30 YEARS

ASERA

ROTORUA, NEW ZEALAND, JULY 1999

Conference Programme and Abstracts

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Haere mai

WELCOME

Welcome to Rotorua, New Zealand

Welcome to the 30th ASERA, 1999

Organising Committee

Conference Chairpersons:

Bev France, Mavis Haigh	*Auckland College of Education*
Lydia Austin	*University of Auckland*
John Barnett	*University of Auckland*
Denis Burchill	*Auckland College of Education*
Ian Milne	*Auckland College of Education*
Ann Northover	*University of Waikato*
Rudy Petersen (Registration Secretary)	*Auckland College of Education*
David Salter	*University of Auckland*
Heather Stonyer	*Auckland Institute of Technology*
Gillian Ward	*Auckland College of Education*
Morley West	*Rotorua Lakes High School*
Vicki Compton	*Auckland College of Education*

We will be identified by our green name tags.

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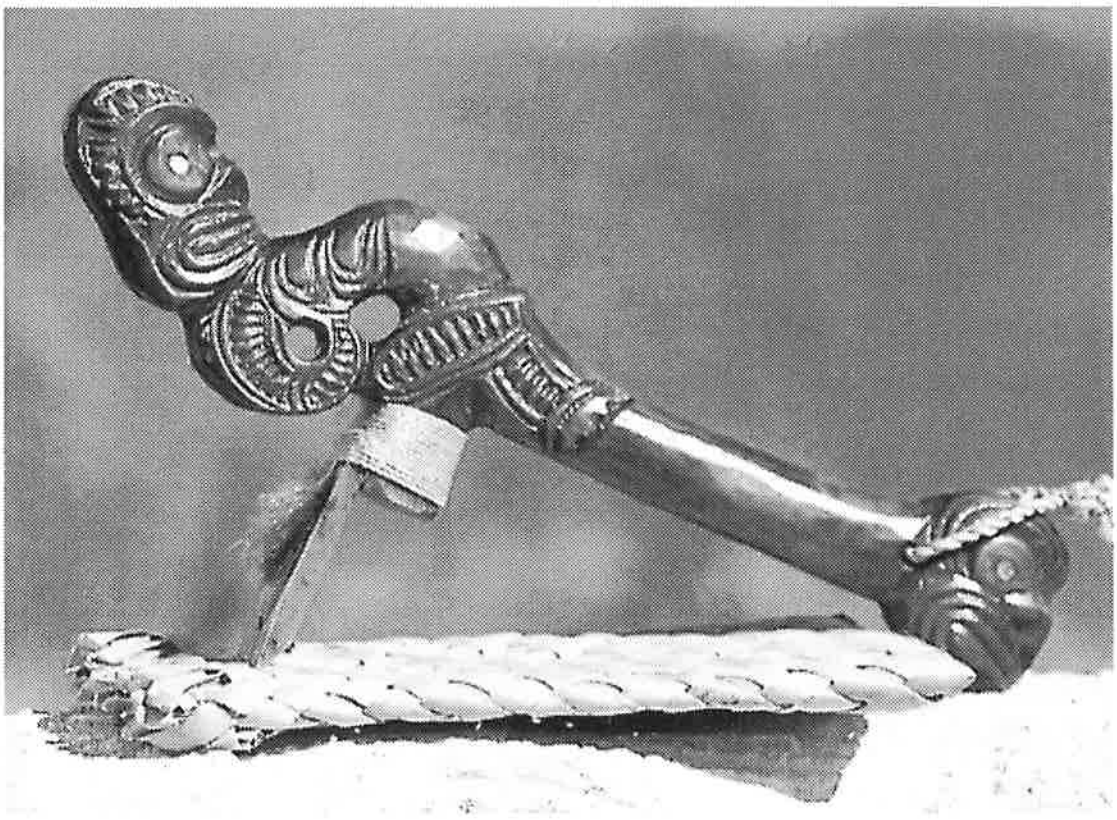


ASERA Timetable Overview

Thursday 8 July

7:30 - 9:00pm	Drinks and nibbles

Friday 9 July

8:50am	Meet outside front entrance of hotel for Powhiri (Welcome)
9:00 - 10:00am	Powhiri
10:00 - 10:30am	Morning Tea
10:30am - 12:40pm	Presentation of papers (three sessions)
12:45 - 2:00pm	Lunch
2:00 - 3:25pm	Presentation of papers (two sessions)
3:30 - 4:00pm	Afternoon Tea
4:00 - 4:40pm	Presentation of papers (one session)
5:30 - 9:30pm	Tamaki Tour (booking required)

