THE UNIVERSITY OF
WAIKATO
Te Whare Wānanga o Waikato

2017 Handbook
Technology, Environmental, Mathematical and Science Education Research Centre

TE KURA TOI TANGATA
FACULTY OF EDUCATION

Welcome to Waikato

The University of Waikato is one of the world's leading universities, and 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 is a world-ranked institution providing state-of-the art facilities for staff and students. The recently completed Law Building and award-winning Student Centre provide excellent spaces for teaching and learning.

Research is the lifeblood of the University and we continue to produce research and researchers who are providing answers to some of the key problems being faced by industries, governments and nations around the world. We have six research institutes which enable our postgraduate students to contribute to regional, national and global research.

Our graduates are committed to making a real difference for their employers. Our Curriculum Enhancement Programme will see us designing and delivering a more future-focused curriculum that is responsive to changing student, employment and societal needs. This includes components that mirror real-life situations, which helps create graduates who are work-ready and attractive to employers.

Data released in early 2016 by Universities New Zealand show the value of investing in a degree; a typical graduate earns about $1.6 million more over their working life than a non-graduate, and those with masters or honours degrees were earning about 9% more than bachelor level, and those with a PhD were earning 22% more than masters or honours level.

Whatever your journey, 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.

Professor Roger Moltzen
Dean, Te Kura Toi Tangata Faculty of Education

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. Fulltime 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.

Contents

Introduction	4
Contact details	6
Staff directory	6
Qualifications	8
Papers	10
Research activities	20
Staff profiles	22
Research area teams	26
Current graduate research	27
Recent graduate research	29
Joint publications	31
Professional development	33
Consultancy and professional activities	36

Note(s): *We have endeavoured to ensure that the information in this publication is accurate at the time of printing, 2016. It is subject to a continuous process of review and improvement. Readers should be aware that the* 2017 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 *2017 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: tems@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

Anne Hume BSc *Auckland*, Dip Ed Studies, DipT, MEd, PGCertTT, EdD *Waikato*

Research area leaders

Science Education

Anne Hume BSc *Auckland*, Dip Ed Studies, DipT, MEd, PGCertTT, EdD *Waikato*

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

Anne Hume (Leader)
Miles Barker
Cathy Buntting
Bev Cooper
Bronwen Cowie
Alister Jones
Kathy Saunders

Technology Education

Louise Milne (Leader)
Cathy Buntting
Richard Edwards
Mike Forret
Alister Jones
John Lockley
Louise Milne
Judy Moreland

Environmental Education

Chris Eames (Leader)
Miles Barker

Mathematics Education

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

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 fulltime or part-time: the MPhil requires the equivalent of one to 1.5 years of fulltime research (two to three years part-time), the PhD requires the equivalent of three to four years fulltime (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 *2017 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:

MSTE501-17B (NET); 17D Mathematics Education

MSTE502-17A (HAM); 17A (TGA) Acquiring Numeracy: How Thinking Develops

MSTE503-17C (BLK); 17D (BLK) Numeracy in the Classroom: Issues and Practice

MSTE504-17C (BLK) Numeracy Difficulties: Issues and Practice

STER508-17A (NET) Science Education

STER511-17A (NET) Technology Education

STER512-17B (NET) Innovations in Science, Technology and Environmental Education

STER513-17C (HAM) Environmental and Sustainability Education

STER543-17A (HAM) Development Project

DSOE556-17A (HAM) Research Methods for Teachers

DSOE557-17A (HAM); 17B (NET); 17C (HAM) Educational Research Methods

STER590-17C (HAM); 17C (NET); 17D (HAM) Directed Study

STER592-17C (HAM); 17C (NET) Dissertation

STER593-17C Thesis (three-paper thesis)

STER594-17C Thesis (four-paper thesis)

STER600-17C MPhil Thesis

STER900-17C 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 two papers during the University of Waikato Summer School programme (STER513-17C and DSOE557-17C).

The Summer School classes are held over one or two weeks in January and involve further study in the first half of the year. Course assessment is usually during or by the end of the First Semester. More details about each paper can be found on the following pages.

