illinois. In 1991 he was awarded a DSc for his research in Mathematics by VUW. In 1992 he was the main player in the creation of the Mathematics Education

Unit within the then Department of Mathematics and Statistics of the University of Auckland. He continues to write research papers in Topology as well as in Mathematics Education. His main interests in the latter are undergraduate mathematics teaching and learning, talented students especially at high school, and language and mathematical concepts. Ivan was co-convenor of DELTA03, the Fourth Southern Hemisphere Conference on Undergraduate Mathematics Teaching and Learning, Queenstown, New Zealand, November 2003. Ivan lives in Auckland with his wife Barbara.

Current and Recent Research Projects:

Topology and Language. This Marsden-funded international project investigates whether research mathematicians understand the base concepts of their field in different ways depending on the language in which they work. Pilot development of instruments is complete and full data collection is currently taking place.

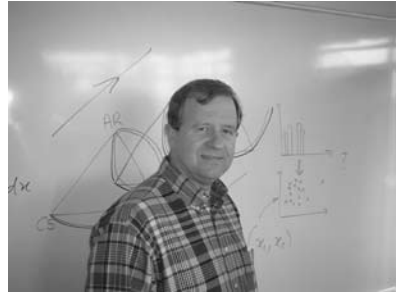
Undergraduate Mathematics for Talented High School Students. This project involves designing and delivering (in two modes—traditional and distance) a course for university credit for talented final year high school students. An assessment of the effectiveness of such a course is part of the project.

Recent Publications:

- Barton, B., Lichtenberk, F., & Reilly, I. L. (2005). The language of topology: a Turkish case study. *Applied General Topology*, 6, 107-117.
- Oates, G., Paterson, J. E., Reilly, I. L. & Statham, M. A. (2005). Effective tutorial programmes in tertiary mathematics. *International Journal of Mathematical Education in Science and Technology*, 36, 731-740.
- Reilly, I. L. (2004). Several topologies on one set. In K. P. Hart, J. Nagata & J. E. Vaughan (Eds.), *Encyclopedia of General Topology* (pp. 22-24), Elsevier Science, Amsterdam.
- Niederer, K., Irwin, R. J., Irwin, K. C. & Reilly, I. L. (2003). Identification of mathematically gifted children in New Zealand. *High Ability Studies*, 14, 71-84.
- Cao, J., Reilly, I. L. & Xiong, H. (2003). A lattice-valued Banach-Stone Theorem. *Acta Mathematica Hungarica*, 98, 85-92.
- Cao, J., Ganster, M., & Reilly, I. L. (2002). On generalized closed sets. *Topology and its Applications*, 123, 37-46.

Associate Professor Mike Thomas

Mike Thomas has been at The University of Auckland since 1993, and has been engaged in research in mathematics education since 1983. He has published over 125 research papers in the fields of algebra, technology use in algebra, calculus and linear algebra, and advanced mathematical thinking. He has completed the supervision of four PhD students on topics of: Versatile Understanding in Integration Using a Computer, Affect and Algebra Problem Solving Performance,



Informal Assessment Questions Used by Secondary School Mathematics Teachers, and Student Understanding and Representation of Derivative. In addition he currently has six other PhD students. Mike was convener of TIME 2000, an international technology conference, and of MERGA 25. He is on the Editorial Board of the Mathematics Education Research Journal and is editor of the New Zealand Mathematics Magazine. Mike is married to Christine and lives in Auckland.

Current and Recent Research Projects:

Neuropsychological Aspects of Brain Function and Mathematical Thinking. This uses fMRI scans to investigate ways in which the brain processes mathematical thinking about concepts and procedures, and the possible influences on learning related to representational thinking.

The use of technology in the mathematics classroom. Research, with international collaboration, looking at the difficulties experienced by students in understanding mathematical processes and concepts and attempting to describe, explain and classify them. It also considers the ways in which graphic and CAS calculators and computers may be used to improve understanding by overcoming difficulties.

Conceptual understanding of students in first year university linear algebra courses. This project considers the role of representation in their learning.

