Welcome to Waikato

The University of Waikato is ranked in the top 1.1% of universities worldwide and is the university of choice for more than 12,000 students each year.

Established in 1964 as a result of the demands of a local community, the University of Waikato offers a comprehensive range of programmes and attracts outstanding students from the Waikato and Bay of Plenty Regions, from the rest of New Zealand, and from around the world. The University is a vibrant multicultural community providing a high quality student experience in a beautiful park-like campus environment.

Research is the driving force that distinguishes universities from other tertiary institutions, and the researchers and postgraduate students at the University of Waikato are providing unique perspectives on issues of importance to contemporary society and answers to some of the key problems being faced by industries, governments and nations around the world. We have seven research institutes, including a new Institute for Security and Crime Science, which enable our academic staff and postgraduate students to contribute to regional, national and global research.

Our graduates are committed to making a real difference for their employers. The newly implemented Curriculum Design Framework will see the University delivering a more future-focussed curriculum that is responsive to changing student, employer and societal needs. This includes a focus on cultural competency and work-integrated learning opportunities, helping to create work-ready graduates with the skills employers need.

Data from Universities New Zealand and the Graduate Longitudinal Survey continue to demonstrate the value of a university degree. A typical university graduate earns about $1.6 million more over their working life than a non-graduate. Two years after graduation, 80% of graduates said that getting a degree was well worth the time and cost, and graduates expressed high levels of satisfaction with their lives following university.

Whatever your aspirations may be, the University of Waikato provides an outstanding learning environment and we look forward to seeing you on campus.

Professor Neil Quigley
Vice-Chancellor
Welcome to Te Kura Toi Tangata
Faculty of Education

Kia ora koutou katoa. A very warm welcome to all those who are considering postgraduate research studies in Te Kura Toi Tangata Faculty of Education.

The Faculty is committed to making a difference through its research and we see the research of our students as an integral part of this. Whether you are at the masters or doctoral level, a thesis offers you the opportunity to research an area of interest at an advanced level.

The staff that supervise our thesis students are themselves researchers. They are committed to supporting you to making this is a rewarding experience, but also to ensuring that the research you undertake and the report that it culminates in are of a high standard.

We extend a special welcome to our international students and we value the unique contribution each of you makes to the Faculty’s research activities.

Unlike taught papers, a thesis can at times seem a very solitary endeavour. We recognise this and offer opportunities for our postgraduate students to come together. Some of these sessions are designed to provide specific support to those undertaking theses. At other times, it is simply providing a forum for those on a similar journey to share their experiences. I strongly encourage you to avail yourself of these opportunities.
Welcome to the Technology, Environmental, Mathematics and Science Education Research Centre

This handbook provides information about the work and programmes of the Technology, Environmental, Mathematics and Science Education Research Centre at the University of Waikato. The Centre is situated within Te Kura Toi Tangata Faculty of Education.

The Centre is known throughout New Zealand and internationally for its research and scholarship, and for the use of its research in the development of policy, practice, curriculum, resources, assessment and professional development.

The Centre offers opportunities for professional growth for people working in:
• Science Education,
• Technology Education,
• Environmental Education, and
• Mathematics Education.

Our students include practicing teachers, teacher educators, curriculum developers and community educators in New Zealand and from a range of countries in the Pacific Islands, Africa and Asia.

Most are graduates seeking mid-career professional development through advanced study for higher qualifications. Staff and students work together as colleagues in a co-operative and friendly way.

The academic programmes we offer are flexible. Full-time and part-time options are available. Our programmes allow students to specialise in their particular area of interest, to undertake interdisciplinary study, and to learn how to conduct research. Excellent facilities are available in the Centre and at the University. Many courses are available online, so that students can complete a qualification from their own location.

The Centre is keen to host New Zealand Science, Mathematics and Technology Teacher Fellows.

Any practicing teacher interested in this option that provides up to one year of study leave on a project of their choice, and of interest to the Centre, would be welcome to discuss this with Centre staff.

We extend a warm welcome to you to come and join our exciting, vibrant community and make the most of all we offer.

The Centre Team

Mission

The mission of the Centre is to provide national and international leadership, and to conduct research in science, technology, environmental and mathematics education.

The goals of the Centre are to:
• Conduct excellent research,
• Provide research-informed teaching and supervision, and
• Provide national and international professional leadership.
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Note(s): We have endeavoured to ensure that the information in this publication is accurate at the time of printing, 2017. It is subject to a continuous process of review and improvement. Readers should be aware that the 2018 University of Waikato Calendar takes precedence.

The Technology, Environmental, Mathematics and Science Education Research Centre (TEMS Education Research Centre) is the new name for what was previously called the Centre for Science and Technology Education Research (CSTER).
Introduction

The Technology, Environmental, Mathematics and Science Education Research Centre was formed in 1989. It has grown from the Science Education Research Unit, which was started in 1981 by Dr Roger Osborne and Professor Peter Freyberg. The Centre is interdisciplinary in nature and is administered within Te Kura Toi Tangata Faculty of Education.

Research in science, technology, environmental and mathematics education is multi-disciplinary in nature and this is reflected in the diverse range of teaching, research and professional activities conducted within the Centre. The Centre has eight inter-related activities.

Research

The major activity of the Centre is to promote and undertake research into science, technology, environmental and mathematics education. The Centre has an international reputation for conducting research of the highest standard. This is reflected in the publication of research in many major internationally refereed journals such as Research in Science Education, Studies in Science Education, the International Journal of Science Education, Environmental Education Research, the Journal of Technology Studies, the International Journal of Technology and Design Education, and the Journal of Co-operative Education, Mathematics Education Research Journal and Educational Studies in Mathematics. In addition, Centre staff serve as referees and editorial board members for the above journals.