Saturday 10 July

9:00 - 10:25am	Presentation of papers (two sessions)
10:30 - 11:00am	Morning Tea
11:00am - 12:30pm	Presentation of papers (two sessions)
12:30 - 1:45pm	Lunch
1:45 - 3:10pm	Presentation of papers (two sessions)
3:10 - 3:30pm	Afternoon Tea
3:30 - 4:30pm	ASERA Annual General Meeting
5:15pm	Buses leave hotel for Dinner venue

Sunday 11 July

9:00 - 10:25am	Presentation of papers (two sessions)
10:30 - 11:00am	Morning Tea
11:00am - 12:25pm	Presentation of papers (two sessions)
12:30 - 1:30pm	Lunch

General Conference Information

Chairing the sessions

The sessions last 40 minutes which allows 20 minutes for paper presentation and 20 minutes for questions. Please introduce the speaker, support the presenters by monitoring the time and chairing the question part of the session. There are helpers who will make sure that the appropriate equipment is set up in the room (eg Powerpoint presentation facilities).

Any requests, check at the conference Registration Desk.

Conference Registration Desk

During the conference Rudy and his team of helpers will be available at the Registration Desk and will be identified by their green name tags. If you have general concerns please consult them.

Daily notices/programme changes will be posted on a noticeboard by the Registration Desk.

Conference dinner

This will be held at the Gondola Restaurant on the slopes of Mt Ngongotaha. Luge rides, simulator rides, and electronic laser shooting will be available during the pre-dinner drinks time. Warm jackets will be necessary for the luge rides. Buses are leaving from 5:15pm outside the front entrance of the hotel and will be returning in relays after the floor show and dancing. There are a small number of dinner places still available ($70 NZ) – please contact the Registration Desk before noon on Friday.

Hotel accounts

It is your responsibility to settle your hotel account prior to departure. Remember that we have been given a special deal of $80 NZ /room + GST (maximum number/ room for this discount is two!).

Medical aid

For emergency medical assistance please contact hotel reception.

Name tags

Please wear name tags at all times, expecially for meals and social functions (so that the hotel staff know you are with the conference). Accompanying persons please wear name tags when at conference functions.

Relaxation areas

Coffee/tea, water and juice is continuously available at stations around the hotel. The lounge area by the Mallards Bar is available for socialising. The hotel pool is open to 10.30pm.

Two minutes from the hotel, next to the lake are the Polynesian Pools. Consider meeting here to pamper those aching bones. The surroundings are exotic with indoor and outdoor pools at temperatures ranging from a steaming bathtub to the large pool for serious swimming. Bar and coffee facilities are also available.

Phone access

This is available through coin phones and credit card phones in the hotel lobby.

Photocopying

This is available at 7 cents (NZ) per sheet. Please leave any copying with Rudy.

Tamaki Tours

This award winning tourist activity is organised for Friday night. The evening involves a tour round a model village, an hour long Maori concert and a hangi (feast). You will need to dress warmly. Buses leave the hotel at 5.30pm and return at 9.30pm. Cost is $50 (NZ) for the whole experience. There are a few places still available – please ask at the Registration Desk before noon on Friday.

Te Powhiri

It is a Maori tradition the tangata whenua (people of the land) welcome manuhiri (visitors) to Aotearoa (New Zealand) and to their marae (home ground). In our case local Maori people are welcoming us to Rotorua at the hotel.

We will assemble outside the front entrance of the hotel at 8.50 am on Friday. You will be called into the hotel with a karanga (call). Walk into the area (in our case the Baycrest Room) behind the leaders with the women in front and the men at the back. Women sit towards the back, speakers and men towards the front. Stand at your seat and when everyone is inside the room please be seated.

The tangata whenua speakers will welcome you first. In their whaikorero (speech) they will pay respect to the marae, the earth mother, or the land laying outside. The dead will be remembered, respect will be paid to the many ancestors who have gone before us. A mihi (greeting) is then made to the living and to us the visitors. A kaumatua (elder's) words are reinforced by the singing of a waiata (song). (Do not clap.)