Recent Publications:

Stewart, S., Thomas, M. O. J., & Hannah, J. (2005). Towards student instrumentation of computer-based algebra systems in university courses. *International Journal of Mathematical Education in Science and Technology*, 36(7), 741-750.

Thomas, M. O. J., & Hong, Y. Y. (2005). Learning mathematics with CAS calculators: Integration and partnership issues. *The Journal of Educational Research in Mathematics*, 15(2), 215-232.

Thomas, M. O. J., Monaghan, J., & Pierce, R. (2004). Computer algebra systems and algebra: Curriculum, assessment, teaching, and learning. In K. Stacey, H. Chick, & M. Kendal (Eds.), *The teaching and learning of algebra: The 12th ICMI study* (pp. 155-186). Norwood, MA: Kluwer Academic Publishers.

Thomas, M. O. J. & Holton, D. (2003). Technology as a Tool for Teaching Undergraduate Mathematics, In A. J. Bishop, M. A. Clements, C. Keitel, J. Kilpatrick, & F. K. S. Leung (Eds.) *Second International Handbook of Mathematics Education* (pp. 351-394). Dordrecht: Kluwer.

Graham, A. T. & Thomas, M. O. J. (2000). Building a Versatile Understanding of Algebraic Variables with a Graphic Calculator, *Educational Studies in Mathematics*, 41(3), 265-282.

Tall, D. O., Thomas, M. O. J., Davis, G., Gray, E. & Simpson, A. (2000). What is the Object of the Encapsulation of a Process? *Journal of Mathematical Behavior*, 18(2), 223-241.

Master of Science Programme

Graduate studies in Mathematics Education can be constructed in a variety of ways, and with credit towards a variety of degrees. Part-time study is available, and credit may be given for work already undertaken at other universities.

Master of Science Level Courses in the MEU

MATHS 701 **Research Issues in Mathematics Education**

Every year, Summer Semester

Research methodology for mathematics and statistics education, designed to meet the needs of students embarking on Master's level studies or planning a dissertation or thesis in Mathematics Education.

Main lecturer: Assoc Prof Bill Barton

MATHS 702 **Mathematics Curriculum**

2008, Second Semester

The historical development, current trends, theories and practice of the mathematic and statistics curricula and assessment. The interconnections between curriculum development, assessment and other mathematics education issues.

Main lecturers: Dr Hannah Bartholomew, Dr Maxine Pfannkuch

MATHS 703 **Theoretical Issues in Mathematics Education**

2008, First Semester

A selection of key learning theories are introduced. Social and psychological perspectives are discussed, including their applications in research and their implications for mathematics education teaching and learning.

Main lecturers: Dr Hannah Bartholomew, Assoc. Prof. Mike Thomas

MATHS 705 **Social Issues in Mathematics Education**

2007 and 2009, Second Semester

A selection of topics from cultural identity, social and language issues arising in mathematics education. Critical examination of theories and current literature will be made, within a case-study approach.

Main lecturer: Assoc Prof Bill Barton, Dr Hannah Bartholomew

MATHS 706 **Technology and Mathematics Education**

2007 and 2009, First Semester

The use of computers and calculators in mathematics education, with a focus on both

theoretical and practical aspects of their use in the mathematics classroom. The pedagogical implications of technology for the present and future will be discussed.

Main lecturer: Assoc Prof Mike Thomas

MATHS 707-710 Special Topics in Mathematics Education A-D

By arrangement

These are special topic 15-point papers that are also available for personal study in a particular area of interest in mathematics education. You will have a supervisor for your topic.

MATHS 711 A & B Special Topics in Mathematics Education E

By arrangement

This is a special topic 30-point paper.

MATHS 712 Mathematics and Learning

2007, 2009, Second Semester, 2008, First Semester

An examination of a mathematical topic up to undergraduate level in the light of current research. The focus will be on investigating how that topic may be effectively learned at senior levels. The topics will be 2007 Calculus, 2008 Algebra and 2009 Calculus).