Papers

DSOE557-17A/C (HAM), 17B (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 Garry Falloon* *TL.3.13*
Phone: *07 838 4466* *extn 6553*
Email: *fallong@waikato.ac.nz*
Note(s): *DSOE557-17C (HAM) is taught partially online. Enrolment in DSOE557-17C (HAM) should be completed two weeks prior to the paper commencing.*

MSTE501-17B (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.*

MSTE502-17A (HAM) & 17A (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.*

MSTE503-17C/D (BLK) – Numeracy in the Classroom: Issues and Practice
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 17C(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 17D(BLK) occurrence.*

MSTE504-17C (BLK) – Numeracy Difficulties: Issues and Practice
This paper is for numeracy educators and those working with learners of all ages experiencing difficulties in numeracy/mathematics. The paper critically examines research and theory on the causes of these difficulties, as well as focusing on the assessment, diagnosis and remediation. The paper considers broader contextual issues within which the practice of diagnosing and remediating numeracy difficulties sit.

Lecturer: *Associate Professor Jenny Young-Loveridge*
Phone: *07 838 4466* *extn 4353 (Hamilton)*
Email: *educ2233@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.*

MSTE590-17A/C (HAM), 17B (TGA), 17C/S (NET) – Directed Study **30 points**

MSTE592-17A/C (HAM), 17B (TGA), 17C (NET) & 17Y (BLK) – Dissertation **60 points**

STER508-17A (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 Kathy Saunders*	*TL.4.13*
Phone:	*07 838 4466*	*extn 7733*
Email:	*kathy@waikato.ac.nz*	

STER511-17A (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*

STER512-17B (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*

STER513-17C (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*
Dates/times: *24-25 February 2017, on campus 9am – 3pm, followed by online supported learning at your place until June 2017.*

STER541 Research Methods in Science, Mathematics and Technology Education
This paper will not be offered in 2017.

STER543-17A 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*
Dates/times: *TBA*

STER590-17C (NET) & 17D (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*

STER593-17C and STER594-17C 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 (fulltime) 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* *TC1.04B*
Phone: *07 838 4357*
Email: *c.eames@waikato.ac.nz*

STER600-17C MPhil Thesis
The Centre offers an MPhil thesis option over one year (fulltime) 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* *TC1.04B*
Phone: *07 838 4357*
Email: *c.eames@waikato.ac.nz*

STER900-17C PhD Thesis
The Centre offers a PhD thesis option over three years (fulltime) 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* *TC1.04B*
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 fulltime 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 has 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 fulltime 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:

DSOE557 **Educational Research Methods**
STER508 **Science Education**
STER594 **Thesis on the Learning of Science in a Kura Kaupapa Programme**

Carolyn is a fourth year secondary science teacher with a BSc who is interested in learning more about biotechnology education. Her proposed part-time programme for a two-year Postgraduate Diploma is:

BIOL584/585 **Genetics**
STER511 **Technology Education**
DSOE557 **Educational Research Methods**
STER590 **Development Project for a New Biotechnology Unit**

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 fulltime. Her proposed programme for a Master of Education part-time over three years is:

PCSS510 **Gender, Race and Education**
STER513 **Environmental and Sustainability Education**
STER590 **Directed Study on Student Learning Through Recycling**
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 enrols 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-recognised higher degree. He feels this will open up overseas career opportunities. He enrols 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 enrols for three years of fulltime 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:

Digital representations of authentic student performance for assessment

This research will investigate the representation in digital forms of secondary student practical performance in order to deliver authentic formative and summative assessment. The authenticity of the assessment will lie in the extent to which it develops as a natural part of the learning process. The forms of assessment will be structured to align with pedagogies that support performance based learning, and so will enhance both teacher planning for learning, and student reflection and action on their own learning.

Research Team: John Williams, Mike Forret and Richard Edwards.

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.

Technology education CoREs

The project aims to investigate the appropriateness and possible redesign of the currently accepted structure of CoREs (Content Representations) in support of the development of technology teachers' Pedagogical Content Knowledge (PCK). CoREs are a way of articulating what a teacher considers when planning for teaching an area of content to a particular group of students at a particular year level. CoREs represent an holistic overview of a teacher's PCK. PCK is theorised as being the knowledge that makes expert teachers expert, and acts upon Subject Matter Knowledge (SMK). The concept of CoREs, developed in Science Education, has been shown to be effective in identifying and developing teachers PCK. In previous research by the applicants a significant difference was found in the way CoREs were used by science teachers and technology teachers, raising doubt as to the direct transferability of the structure of CoREs designed for science education to technology education. The nature of knowledge, as well as classroom practice, in technology are significantly different to science thereby providing a theoretical framework and rationale for the research.

Research Team: John Willams and John Lockley.