A speaker from the manuhiri (visitors) will stand and reply to the welcoming speech. The visitors present stand to sing (see words below). After the last speech a person from the assembled visitors walks towards the tangata whenua and lays down a koha (gift).

This may be followed by another speech from the tangata whenua.

At the end of the powhiri, the tangata whenua will indicate to the visitors to come forward and shake hands and hongi (press noses).

After the powhiri, kai (food) is served to complete the welcoming process. Please move in to the morning tea buffet area.

The New Zealand National Anthem

E Ihowa Atua	God of Nations at thy feet
O nga Iwi, matou ra	In the bonds of love we meet
Ata whakarongo na	Here our voices, we entreat
Me aroha noa	God defend our free land
Kia ua ko te pai	Guard Pacific's triple star
Ki a tatou atawhai	From the shafts of stife and war
Manaakitia ra	Make our praises heard afar
Aotearoa	God defend New Zealand

Waiata 1: Te Aroha

Te Aroha	Where there is love
Te whakapono	and faith,
Ko te rangimarie	there is peace and hope
Tatou tatou e	amongst us all
He tangata ke koutou	All of you are people
He tangata ke matou	We are people
E ngari i roto i enei wa	But in these times
Tatou tatou e	We are all one

Waiata 2: Pokarekare Ana

Pokarekare Ana	When the troubled
Nga wai o Rotorua	waters of Rotorua
Whiti atu koe hine	are calm you will come
Marino ana e	to me my beloved
E hine e	Oh my beloved,
Hoki mai ra	come back to me
Ka mate ahou	Or I shall die,
I te aroha e	over love for thee

About Rotorua

Rotorua, the sulphur city with a population of 52,000 boasts a range of attractions and recreational activities for the visitor including mud pools and geysers, trout fishing, golf courses, shopping and award winning restaurants. Rotorua is also a centre for Maori culture and there are opportunities to be part of a unique experience with New Zealand's indigenous people. Within 150 km there are the surf beaches, Tongariro National Park, Urewera National Park, Waitomo Caves, Huka Falls, the Wairakei and Orakei thermal areas while further afield lies Auckland - city of sails and home of the America's Cup.

Climate

Rotorua's relatively high altitude causes the climate, although changeable, to be warm and dry in summer and cool, dry and sometimes frosty in winter.

Mean daily temperature in July	7.5°C
Annual rainfall	1491 mm - 123 days annually
21 days of air frost	
56 days of ground frost.	

Transport

Rotorua is 234 km from Auckland, 120 km from Hamilton and 462 km from Wellington. Four state highways (5, 30, 33 and 38) converge on the city. It is linked with Auckland and Hamilton by road, rail and air.

Volcanic History

Most of the attractions in Rotorua are based on the geothermal features and the lakes. Both are the direct result of continuing volcanic activity, ranging from minor hot springs to large prehistoric eruptions, which has formed and reformed the landscape for millennia. More recent events have included the Taupo and Tarawera eruptions. Taupo blew in 186 AD and sent ash around the world where it was recorded by the Greeks and Chinese. The Tarawera eruption of 1886 AD buried a village. Rotorua itself is a shallow caldera. According to Maori legend the geothermal activity is the result of two fire gods Te Pupu and Te Hoata speeding underground to rescue another god Ngatoro-i-rangi from freezing to death in the snow of Mount Tongariro.

Farming and Forestry

Rotorua is an important agricultural and forestry centre for the surrounding district. Although the vegetation has been radically changed by pastoral developments, large areas of native bush have been preserved and there are good opportunities for bush hiking and hunting. Kaingaroa Forest, the largest man-made forest in the southern hemisphere is one of several exotic plantations within the Rotorua District. The headquarters of the Forest Research Institute is situated in Rotorua and the Whakarewarewa Forest Park which adjoins it is show piece of exotic and native timbers as well as a haven for walking and mountain biking.

Maori Heritage

The earliest Maori villages in the area around which modern Rotorua is based, were situated close to geothermal sites including Ohinemutu and Whakarewarewa. Although the Maori community is now predominantly urban there are about 35 marae (meeting grounds) in the district. The Maori community and its culture and traditions have a significant influence on life in Rotorua and are of major interest to tourists.

Attractions

Volcanic based attractions include:

Whakarewarewa, Waimangu thermal valley, Waiotapu and Hell's Gate thermal reserves.