Main lecturers: Prof Ivan Reilly, Assoc Prof Mike Thomas

STATS 708 Topics in Statistical Education [2007 and 2009, First semester]

Covers a wide range of research in statistics education at the school and tertiary level. An examination of the issues involved in statistics education in the curriculum, teaching, learning, technology and assessment areas.

Main lecturer: Dr Maxine Pfannkuch



MEU staff at Piha beach on Auckland's west coast

PhD Programmes

The Mathematics Education Unit (MEU) welcomes PhD students as a fundamentally important group within the Unit and the Department of Mathematics. We aim to have at least ten, and as many as 15 people at any one time undertaking doctoral studies. As a group dedicated to in-depth research, they are seen as a source of new ideas for us all, role models for the Masters' programme, and as links to other fields of study or international researchers.

As members of the Department of Mathematics, and the Faculty of Science at The University of Auckland, our students are subject to PhD procedures and requirements, as laid out in the University Calendar, and on the University of Auckland website:

www.auckland.ac.nz/calendar

Further information on PhD students in the Mathematics department can be found at <http://www.math.auckland.ac.nz/PhD/>

Doctoral study may be undertaken in any field of interest. We recommend early contact with MEU staff, as enrolment is not completed until a proposal has been written and accepted. We welcome enquiries from those wishing to join the MEU to participate in our active and diverse PhD group. We wish to hear from suitably qualified candidates, both New Zealand residents, and international students. Contact details for MEU staff are contained on pages 2-3.

Areas of Interest

The Mathematics Education Unit has five staff who supervise PhD study. They, and their areas of interest, are:

Hannah Bartholomew: Social and equity issues, ability grouping, gender, developing identities of mathematics learners

Bill Barton: Socio-political issues, ethnomathematics, language and mathematics education, historical studies, secondary teacher education.

Maxine Pfannkuch: Statistics education, assessment, secondary teacher education, undergraduate statistics, statistical thinking and literacy.

Ivan Reilly: Gifted mathematics students, Mathematical Olympiads, tertiary mathematics education.

Mike Thomas: Technology in mathematics education, algebra and calculus learning, visualisation, advanced mathematical thinking, undergraduate mathematics, neuropsychological aspects of learning.

The focus of the MEU is secondary and tertiary mathematics education. Therefore, it would be unusual for PhD studies aimed at primary level to be accommodated.

Current Research Areas

There are some opportunities for PhD students to join existing research projects. Current projects include:

- **Pangarau - Achieving in Mathematics (AIM)** A longitudinal study following a group of high-attaining Maori students as they move through high-school.
- **Mathematics Enhancement Project (MEP)** A large project aimed at enhancing mathematics participation and achievement at senior levels in low-decile secondary schools. It includes student support, teacher development, and community promotion.
- **Statistical Thinking** A project aimed at developing and enhancing teachers' and students' statistical thinking in secondary schools.
- **Technology and Learning** Studies aimed at evaluating the role of technology in mathematics learning. The nature of student interactions with the technology is considered as well as the influences on content and learning.
- **Topology and Language** A study aimed at understanding whether the language of research mathematicians makes a difference to their understanding of their field.
- **Neuropsychological Aspects of Mathematical Thinking** A study aimed at understanding how the brain processes mathematical thinking.

Research Activities

The PhD programme includes several opportunities for students to participate in discussion, presentations, and to receive support for their research. Students normally are supplied with a desk and a computer in a shared office. They are included in the MEU meetings and social events as well as the academic activities of the department.

Supervision

PhD students always have two supervisors, although one may be a main supervisor and the second an advisor. One supervisor may be someone from outside the MEU.

MEU supervisors tend to have a closer, more frequent supervision style than many other research centres. We also encourage students to discuss their studies with any other people they wish. We expect students to be writing papers and attending conferences as part of their PhD activities and provide collegial support for these activities.

We regard discussion and active participation in groups and seminar series as a vital part of PhD work. Therefore distance PhD supervision is not currently undertaken in the MEU.