Pre-service teachers' perceptions of technology and technology education

Technology teachers' perceptions and understanding of the nature of technology heavily influences their perceptions of technology education and consequently shapes their teaching practice. Understanding the nature of technology is also recognised as an important component of technology education and in 2007 the New Zealand technology curriculum introduced a new strand called the Nature of Technology. An important part of initial teacher education programmes is therefore to help student teachers develop their concepts and philosophies of technology and technology education, a goal that is recognised in the Pre-service Technology Teacher Education Resource (PTTER) framework developed by a community of initial teacher education providers within New Zealand and aimed at supporting a coherence of understanding and purpose across institutions. Based on the goals of the technology curriculum and the PTTER framework, this paper reports findings from a survey of New Zealand student teachers' perceptions of technology and technology education before and after their involvement in a compulsory course in technology education. The findings reported are some of the initial results from one institution but are part of a larger project aimed at brining together similar data from across the country to inform development of pre-service technology education programmes.

Research team: Mike Forret, Richard Edwards, John Williams and John Lockley.

FEDU research project: getting to the CoRe of the matter

This project arose out of research opportunities emerging from the Collaborative University School Project (CUSP), which was set up to promote greater synergy between university-based and school-based pre-service teacher learning opportunities in primary education. From a research perspective this study addressed an identified issue in NZ primary science education, notably falling levels of student interest and achievement in science linked to its low status in primary schools and teachers' underdeveloped pedagogical content knowledge (PCK) for achieving curriculum goals in scientific literacy. At a pragmatic level the project met a desire by the participating school to strengthen and more closely align its school science education programme with the intent of the New Zealand Curriculum and 21st-century learning principles. Using a design-based research (DBR) approach, this year-long collaboration resulted in a jointly-planned, school-based research programme featuring the use of Content Representation (CoRe) design, as both a means of professional learning and curriculum design, over several iterations. The researchers provided expertise in science content, inquiry learning in science, and facilitation of CoRe design while the teachers were knowledgeable of their students, their school context and its complexities, and how best to introduce the intervention and determine its impact. Data from surveys, videos of teacher workshops, document analysis, classroom observations, and focus-group interviews revealed the repeated use of CoRe design in curriculum design and implementation (at classroom and school-wide levels) resulted in processes for: successfully strengthening aspects of the primary teachers' PCK for science teaching; improving their feelings of self-efficacy in science teaching, and achieving their school curriculum goals through coherent school-wide science programmes. The establishment of a science leadership group in the school and their development of a school-wide science education plan brought together and consolidated key elements of the collective professional learning that occurred in the project.

Research Team: Anne Hume (Principal Investigator), Jane Furness, Angela Schipper, Barbara Ryan, Hong Nhung Nguyen.

Staff profiles

Anne Hume the Director of the TEMS Centre since early 2016, has been in her current position as senior lecturer in science education since early 2005, including a two-year period (2013-2015) as Chairperson of the MSTE Department. She has had extensive experience in the wider science education scene in New Zealand, including 25 years secondary teaching, four years with the NZ Education Review Office (ERO); membership of: the Board of the Royal Society of New Zealand; the Writing Team for the 1993 Science in the New Zealand Curriculum, and the Science Expert Panel for the National Certificate of Educational Achievement (NCEA). From 1993-1994 she was President of the New Zealand Science Educators' Association (NZASE).

Her research involvement has included membership of the Science Learning Hub (SLH) development team, the Curriculum Implementation Exploratory Studies (CIES) project, a Teaching and Learning Research Initiative (TLRI) project entitled 'CoRe: A way to build pedagogical content knowledge for beginning teachers' and an FEDU sponsored research project in a local primary school entitled 'Getting to the CoRe of the Matter'. Action research into her own tertiary teaching practice has focused on strategies such as reflective writing, role play and Content Representation (CoRe) design to promote student teachers' learning through development of their pedagogical content knowledge (PCK).

Anne is an Associate Editor of the Research in Science Education (RISE) journal, and is on the editorial boards of the International Journal of Science Education and the New Zealand Science Teacher.

Recently Anne was appointed to an adjunct senior lecturer position at the University of Fiji.

Selected recent publications

Hume, A. (2016). Finding the means to initiate and sustain a teacher educator's pedagogical content knowledge (PCK) development in science education. In G. Buck and V. Akerson, (Eds.), *Allowing Our Professional Knowledge of Pre-Service Science Teacher Education to be Enhanced by Self-Study Research: Turning a Critical Eye on Our Practice* (pages 317-340). ASTE: Springer.

Hume A., Eames, C., Williams, J. &. Lockley, J. (2013). The benefits of collaborative Content Representation (CoRe) design with experts for early career secondary teachers in science and technology. *Set: Research information for teachers, 2*, 35-43.

Hume, A. (2013). Student teachers as future agents of change in New Zealand primary science. *Journal of Educational Leadership, Policy and Practice: Special Educational Edition in Science, Technology, Engineering and Maths Education, 28*(2), 3-14.