Rainbow Valley, Paradise Valley, Hamurana and Golden Springs, Waikite Hot Pools and the Buried Village.

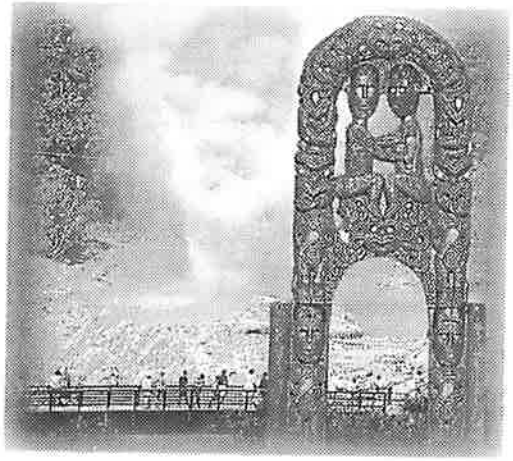
Mounts Tarawera and Ngongotaha and Rainbow Mountain.

Polynesian Pools.

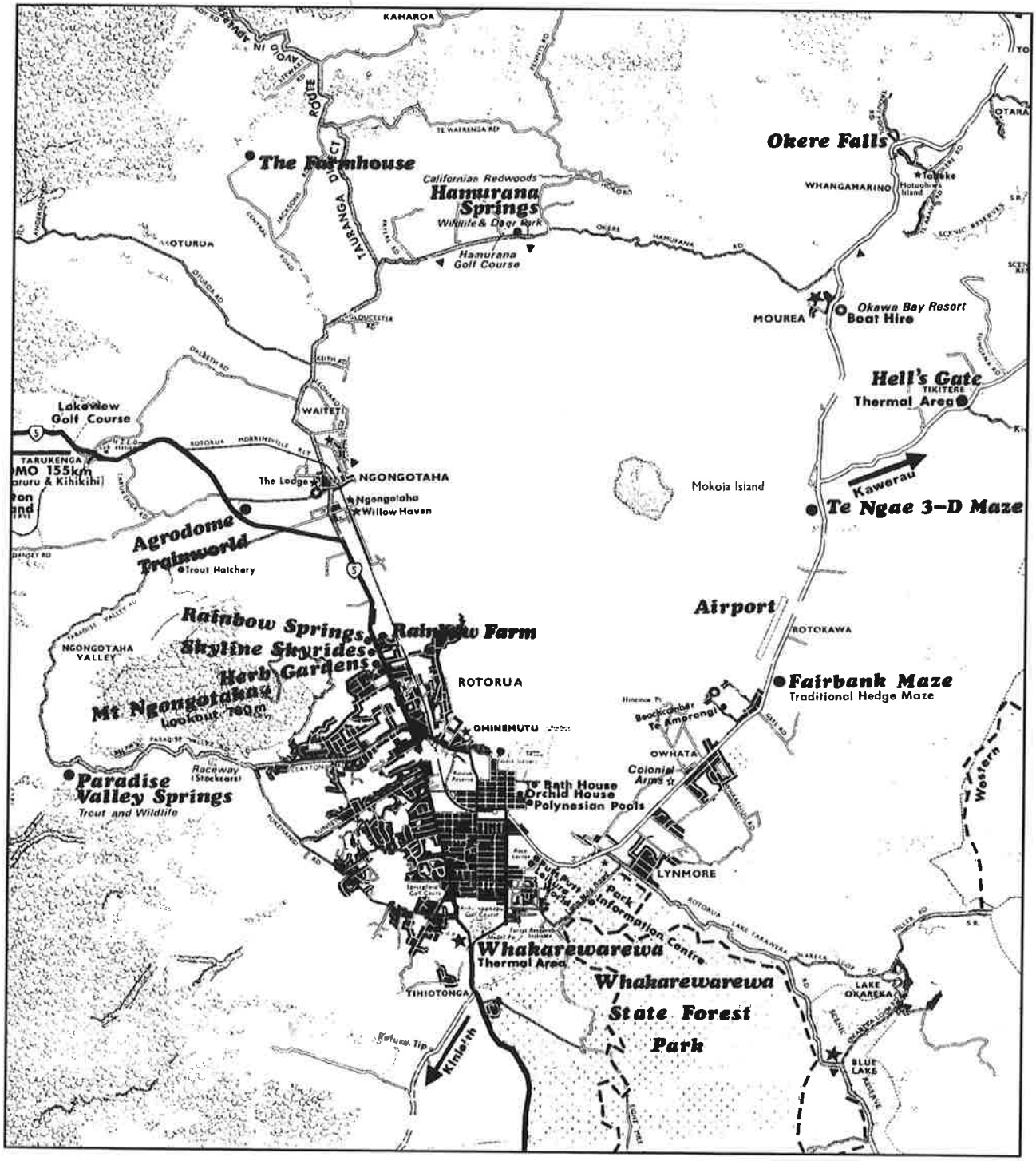
Sixteen lakes including Rotorua, Rotoiti, Rotoehu, Rotorua, Okataina, Okareka, Tikitapu (Blue), Rotokakahi (Green), Tarawera, Rotomahana and Rerewhakaaitu. The lakes are used for trout fishing, water skiing, sailing, picnicking and swimming.