Seminar Series

Graduate Research Interactive Discussions This seminar series is specifically designed for PhD students, although others from the MEU may participate. This series is a “safe” place where ideas-in-formation can be opened up for general discussion or feedback, where conference presentations can be practised, or where research results can be shown in their raw form and ideas for analysis gathered. There is an expectation that the audience will contribute rather than criticise, discuss rather than dispute, and help rather than harass.

Mathematics Education Seminar Series This series is for more formal, conventional presentations. It is often used as a forum for visitors to the MEU or members of the MEU to report their work. We welcome a critical audience from both inside the department and elsewhere in the university and hope for frank discussion on any point of interest.

LOGOS The Local or Overseas Guests Occasional Seminar series is a mechanism by which a 1 or 2-day seminar can be held when there happens to be a conjunction of visitors with a particular common area of interest. This usually happens at least once a year.

Research Groups

The MEU has four research interest groups that meet to discuss common readings or other matters of interest. The areas of interest of these groups are:

- Ethnomathematics
- Statistics and probability
- Methodologies
- Technology issues

International Visitor Programme

The MEU attracts several international visitors every year. In particular there is usually an annual 3-5 week Visiting Professor who takes part in the Masters programme (which PhD students are welcome to audit), but who also usually holds 1-to-1 discussions with PhD students.

Visitors in 2006 included:

Prof Deborah Ball, Head of the Mathematics Teaching and Learning to Teach Project, Dean of Education, University of Michigan at Ann Arbor.

Prof Hyman Bass, President of the International Commission on Mathematical Instruction (ICMI), University of Michigan.

The 2007 visitor will be Prof. Carolyn Kieran, University of Quebec at Montreal. (For a full list of past visitors, please see pages 20-21)

Conference Participation

PhD students are encouraged (and often financially supported by the Mathematics Department and the University of Auckland Research Committee) to attend national and international conferences. Help is given preparing papers or posters, and opportunities exist for practising presentations in a non-threatening environment. Indeed, membership of the Mathematics Education Research Group of Australasia (MERGA) and regular attendance at the annual conference is important.

The MEU has recently hosted MERGA (2002) and the NZ Association of Mathematics Teachers conferences, and an international conference on Technology in Mathematics Education (TIME2000). In 2003 it co-hosted Remarkable Delta03, Southern Hemisphere Symposium on Undergraduate Mathematics Teaching in Queenstown, New Zealand. In 2005 it hosted the SRTL-4 International Statistical Reasoning, Thinking and Literacy Forum, and in 2006 the 3rd International Congress on Ethnomathematics (ICEm-3).

MEU Resources

The MEU grouping itself is large and diverse. Apart from the university employed members, there are graduate students who include many practising teachers, Teacher Fellows, interested members of the Department of Mathematics, and others in the Department of Statistics and the School of Education.

The MEU has a history of contact with schools of all types in the Auckland region, and a wide group of teachers who are interested in participating in studies of various kinds. We have links with the Woolf Fisher Research Centre at Manukau Institute of Technology, and an on-going relationship with Texas Instruments.

The MEU has a room where resources, books, reports and journals are kept for shared use. This supplements an extensive collection in the university library. Members of the MEU are currently Board members or Editors of NZ Mathematics Magazine, Mathematics Education Research Journal, Statistics Education Research Journal, For the Learning of Mathematics, and Educational Studies in Mathematics. They are also members of ICMI Study Groups.



MEU members taking a break

Financial Support

The prime source of financial support comes through the usual university channels (www.auckland.ac.nz - click on "Students" on the main menu then on "Scholarships & Financial Support"). In addition, the Department of Mathematics supports PhD study by amounts that vary year by year depending on budget constraints. There are also opportunities to be employed in a part-time lecturing or tutoring capacity.

Research in the MEU has been supported by grants from a number of funds and organisations, including: Marsden Fund, Texas Instruments, Casio, NZ Qualifications Authority, NZ Ministry of Education, NZCER, Royal Society of New Zealand, Manukau City Council, and Woolf Fisher Research Centre. Some of these projects contain opportunities for supporting graduate work.