The staff collectively have research expertise that spans the spectrum from early childhood to tertiary teaching, learning and assessment, and represents a range of methodological approaches to research, experience in classroom practice, graduate supervision and contract research. A strength of the Centre is its ability to form teams of staff, students and visitors to conduct research in a wide range of science, technology, environmental and mathematics education areas. Within these teams Centre staff, graduate and postgraduate students, carry out research for:

• Masters and doctoral degrees,
• Contract research for government ministries and other education stakeholders, and
• The pursuit of staff members’ research interests.

The Centre focuses on research which is characterised by:

• Engagement with the community,
• Social construction of learning, and
• A school classroom basis.

Qualifications

The Centre contributes to postgraduate diplomas and masters papers in science, technology, environmental, and mathematics education, and in educational research. Papers are run in a variety of ways including group seminars and online forums for distance students, allowing for active discussion between participants. In addition, supervision is provided for independent study in small research projects, theses and dissertations.
Student support

The Centre offers strong support for students in a number of ways. Student support meetings are held regularly and provide guidance and information on topics of general interest. Significant support is provided across the University for new international students and for research students. The Centre ensures that all students are aware of the support opportunities that are available. An online environment provides easy access to resources and discussions that flow across all members of the Centre, regardless of their location. Students are also included as an integral part of the Centre's social activities.

Educational development

The Centre undertakes development in science, technology, environmental and mathematics education, based where appropriate, on the research findings of the Centre. This includes curriculum development, teacher development, resource development and assessment development.

Professional development

The Centre promotes and supports the professional development of science, technology, environmental and mathematics teachers. It provides a forum for discussions, critiques, seminars, and workshops, as well as opportunities to gain postgraduate qualifications. Staff are also involved with international, national and regional subject associations, and professional bodies, and with contract development activities.

Formulation of national education policy

The Centre contributes to the formulation of national policy in science, technology, environmental and mathematics education. The expertise and experience of the staff and students in research and development enable them to make contributions to the national policy of groups such as the Ministry of Education, through contracts and submissions.

Critical and constructive analysis

The work of the Centre staff and students provides a critique of science, technology, environmental and mathematics education at the local, national and international levels, and suggests ways to improve education in these areas.

Consultancy and liaison

The Centre works on a networking or consultancy basis with other local, national and international science, technology, environmental and education research groups.
Contact details

Further information about the University and Faculties/Schools can be obtained from Te Kura Toi Tangata Faculty of Education Postgraduate Studies in Education Handbook and the 2018 University of Waikato Calendar.

Technology, Environmental, Mathematics and Science Education Research Centre
University of Waikato Private Bag 3105, Hamilton 3240, New Zealand

Location: The University of Waikato, Hamilton
Hillcrest Road (Gate 5), Building TC1.04

Phone: 07 838 4500
Email: teach@waikato.ac.nz
Website: education.waikato.ac.nz/tems

Staff directory

Centre management is comprised of a Director and four research area leaders.

Centre director

Chris Eames BSc, MSc, PhD Waikato

Research area leaders

Science Education
TBA

Technology Education
Louise Milne TTC, MEd, PhD Waikato

Environmental Education
Chris Eames BSc, MSc, PhD Waikato

Mathematics Education
Brenda Bicknell BEd, DipT, MEd, PhD Massey
Research teams

Staff in the Centre’s research teams hold substantive positions in other departments within the University. They are involved in supervising postgraduate research students, teaching in Centre papers, have significant roles in Centre research projects and/or are interested in research in this area.

Science Education

Chris Eames (Leader)   Cathy Buntting
Simon Taylor   Bev Cooper
Carrie Swanson   Bronwen Cowie
Miles Barker

Technology Education

Louise Milne (Leader)   Liz Reinsfield
Wendy Fox   Cathy Buntting

Environmental Education

Chris Eames (Leader)   Miles Barker

Mathematics Education

Brenda Bicknell (Leader)   Ngārewa Hāwera
Judy Bailey   Sashi Sharma
Nigel Calder   Judith Mills
Diana Coben
Qualifications

Degrees and diplomas

The Centre offers postgraduate programmes in science, technology, environmental and mathematics education, and in research methodologies for the following degrees and diplomas:

- Doctor of Philosophy,
- Doctor of Education,
- Master of Science,
- Master of Education and Master of Education (STEM) or (Maths Education),
- Master of Social Science,
- Master of Arts,
- Postgraduate Diploma (Science Education),
- Postgraduate Diploma (Mathematics Education),
- Postgraduate Diploma (Technology Education),
- Postgraduate Diploma (Education),
- Diploma of Applied Science.

The 180-point masters at the University of Waikato means that you can start and finish this internationally recognised postgraduate degree within 18 months.

A masters programme must include an approved research methods paper and a thesis, or dissertation or directed study.

The Diploma of Applied Science is designed for graduates who wish to broaden their qualifications at the undergraduate level, while the three postgraduate diplomas include papers at the graduate or masters level.

Masters degrees

Students studying towards a masters degree taught in science, technology, environmental or mathematics education would normally complete four masters-level papers, followed by a four-paper thesis. Guidelines for the papers are described below under Postgraduate Diplomas. The thesis component is undertaken in science, technology, environmental, or mathematics education.

Postgraduate diplomas

The Postgraduate Diploma requires completion of four masters-level papers. Candidates select two papers from offerings in science, environmental, mathematics or technology education, together with a small research project, and our research methods paper. A typical programme consists of:

- One of Science Education, Technology Education, Mathematics Education or Environmental Education,
- Research Methods (compulsory),
- A Directed Study, and
- One other paper (eg Innovations in Science, Technology or Environmental Education).

Alternatively, one or two masters papers from the Faculties of Education or Science & Engineering can be selected in place of the Centre’s papers.
Research degrees MPhil, PhD and EdD

The MPhil and PhD are research degrees, designed to recognise original contributions to knowledge made while extending one’s research skills under university supervision. The usual level of entry is masters or a good honours degree with an adequate background in the field in which the research is proposed. Both degrees may be pursued full-time or part-time: the MPhil requires the equivalent of one to 1.5 years of full-time research (two to three years part-time), the PhD requires the equivalent of three to four years full-time (five to eight years part-time) and both culminate in the presentation of a thesis embodying the results of the research. The EdD degree is offered through Te Kura Toi Tangata Faculty of Education and comprises course work and a doctoral thesis. Students must complete two compulsory papers in education and two elective papers from a list provided in the 2018 University of Waikato Calendar. To qualify to enrol for the EdD, students must have a bachelors or masters degree with honours, have qualified for the award of a recognised teaching or allied professional qualification, and must produce evidence of competent service as an educational practitioner.