Orakei Thermal Power Station.

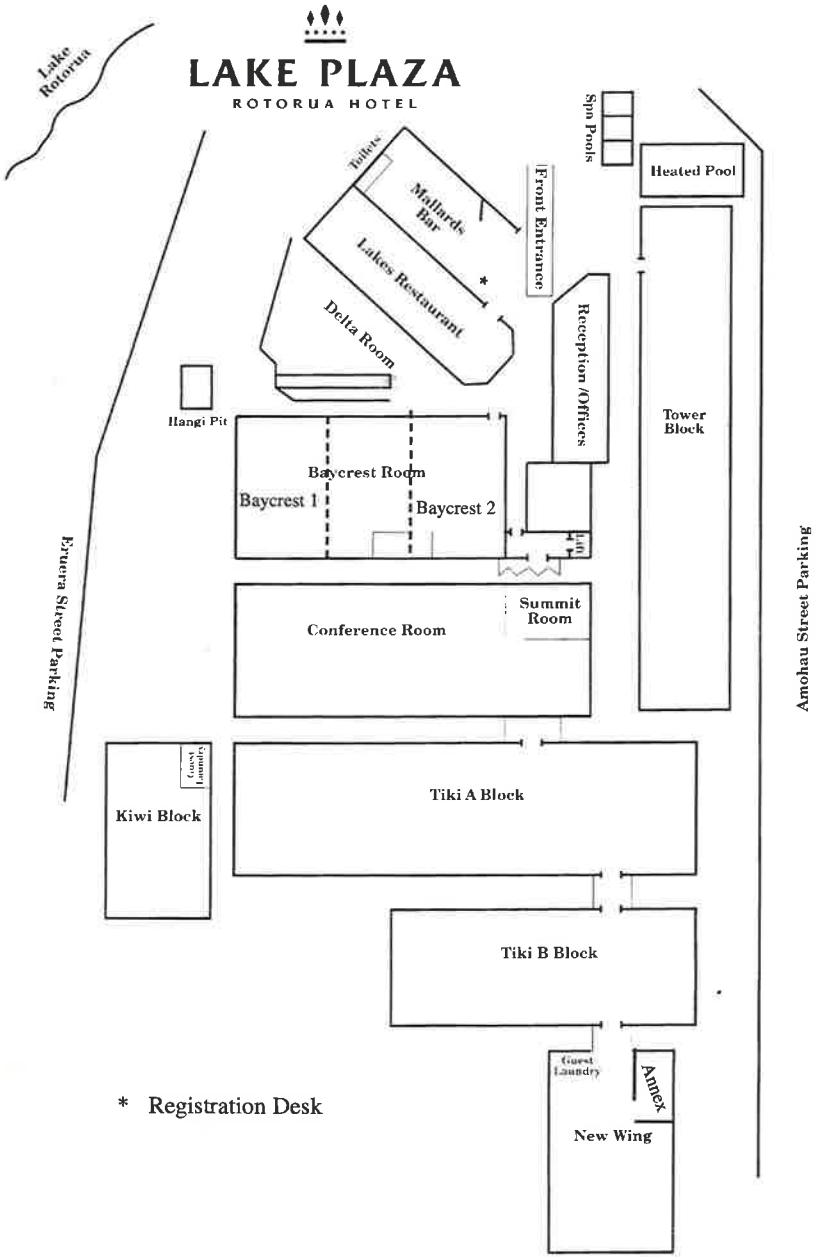
You might also want to visit the Rotorua Art and History Museum and the Atiamuri and Matahina hydroelectric schemes.