First Steps

Interested prospective PhD students are invited to make contact with one of the people named on pages 2-3. It is expected that, at the time of initial contact, prospective students will have:

- read the website and know whether they are likely to be eligible
www.auckland.ac.nz
- have some initial ideas of a topic or research area
- have completed 100 hours of mathematics education research at Master's level or above.

The first task, prior to enrolment, is the preparation of a project proposal. Guidelines will be discussed when contact is made with a supervisor. Students should be aware that there is usually a lead-in time of about six months between initial enquiry and provisional enrolment.

Prospective Master's students are also invited to contact the Head of the MEU, Mike Thomas (2007), Hannah Bartholomew (2008-2009).



Right: Students and staff at morning tea

Other Staff

Dr. Barbara Miller-Reilly is a Senior Tutor. She received her PhD from The University of Auckland. Her research focussed on affective change is adult students in three second chance mathematics courses. She is a course coordinator for MATHS 101/MATHS101G and teaches various others undergraduate courses.

Garry Nathan is a Senior Tutor. He coordinates the Tuakana Programme as well as the Aldis Programme for Maori and Pasifika students. He is involved in doctorate research studying the way students instantiate their understanding through mathematical argumentation.

Greg Oates is a Senior Tutor. He is the course co-ordinator for MATHS 102 and teaches it in summer school and the first semester. He is in charge of the very successful staff-student liaison committee and is involved in the training of tutors. He is currently working on his doctorate researching the uses of technology in teaching mathematics at a tertiary level.

Sheena Parnell is a Senior Tutor. She co-ordinates and teaches the foundation courses MATHS 91F and MATHS 92F, amongst other courses. She is also team leader of the combined Maths and General Education courses MATHS101/MATHS101G and will be teaching this course in the first semester. Her research interests include calculus examination development and the teaching and learning of mathematics.

Judy Paterson is a Senior Tutor. In 2007 she will be co-ordinating Maths 302, Introduction to Mathematics Education, and teaching MATHS 101. Her particular area of interest is the professional development of secondary mathematics teachers. She is currently completing her doctorate that has focussed on using mathematics talks to stimulate teachers' thinking about learning. In 2007 she will be involved in a new programme for mathematics content outreach.

Moira Statham is a Senior Tutor. In 2007 she will be co-ordinating and teaching the foundation courses MATHS 93F and MATHS 94F. She is the course coordinator for the Maths tutoring course MATHS 202 and teaches it in the first semester. Her research interests are in the teaching and learning of Mathematics in Foundation Courses.

Research fellows

Dr. Ye Yoon Hong received her PhD from The University of Auckland. She is involved in a long-running research project with Mike Thomas, looking at teacher knowledge and student learning issues in the area of calculators in the mathematics classroom.

Dr. Caroline Poisard received a her PhD degree from the University of Provence at Aix-Marseille, in France. Her research interests are in language, culture and mathematics. She works with Bill Barton on fractions' teaching and learning, comparisons of schools and everyday life in France and New Zealand. She equally works on compared curriculums between these two countries.

Dr. Anna Wilson received her PhD from the University of Oregon, USA. She is involved in a research project with Mike Thomas, looking at neuropsychological aspects of mathematical thinking. The study uses fMRI and ERP scans of participants' brains while they think about mathematics problems.

Current PhD Students

David Godfrey "My PhD is concerned with how students perceive equations. This entails looking at the development of the concept of equation in students as they progress through school to university. In particular the research will look at how a more or less sophisticated view of the equals symbol aids this development. The research also looks at how one's concept of variable impacts on this development."

Gillian Frankcom "Having recently completed my masters thesis on Maths Anxiety in primary pre-service student teachers, I intend to continue this study through into my doctoral work. I am interested in how a teacher with high maths anxiety copes with teaching mathematics everyday in their primary or intermediate classroom. Primary teachers are generalists, not experts, but the levels of anxiety I previously found leads me to question whether these people could bring into their classroom the pedagogy associated with constructivist-aligned principles as espoused by their teacher educators and whether they have enough mathematical content knowledge to be a "good" teacher of mathematics."