Hume, A., & Berry, A. (2013). Enhancing the practicum experience for pre-service chemistry teachers through collaborative CoRe design with mentor teachers. *Research in Science Education*, DOI: 10.1007/s11165-012-9346-6

Williams, J., Eames, C., Hume A., &. Lockley, J. (2012). Promoting pedagogical content knowledge (PCK) development for early career secondary teachers in science and technology using Content Representation (CoRes). *Research in Science and Technological Education, 30*(3), 327-343.

Hume, A. (2012). Role-play, using the Primary Connections Programme, in pre-service primary science teacher education. *NZ Science Teacher,* 129, 39-42.

Room: TC1.04A
Phone: 07 838 4466 extn 7880
Email: annehume@waikato.ac.nz

Chris Eames is an Associate Director of the TEMS Centre. 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, the Teaching and Learning Research Initiative and WWF New Zealand 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 other research interests are in secondary and tertiary science/biology.

Selected recent publications

Taylor, N., Quinn, F. and Eames, C. (Eds.) (2015). *Education for sustainability in primary schools: Teaching for the future*. Rotterdam, The Netherlands: Sense

Lebo, N. and Eames, C. (2015). Cultivating Attitudes and Trellising Learning: A Permaculture Approach to Science and Sustainability Education. *Australian Journal of Environmental Education*. Available on CJO 2015 doi:10.1017/aee.2015.23

Eames, C., Wilson-Hill, F. and Barker, M. (2013). Exploring whole school approaches to education for sustainability. *Set: Research Information for Teachers*, 1, 12-20.

Wake, S. J., & Eames, C. (2013). Developing an "ecology of learning" within a school sustainability co-design project with children in New Zealand. *Local Environment: The International Journal of Justice and Sustainability*, 18(3), 305-322.

Williams, J., Eames, C., Hume, A., & Lockley,`J. (2012). Promoting pedagogical content knowledge development for early career secondary teachers in science and technology using content representation. *Research in Science & Technological Education*, 30(3), 327-343

Calik, M. & Eames, C. (2012). The significance of a national context: A comparison of environmental education in Turkey and New Zealand. *The Asia-Pacific Education Researcher*, 21(3), 423-433.

Eames, C. & Barker, M. (2011). Understanding student learning in environmental education in Aotearoa New Zealand. *Australian Journal of Environmental Education*, 27(1), 186-192.

Eames, C., Roberts, J., Cooper, G., & Hipkins, R. (2010). Education for sustainability in New Zealand schools: An evaluation of three professional development programmes. (Report to Ministry of Education) *Ministry of Education*, 2010, 1-302.

Room: TC1.04B
Phone: 07 838 4357
Email: c.eames@waikato.ac.nz

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 serves on editorial boards for International Journal for Mathematics Teaching and Learning and Apex: The New Zealand Journal of Gifted Education. She was the New Zealand delegate in 2016 for ICME and New Zealand delegate for the World Council for Gifted and Talented Children.

Selected recent publications

Young-Loveridge, J. & Bicknell, B. (2015). Using familiar materials and cultural artifacts to assess multiplication and division understanding. In C. Suurtamm (Ed.) *Annual Perspectives in Mathematics Education (APME) 2015: Assessment to enhance learning and teaching*. Reston,VA: NCTM.

Bicknell, B., Cramond, A., & Van der Schans, S. (2014). Challenging tasks and persistence. In R. Averill (Ed.), *Mathematics and statistics in the middle years: Evidence and practice* (pages 253-270). Wellington: NZCER Press.

Bicknell, B. (2014). Parental roles in the education of mathematically gifted and talented children. *Gifted Child Today, 37*(2), 83-93.

Riley, T., & Bicknell, B. (2013). Gifted and Talented Education in New Zealand Schools: A decade later. *APEX: The NZ Journal of Gifted Education*, *18*(1). Retrieved from **giftedchildren.org.nz/apex**

Young-Loveridge, J., & Bicknell, B. (2013). Introducing multiplication and division contexts in junior primary classes. *Teachers and Curriculum*, 13, 70-76.

Bicknell, B., & Riley, T. (2013). School transition and mathematically gifted students. *Gifted and Talented International, 28*(1/2), 135-148

Young-Loveridge, J., Bicknell, B., & Mills, J. (2013). The mathematical content knowledge and attitudes of New Zealand pre-service primary teachers. *Mathematics Teacher Education and Development, 14*(2), 28-49.