Bachelor Honours level courses

The Centre’s masters courses can be credited towards some honours level bachelor degrees. The Centre Director will be happy to advise interested students which papers may be suited to their needs.

Paper details

The Centre contributes to the following papers for masters degrees and diplomas:

- **MSTE501-18B (NET); 18D Mathematics Education**
- **MSTE502-18A (HAM); 18A (TGA) Acquiring Numeracy: How Thinking Develops**
- **MSTE503-18C (BLK); 18D (BLK) Numeracy in the Classroom: Issues and Practice**
- **MSTE504-18C (BLK) Numeracy Difficulties: Issues and Practice**
- **STER508-18A (NET) Science Education**
- **STER511-18A (NET) Technology Education**
- **STER512-18B (NET) Innovations in Science, Technology and Environmental Education**
- **STER513-18C (HAM) Environmental and Sustainability Education**
- **STER543-18A (HAM) Development Project**
- **DSOE556-18A (HAM) Research Methods for Teachers**
- **DSOE557-18A (HAM); 18B (NET); 18C (HAM) Educational Research Methods**
- **STER590-18C (HAM); 18C (NET); 18D (HAM) Directed Study**
- **STER592-18C (HAM); 18C (NET) Dissertation**
- **STER593-18C Thesis (three-paper thesis)**
- **STER594-18C Thesis (four-paper thesis)**
- **STER600-18C MPhil Thesis**
- **STER900-18C PhD Thesis**

Papers designated (Y) are Mar-Nov, (A) are First Semester Mar-Jun, (B) are Second Semester Jul-Nov, and (C) are variable (but fixed at date of enrolment). All courses designated this way are based in Hamilton or Tauranga. Papers taught wholly online are shown as (NET) (ie B/NET indicates taught online in B Semester). Papers with more than one designation (ie A or C) are offered more than once during the year.
Summer School, distance education, web-supported and web-based courses

The Summer School and web-based (NET) programmes are particularly suitable for students who are unable to attend on-campus classes during the academic year. The Centre currently offers one paper during the University of Waikato Summer School programme (DSOE557-18C).

The Summer School classes are held over two weeks in January and involve further study in the first part of the year. Course assessment is complete by the end of the February 2018. More details about the paper can be found on the following pages.

Papers

DSOE557-18A/C (HAM), 18B (NET) Educational Research Methods
This paper introduces students to the major educational research paradigms, methodologies appropriate to collecting data in schools (including interviews, observations, surveys, case studies), action research, literature reviews, critiquing research, and report writing. It includes consideration of ethical issues in research.

*Paper assessment:* Internal assessment

*Co-ordinator:* Associate Professor Kathie Crocket TTS.10A
*Phone:* 07 838 4500
*Email:* kathie.crocket@waikato.ac.nz

*Note(s):* DSOE557-18C (HAM) is taught partially online. Enrolment in DSOE557-18C (HAM) should be completed two weeks prior to the paper commencing.

MSTE501-18B (NET) – Mathematics Education
This paper is designed to enable teachers to develop their mathematics teaching with learners of all ages. Teachers will be encouraged to engage critically with theory and research in mathematics education, focusing on issues such as communication, assessment, and catering for diverse learners.

*Lecturer:* Dr Brenda Bicknell
*Phone:* 07 838 4466 extn 6971
*Email:* bicknell@waikato.ac.nz

*Lecturer:* Dr Sashi Sharma
*Phone:* 07 838 4466 extn 6298
*Email:* sashi@waikato.ac.nz

*Note(s):* This paper is an approved course for the fee subsidy offered by the Ministry of Education to practising primary and intermediary teachers.
MSTE502-18A (HAM) & 18A (TGA) – Acquiring Numeracy: How Thinking Develops
This paper looks at how students’ thinking becomes increasingly sophisticated as their mathematical understanding grows. A particular focus of the paper is in the Numeracy Development Projects and the use of diagnostic interviews to explore various aspects of students’ mathematical thinking and understanding.

Lecturer: TBA (Hamilton)
Lecturer: Dr Nigel Calder
Phone: 07 377 512 (Tauranga)
Email: ncalder@waikato.ac.nz
Note(s): This paper is an approved course for the fee subsidy offered by the Ministry of Education to practising primary and intermediary teachers.

MSTE503-18C/D (BLK) – Effective Practice in the Mathematics Classroom
This paper complements the Numeracy Development Project (NDP) professional development programme. The paper provides an in-depth focus on: understanding students’ learning and thinking strategies in mathematics; the number framework for developing students’ number knowledge and strategies; formative assessment tools to enhance quality mathematics teaching; and national and international developments in mathematics education. There will be an emphasis on personal mathematics content knowledge and pedagogical content knowledge in mathematics. The paper is an approved course for the fee subsidy offered by the Ministry of Education to practising teachers.

Lecturer: Judith Mills
Phone: 07 838 4466 extn 7872
Email: judith@waikato.ac.nz
Lecturer: TBA (Hamilton)
Note(s): The 18C(BLK) occurrence is for practising teachers or students who have completed the TEMS324 paper. Students who are not practising teachers or have not completed the TEMS324 paper would be required to enrol in the 18D(BLK) occurrence.
STER508-18A (NET) Science Education
This paper aims to provide an overview of current research and development in learning, teaching and assessment in science education in New Zealand and internationally. The synthesis of research findings with classroom practice is a goal of the paper and so it is expected that students will participate in debate and discussion. The modules within the course examine current purposes and aims for science education, views of the nature of science, views of learning in science education, the nature of effective pedagogies for science education and current issues in science education. Topics include:

Purposes of science education
The paper will begin by considering past and present purposes for science education in New Zealand and internationally.