Barbara Kensington-Miller "My research is investigating how mentoring senior mathematics teachers in low decile schools could be a useful professional development strategy to help raise student learning and achievement in the long-term.

During previous research in 2002, four teachers had been set up with a mentor. This mentor was a researcher from the University of Auckland who had previously been a secondary school mathematics teacher. There were no set guidelines for either teacher or mentor, these were to be organised between each pair. Mostly, the mentors assisted in the classroom and some teaching was done.

As the year continued, the teachers were appreciative of the support, in particular having lessons done for them, which decreased their workload and enabled them to observe different ways of presentation. However, there was no indication of any reflection on, or change in, their teaching styles, other than some new ideas inherited to enhance their existing programme. The question remained as to how this professional development aspect could be more effective.

The challenge to understand the process of mentoring and the process of change invited many questions. Who should mentor? Should a mentor be from outside the school, such as a University researcher, or should it be another teacher in the school? How does a mentor be a catalyst for teacher change? What are the structures that should be set in place for effective mentoring? This led to the present research question."

Mala Nataraj "My PhD is on improving the teaching and learning of mathematics through a study of the history of mathematics. Students' difficulties in algebra are well known and my research is on improving school students' conceptual understanding in algebra through the study of the history of mathematics, particularly Indian mathematics. I believe such a study is appropriate as the present-day place value decimal number system and many of the algorithms in arithmetic and algebra originated in India. I propose to develop a framework of the development of the number system, arithmetic and algebra through a study of the evolution of ideas in Indian history. I will also examine the effect of a teaching approach based on the developed framework."

Garry Nathan "My research interest concerns the way that students understand, read, and write the statements of theorems or mathematical argumentation, especially the logical components of these statements. My work focuses on undergraduate level mathematics, but I am also interested in how students develop their ability to comprehend mathematical texts from senior secondary level. While my interest is with all students, there are special problems for Maori, Pasifika, and new immigrant students learning mathematics in this respect. My involvement in the Mathematics Enhancement Project in Manukau schools and my position as Tutor for Maori & Pasifika students at the university therefore contribute to my research."

Greg Oates “My research is investigating the particular relationship between technology and curriculum development in tertiary mathematics. The use of graphics calculators and more recently CAS calculators has been increasing dramatically in school and tertiary mathematics teaching in recent years. However, in most cases the evidence is that the calculators have been merely incorporated into existing curricula as a tool to facilitate existing teaching and learning schemes. Much attention to the use of these calculators has been on how they enable us to teach, and students to understand existing curriculum content better.

Technology in general has not been regarded as a major influence on the mathematics curriculum, with little attention being paid to how technology may affect both what is taught, and the sequence in which it is taught. Many proponents of the use of technology argue that courses should be developed where technology is fully integrated into all aspects of the curriculum. This notion of technology integration however is itself not clearly defined, with much debate on what constitutes a technology-integrated curriculum. My most recent work has centred on developing a description of what constitutes a technology-integrated curriculum, and examining some of the practical and theoretical implications of this model.”

Judy Paterson “I have been involved in the education of mathematics teachers at the University of Auckland since 1997. Prior to this I taught mathematics and statistics both in South Africa and New Zealand to students at high school and in a tertiary bridging programme. The focus of my research is on investigating whether mathematics can play a part in opening up discussion about approaches to teaching.”

Sepideh Stewart “I enrolled at the University of Auckland in 1995 and graduated with a BSc followed by a MSc degree in Mathematics in 2000. I have been working for the mathematics department as a tutor since 1999. The topic of my PhD is, conceptual understanding of linear algebra in the three worlds of *embodied*, *symbolic* and *formal* mathematics.



Mathematical artwork: *Twins* by Chiara Corbeletto, 2003

MEU School and Community Links

The MEU is involved in a number of activities linked to schools and the general mathematics community. One of these is the important area of pre-service secondary teacher education. Each year the unit trains around 30 prospective teachers of mathematics. In addition we have research projects based in local schools. Among these is the MEP (Mathematics Enhancement programme), which is a 5-year programme to enhance participation and achievement in senior classes of Auckland decile 1 and 2 secondary schools. Part of this involves a group tutoring programme for the students of the MEP schools, where holiday classes are held in both NCEA level 3 Mathematics with Statistics and NCEA level 3 Mathematics with Calculus. Other projects in local schools involve the development of statistical thinking and the use of CAS calculators.