Gervasoni, A., Hunter, R., Bicknell, B., & Sexton, M. (2012). Powerful pedagogical actions in mathematics education. In B. Perry, T. Lowrie, T. Logan, A. MacDonald, J. Greenlees (Eds.), *Research in mathematics education in Australasia 2008-2011* (pages 193-218). Rotterdam, The Netherlands: Sense Publishers.

Bicknell, B., & Riley, T. (2012). The role of competitions in a mathematics programme. *APEX: The New Zealand Journal of Gifted Education, 17*(1). Retrieved from **giftedchildren.org.nz/apex**

Bicknell, B., & Hunter, R. (2012). School transition from year 6 to year 7: A focus on mathematics. *International Journal for Mathematics Teaching and Learning, June 22*. Retrieved from **cimt.plymouth.ac.uk/journal/default.htm**

Room: TL4.05
Phone: 07 838 4466 etxn 6971
Email: bicknell@waikato.ac.nz

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. She teaches primary pre-service teachers in both graduate and undergraduate papers, working in Hamilton, Tauranga and on-line. Prior to this she was a primary school teacher with a special interest in junior primary students. In 1997 she was seconded to the University of Waikato for the purpose of joining a team to facilitate the first Ministry of Education technology contract, and in 1999 was appointed the Director of the second Technology in the New Zealand Curriculum contract. She has also worked on a wide range of associated contracts including Technology Education for Year 7 and 8 specialist teachers, planning and assessment contracts and the development of resources for technology.

Louise holds a Higher Diploma of Teaching (Primary), an M.Ed 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

Eames CW, Lockley J, Milne. (2015). Education for sustainability in primary technology education, *Educating for Sustainability in Primary Schools. Teaching for the Future.* Editors: Taylor N, Quinn F, Eames C. 121-134. Sense publishers, Rotterdam, The Netherlands.

Milne RL. (2015). Manahi's red chocolate sunglasses: the impact of a learning experience outside the classroom on a five-year-old student's technological practice 29th PATT conference, Marseilles, France, 07 Apr 2015 - 10 Apr 2015. Editors: Chatoney M. *Plurality and Complementarity of Approaches in Design and Technology Education.* 287-292.

Milne RL. (2015). *The EOTC milieu as a setting for teaching and learning experiences for five-year-old students in technology education.* Thesis type: PhD Thesis. Supervisors: Eames C, Williams J. University of Waikato, 2015.

Milne L. (2013). Nurturing the designerly thinking and design capabilities of five-year-olds: Technology in the new entrant classroom, *International Journal of Technology and Design Education 23*(2): 349-360.

Room: TC4.05
Phone: 07 838 4466 extn 4680
Email: louisem@waikato.ac.nz

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
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
Alister Jones	waikato.ac.nz/research/expertise/staff/AlisterJones.shtml
Kathy Saunders	education.waikato.ac.nz/about/faculty-staff/?user=kathy

Technology Education

Louise Milne (Leader)	education.waikato.ac.nz/about/faculty-staff/?user=louisem
Cathy Buntting	education.waikato.ac.nz/about/faculty-staff/?user=buntting
Richard Edwards	education.waikato.ac.nz/about/faculty-staff/?user=richarde
Mike Forret	education.waikato.ac.nz/about/faculty-staff/?user=mforret
Alister Jones	waikato.ac.nz/research/expertise/staff/AlisterJones.shtml
John Lockley	education.waikato.ac.nz/about/faculty-staff/?user=johnl
Judy Moreland	education.waikato.ac.nz/about/faculty-staff/?user=moreland

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/facultstaff/?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
Carol Murphy	education.waikato.ac.nz/about/faculty-staff/?user=carolmm
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

Debby Bandele (PhD)	Environmental literacy of pre-service teachers.
Jared Carpendale (PhD)	Addressing Senior Physics students' misconceptions by enhancing the PCK around Physics Education of Junior Science Teachers' using CoRE Design.
Lorraine Evening (PhD)	Enhancing success of Māori and Pacific Island students in science at university.
Tatiana Kalnins (PhD)	Whole school approaches to EFS.
John Lockley (PhD)	Teacher professional development and curriculum development in education for sustainability.
Judith Mills (PhD)	Improving the pedagogical content knowledge of teachers to enable confidence in providing quality classroom mathematics programmes.
Kelvin Mills (EdD)	The use of numeracy in the workplace by toolmakers.
Bruce Moody (PhD)	Students' learning about proportional thinking.
Fariba Mostafa (PhD)	Use of social media in teacher professional learning in environmental education.
Sela Tapa'atautai	Faiako Ma'a Tonga: Conceptions of professional attitude development and implications for teacher education in Tonga.
Mathew TijuThomas (PhD)	Implementation of STEM in schools.
Sangion Tiu (PhD)	Environmental policy in Papua New Guinea.
Damon Whitten (PhD)	Understanding the role of adult learners' beliefs about mathematics: The impact of an intervention designed to challenge negative beliefs.