The nature of science and science education
This module focuses on debates about the nature of science itself through an introduction to the work of past and current philosophers of science, such as, Bacon, Popper, Kuhn and Feyerabend with a view to considering how their perspectives are reflected in science education. The use of material from the history of science for teaching will be discussed.

Views of learning informing science education
This module builds from the notion that students come to class with their own ideas about the natural world to explore current theories about how they might go about learning science.

Effective pedagogies in science education
This module examines the ways in which students may be helped to more effectively learn science, to learn about the nature of science and to develop scientific skills and attitudes. It also examines the merits of a variety of ways in which that learning can be assessed.

Current issues in science education
This module focuses on current issues in science education. Examples include the use of ICT, informal science education, culture and gender in science and science education.

Course assessment: The course is fully internally assessed by means of three assignments

Required text: Students will be provided with references and extensive course material

Co-ordinator: Dr Chris Eames

Phone: 07 838 4357

Email: c.eames@waikato.ac.nz
STER511-18A (NET) Technology Education
This paper aims to provide an understanding of the current issues in technology education research and development. The course consists of three modules:

The nature of technology and technology education. The history and philosophy of technology will be considered in relation to technology education. Different views of technology and technology education will be examined, including teacher and student perceptions. The aims and goals of technology education will also be considered.

Learning and curriculum in technology education. Learning theories and their implications for learning in technology education will be considered. The interaction of knowledge, processes and skills will be explored related to research on technological awareness and knowledge, and problem-solving in technology education. The social construction of knowledge and its relationship with learning in technology will be emphasised. Current curriculum discussions about technology education in New Zealand and internationally will be related to a historical perspective of curriculum development, as well as recent technology curriculum innovations.

Issues in technology education. The implications of technology education will be considered in terms of implementation, management at department and school level educational settings, inclusiveness, and teacher development. Included in this will be issues related to subcultures and innovation. Issues related to assessment in technology education are considered.

Course assessment: The course is fully internally assessed by means of three assignments
Required text: Students will be provided with references and extensive course material
Co-ordinator: Dr Louise Milne TC.4.05
Phone: 07 838 4466 extn 4680
Email: louisem@waikato.ac.nz

STER512-18B (NET) Innovations in Science, Technology or Environmental Education
This paper aims to help teachers of science, technology or environmental education to develop their knowledge of science, technology or the environment and to consider how this knowledge might be integrated into educational activities. Students will develop an understanding of the wider issues of curriculum and assessment innovation.

The paper is taught online by a combination of set readings, online discussions and assignment completions. This paper consists of three parts:

• Whole class exploration of current ideas about educational innovation, particularly in regard to curriculum and assessment. This will involve reading set texts and participating in online discussion with the tutors and classmates,
• Individual independent research on a topic of your choice in a knowledge area in science, technology or environment/sustainability. You will be assigned a tutor to work one-on-one with through this part, and
• Individual work to design an educational innovation using your new found knowledge in your topic area.

This part will again be mentored by your individual tutor.

Course assessment: The course is fully internally assessed by means of assignments
Required texts: Students will be provided with references and extensive course material
Co-ordinator: Dr Chris Eames TC1.04B
Phone: 07 838 4357
Email: c.eames@waikato.ac.nz
STER513-18C (HAM) Environmental and Sustainability Education
This paper aims to provide an opportunity for in-service and pre-service teachers, and community educators to enhance their knowledge and skills in environmental/sustainability education. During this paper students will have an opportunity to:

- Develop knowledge of national and international research, policy and practice in environmental and sustainability education,
- Develop an awareness of the principles and theoretical ideas which underpin environmental and sustainability education practice in schools and/or the community,
- Develop an understanding of the links of environmental and sustainability education with other bodies of knowledge (eg indigenous knowledges, gender ideas, philosophy/values etc),
- Develop a critical understanding of policies for environmental and sustainability education in New Zealand, and
- Develop an understanding of the teaching and learning approaches that are appropriate to environmental and sustainability education practice.

**Paper assessment:** The course is fully internally assessed by means of assignments.

**Required texts:** Students will be provided with references and extensive course material at the beginning of the paper.

**Co-ordinator:** Dr Chris Eames  TC1.04B
**Phone:**  07 838 4357
**Email:** c.eames@waikato.ac.nz
**Dates/times:** 23-24 February 2018, on campus 9am – 3pm, followed by online supported learning at your place until June 2018.

STER543-18A Development Project
The overall aim of the Development Project is to provide a student with the opportunity to develop a project incorporating some specific aspect of STEM subject(s) and evaluate its effectiveness with students in classrooms. The specific attributes that successful students will acquire are:

- Ability to plan and execute a small implementation project under supervision,
- Ability to work independently to interrogate a topic or subject,
- Obtain specialised knowledge in a STEM subject or a combination thereof.

**Paper assessment:** The course is fully internally assessed by means of assignments.

**Required texts:** Students will be provided with references and extensive course material at the beginning of the paper.

**Co-ordinator:** Dr Chris Eames  TC1.04B
**Phone:**  07 838 4357
**Email:** c.eames@waikato.ac.nz
**Dates/times:** TBA
STER590-18C (NET) & 18D (NET) Directed Study

This paper aims to provide students with an opportunity to work one-to-one with a supervisor to undertake a research study in an area of interest to them, within the areas of science, technology, environmental or ICT education or a closely related area. This study will normally take the form of a small-scale research project involving data collection, but could take the form of an extensive review of the research literature on a particular topic, or the trial and evaluation of an aspect of education. During the paper, students will have opportunities for some or all of the following:

- Develop an understanding of an area of educational research,
- Frame a research question to be investigated,
- Develop skills in reviewing and critiquing educational research literature,
- Develop skills in the use of one data generation method,
- Analyse data,
- Construct an argument based on data that has been collected and analysed, and
- Discuss research findings or the problem of interest in relation to relevant literature.