The MEU also runs several professional development courses for secondary teachers each year, and many of our graduate students are local teachers. In recent years one mathematics teacher per year has been offered a teacher fellowship which involves them teaching a stage one mathematics paper, studying Mathematics Education, and being a resident part of the Mathematics Education Unit for one year. We have also developed a specialist mathematics course for Year 13 (age 18 years) school students, which runs throughout the year, and the students get university credit for passing it.

We are also active participants in many activities in the local mathematics education community. Members of the MEU are on the Auckland Mathematics Association (AMA) executive or are otherwise involved in the running of AMA activities, helping in sharing knowledge and making connections between secondary and tertiary mathematics. Other MEU members are actively participating in the organization of the NZ Mathematics Olympiad team, and the setting of national examinations.



A beach in north Auckland

International Visitors

The MEU has been able to attract a large number of internationally respected mathematics education visitors. Some have stayed for just a day or two, and others for up to six weeks. Among those we have been pleased to host in recent years are professors from the following countries:

Africa

Chris Breen, University of Capetown, South Africa

Johann Engelbrecht, University of Pretoria, South Africa

Asia

C. K. Raju, New Delhi., India

Lee Peng Yee, National Institute of Education, Singapore

Australia and New Zealand

Glenda Anthony, Massey University, New Zealand

Alan Bishop, Monash University, Australia

Tony Brown, Waikato University, New Zealand

Megan Clark, Victoria University of Wellington, New Zealand

Derek Holton, University of Otago, New Zealand

Kaye Stacey, Melbourne University, Australia

Jane Watson, University of Tasmania, Australia

Canada

Joel Hillel, Concordia University, Canada

Carolyn Kieran, University of Quebec at Montreal

Susan Pirie, University of British Columbia, Canada

Grant Woods, University of Manitoba

Europe

Mike Askew, King's College London, UK

Rolf Biehler, Kassel University, Germany

Neville Davies, Royal Statistical Society Centre for Statistical Education, UK

Willi Doerfler, University of Klagenfurt, Austria

Koeno Gravemeijer, Freudenthal Institute, The Netherlands

John Howie, University of St. Andrews, UK

Celia Hoyles, Institute of Education, University of London, UK

George Joseph, Manchester University, UK

Christine Keitel, Freie Universität, Berlin, Germany

Colette Laborde, University of Grenoble, France

Steve Lerman, London South Bank University



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DISCLAIMER

Although every reasonable effort is made to ensure accuracy, the information in this document is provided as a general guide only for students and is subject to alteration. All students enrolling at The University of Auckland must consult its official document, the 2007 Calendar of The University of Auckland, to ensure that they are aware of and comply with all regulations, requirements and policies.

Richard Noss, Institute of Education, University of London, UK
Hans Schupp, Universität des Saarlandes, Germany
Rosamund Sutherland, Bristol University, UK
David Tall, Warwick University, UK
Pierre van Hiele, The Netherlands

South America

Maria do Carmo S. Domite, University of Sao Paolo, Brazil

USA

Deborah Ball, University of Michigan, Ann Arbor
Hyman Bass, University of Michigan
Tom Berger, Colby College, Maine
Judith Cederberg, St. Olaf College, Minnesota
Marilyn Frankenstein, State University of New York
James Kaput, University of Massachusetts-Dartmouth
Clifford Konold, University of Massachusetts
Cathy Kessel, University of California
Richard Lesh, Purdue University, Indiana
Mel Nyman, Alma College, Michigan
Tom Sallee, University of California, Davis
Mike Shaughnessy, Portland State University, Oregon
David Smith, Duke University, North Carolina
Al Taylor, University of Michigan



Deborah Ball and Hyman Bass during their visit