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

Recent graduate research

Recent PhD theses

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.
Valerie Bianchi	Conservation Education.
Kathy Broadhead	Public perceptions of sharks.
Anita Croft	Environmental education in early childhood.
Thea de Petris	Kids Greening Taupo.
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.
Denis Lajium (PhD)	Student mental models of chemical reactions.
Nelson Lebo (PhD)	Permaculture in a redesign of secondary science education.
Joseph Lingawa (PhD)	An analysis of lessons learned from the outcome-based curriculum: A case study of Madang Province primary schools in Papua New Guinea.
Louise Milne (PhD)	The role of LEOTC in primary school technology education.
Alcuin Mwalongo (PhD)	Student teachers' perceptions about learning management systems as tools for promoting critical thinking.
Mohd Nihra Said (PhD)	Online collaborative learning in Malaysian tertiary education.
Asaku Openg (PhD)	Pre-service teacher education in education for sustainability in Papua New Guinea.
Franco Rodie (PhD)	Solomon Islands Year 9 science teachers summative assessment practice.
Tony Trinick (EdD)	The Māori medium mathematics register: Challenges for students and teachers.

Recent masters theses

Osamah Almaghlouth	ICT in Saudia Arabia schools.
Nicholas Bowskill	Success and failure in technology education.
Jared Carpendale	Science education in a museum setting.
Ellison Giano	Science education in the Solomon Islands.
Liz Haines	Secondary students' conceptions of sustainability.
Alan Reilly	Interactive historical sites.
Thomas Smith	Understanding how an audiovisual introduction engaged GATE students in technology activity.
Hayley Ryan	Perspectives on the purpose and importance of science education.
Shaunnie Farr	The influence of parents on students' attitudes towards mathematics.
Joanna Matthews	Exploring the transition into Year 3 of Year 2 students who use counting on to solve mathematical problems.

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:

Gedera, D., Williams, P.J., and Wright, N. (2015) Identifying Factors Influencing Students' Motivation and Engagement in Online Courses. Chapter 2 in C. Koh (Ed.) *Motivation, Leadership and Curriculum design*. Singapore: Springer. DOI 10.1007/978-981-287-230-2.

Peters, M.A., Hamilton, D.P., & Eames, C. (2015). Action on the ground: a review of community environmental groups' restoration objectives, activities and partnerships in New Zealand. *New Zealand Journal of Ecology*, 39(2).

Lebo, N., & Eames, C. (2015). Cultivating Attitudes and Trellising Learning: A Permaculture Approach to Science and Sustainability Education. *Australian Journal of Environmental Education,* 1-14. Doi:10.1017/aee.2015.23.

Nguyen, N., Williams, P.J. & Forret, M. (2015) Teaching Model of Integrating Constructivist & Sociocultural Learning Principles and Information & Communication Technology. *International Journal of Science Educators and Teacher*, 1(1), 19 – 40.

Thomas, T.M. & Williams, P.J. (2014) STEM interaction in a Technological Design Cont Presented at the Technology Education Research Conference (TERC), *Technology Education: Learning for Life*, Sydney, Australia, November 26-29.

Anney, V. & Hume, A. (2014). Enhancing untrained science teachers' pedagogical content knowledge (PCK) in developing countries through teachers' professional learning communities (PLCs). *International Journal of Development and Sustainability,* 3(8), 1709-1744.

Chikasanda,V., Otrel-Cass, K., Williams, J. and Jones, A. (2012) Enhancing teachers' technological pedagogical knowledge and practices: A professional development model for technology teachers in Malawi. *International Journal of Technology and Design Education*, DOI; 10.1007/s10798-012-9206-8.

Milne, L. & Eames, C. (2011). Teacher responses to a planning framework for junior technology classes learning outside the classroom. *Design and Technology Education: an International Journal*, 16(2), 33-44.

Nguyen, N., Williams, P.J., Nguyen, K., Nguyen, T., Chantaranima, T. (2012) *The use of ICT in teaching tertiary Physics in Vietnam*. International Science Education Symposium, Kon Kean University, May.

Nguyen, N., & Williams, J. (2011, June). *Science Education in Vietnam: Current state and future directions*. Paper presented at the 2011 Science Education Symposium, Khon Kaen University, Thailand.