This paper can be taken completely online, completely face-to-face or through a mix of these modes. Students at a distance to the University will typically work with a supervisor through email and phone calls, with possible, but not essential, occasional face-to-face sessions.

**Paper assessment:** The directed study report will normally comprise a document in report format. The exact nature of the product of the directed study should be negotiated and agreed with the supervisor of the study. Typically, the study will be a small-scale research project or an in-depth literature review. The word limit for the report is between 8,000-10,000 words.

**Dates/Times:** Times may be negotiated.

**All Centre staff are available for the supervision of projects. Initial contact should be made with:**

**Co-ordinator:** Dr Chris Eames TC1.04B

**Phone:** 07 838 4357

**Email:** c.eames@waikato.ac.nz
STER593-18C and STER594-18C Masterate Theses
The Centre offers theses equivalent to three (eg STER593) or four (STER594) papers at the masterate level, in accordance with the calendar regulations. In exceptional circumstances, smaller dissertations equivalent to one paper (STER591) or two papers (STER592) may be offered.
Thesis work involves study over one year (full-time) or two years (part-time) on a research topic of interest. The topic is negotiated with, and supervised by, at least one member of the Centre staff.

All Centre staff are available for the supervision of projects. Initial contact should be made with:
Co-ordinator: Dr Chris Eames  
Phone: 07 838 4357  
Email: c.eames@waikato.ac.nz

STER600-18C MPhil Thesis
The Centre offers an MPhil thesis option over one year (full-time) or two years (part-time) for study on a research topic. This option is suitable to those students who already hold an honours degree (masters or bachelors degree with honours) who wish to undertake a short research study, rather than a PhD. Students may be encouraged to enrol in the MPhil option and subject to satisfactory performance upgrade to a PhD. Approval to undertake this programme is required from Centre staff.
The research topic is negotiated with, and supervised by, at least one member of the Centre staff.

All Centre staff are available for the supervision of projects. Initial contact should be made with:
Co-ordinator: Dr Chris Eames  
Phone: 07 838 4357  
Email: c.eames@waikato.ac.nz

STER900-18C PhD Thesis
The Centre offers a PhD thesis option over three years (full-time) or five to six years (part-time) for study on a research topic. This option is open to those students who already hold an honours degree (masters or bachelors degree with honours) who wish to undertake an original research study.
Approval to undertake this programme is required from Centre staff and the University Postgraduate Studies Committee. The research topic is negotiated with, and supervised by, at least two members of the Centre staff.

All Centre staff are available for the supervision of projects. Initial contact should be made with:
Co-ordinator: Dr Chris Eames  
Phone: 07 838 4357  
Email: c.eames@waikato.ac.nz
Examples of possible programmes for students

The Centre has a strong desire to provide flexible learning, tailored to the individual needs of students. The variety of papers and options open to you for research and study towards a higher degree or diploma are many and varied. Outlined below are some options chosen by teachers and students to further their qualifications. Some programmes combine papers from the Centre with papers from other Faculties of study.

Allan is a graphics and technology teacher at a secondary school. He successfully applied for a PPTA study award to complete a full-time Postgraduate Diploma in Technology Education, as follows:

DSOE557 Educational Research Methods  
STER511 Technology Education  
STER513 Innovations in Science, Technology and Environmental Education  
STER590 Directed Study

Jo is a BEd and is a teacher of Year 2 children in a primary school. She has completed a Postgraduate Diploma in Mathematics Education part-time and received a 50% fee subsidy from the Ministry of Education for all three of her mathematics education courses, as follows:

MSTE503 Numeracy in the Classroom: Issues and Practice  
MSTE502 Acquiring Numeracy: How Thinking Develops  
MSTE504 Numeracy Difficulties: Issues and Practice  
STER590 Directed Study (her topic was: Multiplicative and Division Problem-Solving of Six and Seven Year-Olds)

Diana has a BSc in Biology and is interested in gaining further qualifications in conservation science and environmental education. She has been working for the Department of Conservation for 10 years. Her proposed programme for a full-time Master of Education is:

BIOL572/573 Animal Behaviour and Conservation  
DSOE557 Educational Research Methods  
STER513 Environmental and Sustainability Education  
STER593 Thesis on the Educational Impact of Displays on Visitors to National Park Centres

Harry is an experienced secondary science teacher who has a BSc in physics and a GradDipT and is interested in gaining further professional qualifications. Currently he is unsure about committing himself to a full masterate programme because of family commitments. He undertakes the following programme for a Postgraduate Diploma part-time over two years:

DSOE557 Educational Research Methods  
STER508 Science Education  
STER511 Technology Education  
STER590 Directed Study on the Introduction of Electronics in Schools

Hone is a primary teacher with a BEd and is working with bilingual students. He is interested in gaining qualifications in science education and Māori education. His proposed programme for a Master of Education is:

PCSS502-17 Kaupapa Māori Research  
PRO523 Māori Education Policies  
STER508 Science Education  
STER593 Thesis on the Learning of Science in a Kura Kaupapa Programme
David has a BSocSc in Sociology and Education Studies. He has been working as a tutor in adult literacy and numeracy. He completed a Postgraduate Diploma in Education, with a specialisation in Adult Literacy and Numeracy Education as follows:

- DSOE557  Educational Research Methods
- MSTE502  Acquiring Numeracy: How Thinking Develops
- MSTE504  Numeracy Difficulties: Issues and Practice
- ALED525  The Context of Adult Literacy and Numeracy

Meri has a BTchg(Hons) and is a teacher of mathematics in a secondary school. She has completed a Master of Education part-time, as follows:

- MSTE501  Mathematics Education
- MSTE503  Numeracy in the Classroom: Issues and Practice
- DSOE592  Dissertation (her topic was: Exploring the Mental Strategies of Year 9 Students)

Tui completed her Bachelor of Teaching online through a Mixed Media Programme. She really misses her online learning connections and is keen to continue to learn from her rural base while teaching full-time. Her proposed programme for a Master of Education part-time over four years is:

- PCSS510  Gender, Race and Education
- STER513  Environmental and Sustainability Education
- DSOE557  Educational Research Methods
- STER593  Thesis on Māori Values in Environmental Education
MPhil

Jane is an experienced biology teacher. She has a BSc(Hons) and GradDipT and five years of classroom experience. She is interested in improving her classroom practice. Jane enrolls in a part-time MPhil over two years and her thesis project consists of a comparative study investigating the implementation of a novel teaching style including extensive use of analogies.