Nguyen, N., Williams, J., & Forret, M. (2011, June). *A Model of integrating constructivist learning principles and ICT*. Paper presented at the 2011 Science Education Symposium, Khon Kaen University, Thailand.

Said, M.N.H.M, Hassan, J., Idris, A.R.,Zahiri, M.A., Forret, M., Eames, C. (2013). Technology-enhance classroom learning community for promoting tertiary ICT education learning in Malaysia. In K.M. Yusof, M. Arsat, M.T. Borhan, E.de Graff, A. Kolmos, F.A. Phang (Eds.), *PBL across cultures* (pages 326-334). Aalborg University Press.

Wake, S. J., Eames, C. (2013). Developing an "ecology of learning" within a school sustainability co-design project with children in New Zealand. *Local Environment: The International Journal of Justice and Sustainability*. 18 (3), 305-322.

Williams, P.J. & Lockley, J. (2012) *An analysis of PCK to elaborate the difference between scientific and technological knowledge*. Paper presented at the PATT 26 Conference: Technology Education for the 21st Century. Stockholm, June.

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:

Jenny Young-Loveridge
Using Multiplication and Division to Enhance Young Children's Part-Whole Thinking in Mathematics

Carol Murphy and Nigel Calder
Phase 2 –The Use of Apps in Mathematics Education

Mike Forret
Reflections on a Career in Science and Technology Research

Sashi Sharma
Bridging Language Barriers in Statistics for Year-12 Pasifika Students: A Collaborative Study

Cathy Buntting, Kathy Saunders & Anne Hume
Views About Scientific Inquiry - An International Study

Louise Milne
Cultivating Young Students' Creative Thinking in Technology Education

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:

Nelson Cyril
An Investigation of Malaysian Secondary School Students' Mental Models of Acid-base Chemistry

Søren Witzel Clausen
Danish Geography Teachers' Professional Knowledge and Skills

Modupe Agnes Akinnuoye
Understandings, Attitudes and Motivation to Act Towards Environmental Issues Among Secondary School Students in New Zealand

Farshad Hashemzadeh
Environmental Education in Iranian Secondary Schools

Jared Carpendale
Collaborative Core Design and Implementation for Electricity and Magnetism: Enhancing Practising Science Teachers' PCK

Chandan Boodhoo
Assessment for Learning in Design and Technology: A Multi Case Study in Mauritius Secondary Schools

Tiju Mathew Thomas
The Application of Mathematics in Design and Technology

Deborah Bandele
Evaluation of Environmental Literacy of Pre-service Teachers in New Zealand

Fariba Mostafa
Integrating Social Media in Teachers' Professional Learning in Environmental Education

Nhung Nguyen
A Hint of Vietnam's History and Culture

Liz Reinsfield
Technology Teachers' Perceptions: Who's in the Driver's Seat?

Sharyn Gee
Participants' Views on the Effects of Digital Technologies on their Teaching/Learning in Food and Textiles Technology Education

Richard Edwards
Assessing Learning in a Collaborative Design Project: A Teacher's Perspective

Judith Mills
The Professional Knowledge Required for Effective Teaching and Learning of Mathematics for Numeracy

Thea DePetris
Kids Greening Taupo: Achieving Effective Partnerships between Schools and the Community in Conservation Education

Sangion Appiee Tiu
Educating for Sustainability Through Traditional Ecological Knowledge: A Lesson from the Past

Jenny Mangan
Enhancing Teachers' Use of Web-based Resources in Technology Education

Monica Peters
Grassroots Citizen Science in New Zealand: Barriers and Opportunities

Sela Tapa'atoutai Teisina
An Insider's Perspectives on Data Collection Experiences

Carrie Swanson
Expanding Student Perceptions of Scientists Through the Dramatic Technique of 'Role on the Wall'

Study groups

The Centre encourages and supports the formation of study groups to debate and discuss recent research. The Centre currently operates a series of reading groups in research related areas conducted from within the three research groups, the Tertiary Science Education Research Group, the Science and Environmental Research Group, and the Technology Education Research Group. These groups meet on an informal basis regularly throughout the year. Interested individuals should contact the Centre director if they wish to be a part of a study group.