PhD

Michael is an experienced chemistry teacher. He has a BSc and MEd and many years of classroom experience. He is interested in a major research project to improve the teaching of abstract chemical concepts in atomic structure and bonding. He also wishes to improve his future prospects by obtaining an internationally-recognized higher degree. He feels this will open up overseas career opportunities. He enrolls in a part-time PhD over five years; his thesis project consists of a qualitative inquiry investigating students’ understanding of atomic structure.

Li has recently completed her masters degree and is lecturing at a university in her country. She is interested in improving her pedagogy in teaching technology, and believes there is a gap in the research in this area. She gains a scholarship to study at Waikato, and enrolls for three years of full-time PhD study. Shortly after successfully defending her proposal, she returns to her country to conduct an intervention and collect her data, which is relevant to the position she will return to upon completion of her studies.
Research activities

The Centre has been recently involved in the following research:

Using multiplication and division contexts to enhance young children’s part-whole thinking in mathematics

This study aims to provide young children from diverse cultures with learning opportunities and challenges within the context of multiplication and division. The goal is to help children develop greater understanding of part-whole relationships in mathematics.

The project challenges teachers and children to work with mathematics problems that are not usually given to five and six year-olds. The purpose is to expose children to situations and problems where they work with ‘groups of’ quantities such as pairs of socks (groups of two) and fingers on a hand (groups of five).

Research Team: Brenda Bicknell and Jenny Young-Loveridge.

Using mobile learning in free-choice educational settings to enhance ecological literacy

This Teaching and Learning Research Initiative-funded research addresses the intersection of mobile learning, free-choice learning in science and sustainability education, and ecological literacy. It examines the outcomes of an intervention using mobile learning to enhance primary school teaching and learning during a unit on marine reserves. The unit will include a visit to Goat Island marine reserve and its associated Marine Discovery Centre. The study will examine how mobile learning in a free-choice learning setting influences teaching and learning for students, their teacher and their parents, and promotes ecoliteracy outcomes, developing the knowledge, attitudes and behaviours for a sustainable future.

Research Team: Dr Chris Eames and Dr Claudio Aguayo.
Staff profiles

Chris Eames was appointed Director of the TEMS Centre in 2017. He teaches and supervises research students in environmental education/education for sustainability, and science education. He has conducted research and evaluation projects for the Ministry of Education, and the Teaching and Learning Research Initiative in the past few years. His current research interests focus on whole school approaches and action learning in sustainability. He is an executive member of the New Zealand Association for Environmental Education (NZAEE) and committee member for the Waikato branch. He is Associate Editor of the Australian Journal of Environmental Education, on the editorial board of the Journal of Environmental Education and acts as a reviewer for Environmental Education Research. Chris also has extensive experience teaching biochemistry and microbiology at the tertiary level, and in liaison with science and technology companies and biology secondary teachers. He is an Honorary Life member of the New Zealand Association for Co-operative Education (NZACE). His main research interests are in all aspects of environmental and sustainability education, and in secondary and tertiary science/biology.

Selected recent publications


Room: TC1.04B
Phone: 07 838 4357
Email: c.eames@waikato.ac.nz
URL: education.waikato.ac.nz/about/faculty-staff/?user=biol2120
**Brenda Bicknell,** an Associate Director of the TEMS Centre, is an Associate Professor in mathematics education. Brenda has taught in postgraduate and undergraduate initial teacher education programmes at Waikato and Massey University. Prior to this, she has taught at all levels of the school sector and in a variety of school settings. She has been president of a local mathematics association and worked for a seconded period as an Education Review Officer. Brenda’s research has focused primarily on mathematics and gifted and talented education. More specifically, she has worked with teams of researchers on national research that has examined the state and effectiveness of gifted education in NZ, and numeracy and school transition. Other research has addressed mathematics and language, challenging tasks, multiplication and division, and subject matter knowledge in teaching mathematics. Most recently, Brenda worked with A/Prof Jenny Young-Loveridge on a TLRI-funded project that explored the use of multiplication and division contexts with young children. She uses primarily design research and case study methodologies and qualitative methods.

Brenda is also the Associate Dean Academic for the Faculty of Education with responsibility for overseeing academic programmes and developments, quality assurance, and strategic planning.

**Selected recent publications**


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Room: TL4.05  
Phone: 07 838 4466 etxn 6971  
Email: bicknell@waikato.ac.nz  
URL: education.waikato.ac.nz/about/faculty-staff/?user=bicknell
Louise Milne, an Associate Director of the TEMS Centre, is a senior lecturer in technology education since 2013, and lecturer at the Faculty of Education since 2004. Louise teaches primary pre-service teachers in both graduate and undergraduate papers in Hamilton, Tauranga and in the on-line versions of these papers. She has an extensive involvement in technology education beginning in 1997 when she was seconded to the university to join the first Ministry of Education technology contract introducing the new curriculum into primary, intermediate schools and secondary schools. Since then she has been involved with a wide range of Ministry led projects including Technology Education for Year 7 & 8 teachers, planning and assessment in technology education, Biotechnology in the New Zealand Curriculum and more recently Education Outside the Classroom.

Prior to this Louise was a primary school teacher working in both New Zealand and Australia, with a special interest in junior primary students. She holds a Higher Diploma of Teaching (Primary), a Master of Education (Hons) and a PhD from the University of Waikato. Louise’s PhD investigated Education Outside the Classroom and how this supports five-year-old students studying technology education.

Selected recent publications


Room: TC4.05
Phone: 07 838 4466 extn 4680
Email: louisem@waikato.ac.nz
URL: education.waikato.ac.nz/about/faculty-staff/?user=louisem
Wendy Fox, is an Associate Professor at the University of Waikato. She is a primary trained teacher and taught at the University of Canterbury’s College of Education, in Technology Education, primary and secondary, Professional Inquiry Studies and Inquiry Learning from 1997-2017. Research special interests include authentic learning in technology education, the role and nature of effective conversation in learning and teaching and learning approaches for the 21st Century. She has presented regularly at PATT and other international conferences and is published in a range of journals and books in the field of technology education. Wendy has been chair of the Technology Education New Zealand (TENZ Council) since 2006 but has recently stepped aside to concentrate on her role as convenor of the 2017 TENZ/ICTE conference.

Selected recent publications


Room: TC1.04A
Phone: 07 838 4466 extn 7880
Email: wfoxturn@waikato.ac.nz
URL: education.waikato.ac.nz/about/faculty-staff/?user=louisem
Research area teams

Staff in the Centre's research area teams hold substantive positions in other departments within the University. They are involved in supervising postgraduate research students, teaching in Centre papers, have significant roles in Centre research projects and/or are interested in research in this area. The URL for the profile of each researcher is listed beside their names below.

Science education
Anne Hume (Leader)  education.waikato.ac.nz/about/faculty-staff/?user=annehume
Miles Barker  education.waikato.ac.nz/about/faculty-staff/?user=mbarker
Simon Taylor  education.waikato.ac.nz/about/faculty-staff/?user=simont
Cathy Buntting  education.waikato.ac.nz/about/faculty-staff/?user=buntting
Bev Cooper  education.waikato.ac.nz/about/faculty-staff/?user=bcooper
Bronwen Cowie  education.waikato.ac.nz/about/faculty-staff/?user=bcowie

Technology education
Louise Milne (Leader)  education.waikato.ac.nz/about/faculty-staff/?user=louisem
Wendy Fox  education.waikato.ac.nz/about/faculty-staff/?user=wfoxtturn
Liz Reinsfield  education.waikato.ac.nz/about/faculty-staff/?user=reinsl
Cathy Buntting  education.waikato.ac.nz/about/faculty-staff/?user=buntting

Environmental education
Chris Eames (Leader)  sci.waikato.ac.nz/about-us/people/biol2120
Miles Barker  education.waikato.ac.nz/about/faculty-staff/?user=mbarker

Mathematics education
Brenda Bicknell (Leader)  education.waikato.ac.nz/about/faculty-staff/?user=bicknell
Judy Bailey  education.waikato.ac.nz/about/faculty-staff/?user=jlbailey
Nigel Calder  education.waikato.ac.nz/about/faculty-staff/?user=ncalder
Diana Coben  education.waikato.ac.nz/about/faculty-staff/?user=dccoben
Ngārewa Hāwera  education.waikato.ac.nz/about/faculty-staff/?user=ngarewa
Sashi Sharma  education.waikato.ac.nz/about/faculty-staff/?user=sashi
Judith Mills  education.waikato.ac.nz/about/faculty-staff/?user=judith
Current graduate research

The Centre has a large number of graduate students working on a remarkable variety of interesting research projects either by distance or in residence.

Current doctoral students in the Centre

<table>
<thead>
<tr>
<th>Name</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Debby Bandele (PhD)</td>
<td>Environmental literacy of pre-service teachers.</td>
</tr>
<tr>
<td>Chandan Boodhoo (PhD)</td>
<td>Assessment in technology education in Mauritius secondary education.</td>
</tr>
<tr>
<td>Jared Carpendale (PhD)</td>
<td>Addressing Senior Physics students’ misconceptions by enhancing the PCK around Physics Education of Junior Science Teachers’ using CoRE Design.</td>
</tr>
<tr>
<td>Tatiana Kalnins (PhD)</td>
<td>Whole school approaches to EFS.</td>
</tr>
<tr>
<td>John Lockley (PhD)</td>
<td>Teacher professional development and curriculum development in education for sustainability.</td>
</tr>
<tr>
<td>Judith Mills (PhD)</td>
<td>Improving the pedagogical content knowledge of teachers to enable confidence in providing quality classroom mathematics programmes.</td>
</tr>
<tr>
<td>Kelvin Mills (EdD)</td>
<td>The use of numeracy in the workplace by toolmakers.</td>
</tr>
<tr>
<td>Cheryl Mitchell (EdD)</td>
<td>Enhancing the experiences of young Māori women in STEM.</td>
</tr>
<tr>
<td>Bruce Moody (PhD)</td>
<td>Students’ learning about proportional thinking.</td>
</tr>
<tr>
<td>Fariba Mostafa (PhD)</td>
<td>Use of social media in teacher professional learning in environmental education.</td>
</tr>
<tr>
<td>Regan Pretorius (EdD)</td>
<td>Exploring the culturally responsive pedagogies for the post-school transition of technology students.</td>
</tr>
<tr>
<td>Sela Tapa’atautai</td>
<td>Faiako Ma’a Tonga: Conceptions of professional attitude development and implications for teacher education in Tonga.</td>
</tr>
<tr>
<td>Imran Tufail (PhD)</td>
<td>Pedagogical content knowledge of Chemistry teachers in New Zealand high schools.</td>
</tr>
<tr>
<td>Damon Whitten (PhD)</td>
<td>Understanding the role of adult learners’ beliefs about mathematics: The impact of an intervention designed to challenge negative beliefs.</td>
</tr>
</tbody>
</table>
Current masters students in the Centre

Steven Awape  Exploring quality of mathematics teaching and learning in secondary schools in Papua New Guinea.

Surette du Plessis  Assessing secondary school students’ beliefs and attitudes towards statistical literacy.