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

2004	**Mary McPherson**
2005	**Marianne Robertson** and **Kathy Paterson**
2006	**Barbara Ryan** and **Sara Loughnane**
2008	**John Dudli, Jenny Mangan, Debra Leong** and **Colin Milne**
2010	**Alison Basel**
2012	**William Van Zyl**

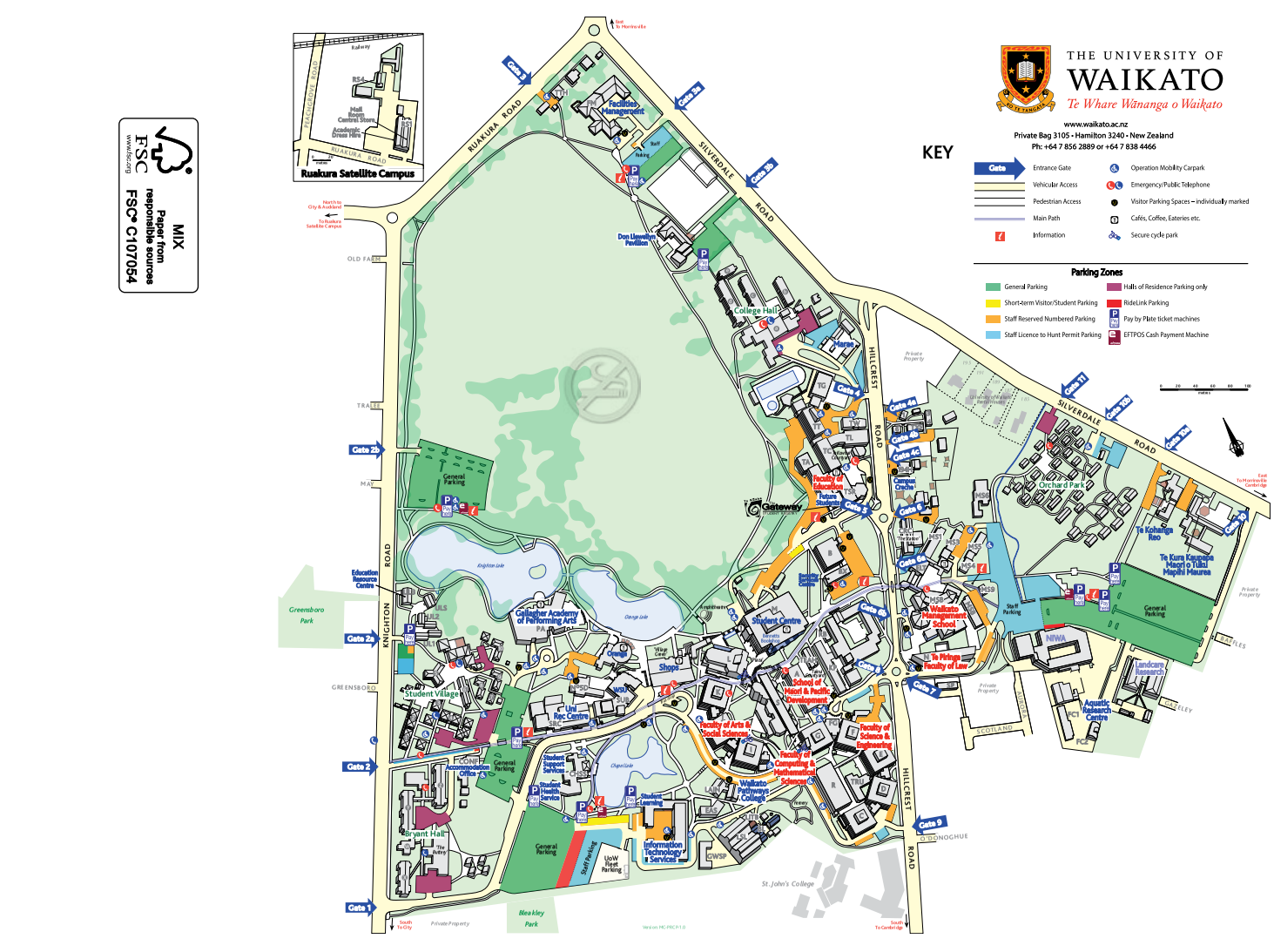
We invite teachers interested in applying for a Fellowship to discuss having the Centre as a host or co-host.

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. In 2011-2016 we were visited by numerous casual education visitors from throughout New Zealand and overseas.

Participating schools 2016

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 2016.



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Te Whare Wānanga o Waikato

WHERE THE WORLD IS GOING
TE AHUNGA O TE AO

The University of Waikato
Private Bag 3105
Hamilton 3240
New Zealand

Toll Free: **0800 WAIKATO**
Website: **waikato.ac.nz**

Technology, Environmental, Mathematics and Science Education Research Centre

Phone: **+64 7 838 4500**
Email: **tems@waikato.ac.nz**
Website: **education.waikato.ac.nz/tems**