Jim Guffey  Teachers’ perceptions of developing student creativity.

Helena Kara  Mathematics for Māori students in mainstream settings.

Jay Mackenzie  Secondary mathematics teachers’ perspectives on the use of visual representations including manipulatives to teach multiplicative strategies.

Jo Matthews  The mathematics thinking of Year 3 students in relation to National Standards.

Christine Murphy  Perceptions and challenges of modern learning practice.

Jo Thompson  Sustainability education through a place-responsive journey.

Helen Twentyman  The impact of integrating mathematics and technology on students’ attitudes towards mathematics.

Ben Wood  Integrating science and sustainability learning into outdoor education camps.
Recent graduate research

Recent PhD theses
Mathew Tiju Thomas (PhD)  Implementation of STEM in schools.
Sangion Tiu (PhD)  Environmental policy in Papua New Guinea.
Nelson Cyril (PhD)  Models of acid-based reactions.
Farshad Hashemzadeh (PhD)  Environmental education in secondary schools in Iran.
Nhung Nguyen (PhD)  Enhancing flexible and constructivist learning by integrating information and communication technology.
Susan Pudin (PhD)  Community-based sustainability education in Sabah.
Claudio Aguayo (PhD)  Environmental education using ICT in Chilean communities.
Vicent Anney (PhD)  Professional development approaches for science and mathematics teachers in Tanzania.
Wendy Fox-Turnbull (PhD)  Using autophotography to investigate technology education.
Dilani Gedera (PhD)  An activity theory analysis of mediational engagement with E-learning activities.

Recent masters theses
Valerie Bianchi  Conservation education.
Kathy Broadhead  Public perceptions of sharks.
Anita Croft  Environmental education in early childhood.
Thea de Petris  Kids Greening Taupo.
Osamah Almaghlouth  ICT in Saudia Arabia schools.
Nicholas Bowskill  Success and failure in technology education.
Joint publications

It is encouraged within the Centre to publish research outcomes and present at conferences during the research process. For students this is most commonly done jointly with supervisors, and resources are provided to students to enable them to achieve these research dissemination goals.

Some recent examples of joint publications and presentations are:


Professional development

The Centre has a strong commitment to professional development. While the Centre's teaching of courses and supervision of research is one form of professional development, and the involvement in development contracts is another, the Centre is also involved with other activities that assist professional development.

The Centre conducts a series of Autumn and Spring Seminar presentations by staff in areas of their current research. A conference is held each year for doctoral and masters students to present their research; and study groups are supported by the Centre.

Spring and Autumn seminar series

In recent seminar series, the following presentations were made:

Chris Eames  
Mobile Learning and Free Choice Educational Settings: Initial Data from a TLRI Project

Simon Taylor  
Flexible Learning Spaces in Secondary Science

Carrie Swanson  
Exploring Science Through Drama: Taking a Closer Look at Conceptual Change, Buoyancy and Literacy in Science

Chris Eames  
(RE)-Creating a National Strategy for Environmental Education in New Zealand

Garry Falloon  
The Use of Apps in Maths Education

Jenny-Young Loveridge  
Reflections on a Career in Mathematics Education Research
Graduate conference

The Centre holds an annual graduate conference to showcase student work and allow students to gain practice in presenting their work. The presenters at the most recent conference included:

Elizabeth Reinsfield
Teachers’ Perceptions of the Technology Curriculum: The “So What?” of Meaning-Making and Knowledge for Practice

Chandan Boodhoo
Design and Technology Teachers’ Perspectives of Assessment for Learning

Sela Tapa’atoutai Teisina
In Search for a Conceptual Framework: Reviewing of Literature

Fariba Mostafa
Teachers’ Perceptions of Professional Learning Through Social Media in Environmental Education

Oluwaseun Deborah Bandele
Is Environmental Education Developing the Environmental Literacy of Pre-Service Teachers?

‘Elisapesi Hepi Havea
Climate Education in Tongan Secondary Schools

Jared Carpendale
Investigating PCK Developments for Teaching Electricity and Magnetism Using Core Design
Consultancy and professional activities

Professional activities

Many staff hold leadership positions in relevant professional associations, serve on the editorial boards of journals, review papers for conferences and journals, work with fellow experts on curriculum development and consult on educational projects both in New Zealand and overseas.

Liaison

Centre staff liaise both nationally and internationally with a number of groups including the Ministry of Education, the New Zealand Council for Educational Research, the Royal Society, APEID/UNESCO, ICMI, IASE, New Zealand Science Teachers’ Association, Technology Education New Zealand, the National Education for Sustainability Team, ITEA and other centres, for example, in Leeds, London, Reading and Melbourne.

Teacher fellows

The Centre regularly hosts teachers for Royal Society Teacher Fellowships (royalsociety.org.nz) and other scholarships.

New Zealand Science, Mathematics and Technology Royal Society Teacher Fellows

<table>
<thead>
<tr>
<th>Year</th>
<th>Fellows</th>
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<tbody>
<tr>
<td>2004</td>
<td>Mary McPherson</td>
</tr>
<tr>
<td>2005</td>
<td>Marianne Robertson and Kathy Paterson</td>
</tr>
<tr>
<td>2006</td>
<td>Barbara Ryan and Sara Loughnane</td>
</tr>
<tr>
<td>2008</td>
<td>John Dudli, Jenny Mangan, Debra Leong and Colin Milne</td>
</tr>
<tr>
<td>2010</td>
<td>Alison Basel</td>
</tr>
<tr>
<td>2012</td>
<td>William Van Zyl</td>
</tr>
</tbody>
</table>

We invite teachers interested in applying for a Fellowship to discuss having the Centre as a host or co-host.

Centre visitors

The Centre is pleased to host international and national visitors who may be on study leave, or academics who have a research agenda.

Participating schools 2017

Centre staff are grateful for the help and support of the staff and students from New Zealand schools who were involved in research with the Centre in 2017.