The Rotorua Region

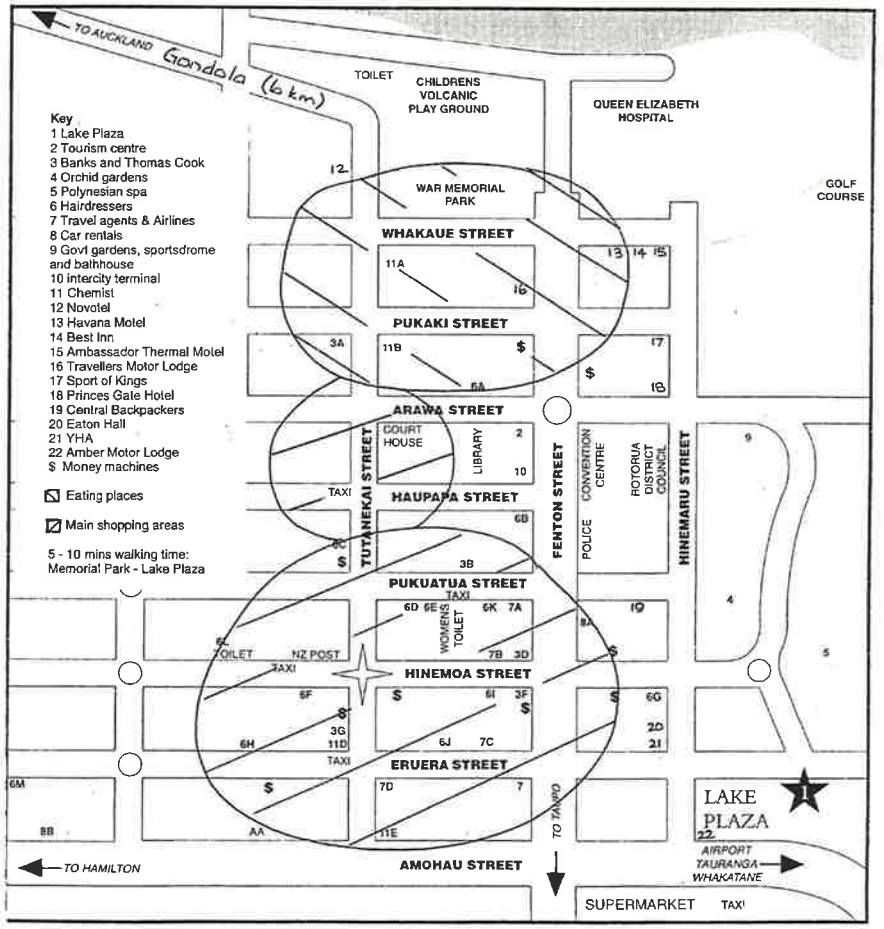


LAKE PLAZA
ROTORUA HOTEL



* Registration Desk

LAKE PLAZA
ROTORUA HOTEL



1000 Eruera Street, P.O. Box 884 Rotorua, New Zealand
Telephone (07) 348-1174 Facsimile (07) 346-0238
Reservation Freephone Phone 0800 801 440
DX JP30107 - Email:lakeplaza@clear.net.nz

Friday 9 July

Times	Baycrest 1	Baycrest 2	Delta	Summit	Annex
9.00 - 10.00am	**Powhiri and Welcome**				
10.00-10.30am	**Morning Tea**				
10.30 - 11.10am	**Judy Moreland & Alister Jones** Emerging Assessment Practices in an Emergent Curriculum: Implications for Science and Technology. *Chair: Vicki Compton*	**Wonkun Oh & Jaewoo Kim** Conceptual Change in Galilean Relativity with the Help of Idealisation. *Chair: Stephen Ritchie*	**Carolyn English & Rosemary Hipkins** Supporting Primary Teachers in Their Understanding of Some Key Science Concepts while Focusing on the Development of Provisional Concepts. *Chair: Debbie Corrigan*	**Tony Wright, Paul Buckley & Slavica Pavlinic** Towards a Method for Evaluating Computer-Assisted Learning Software. *Chair: Yvonne Zeegers*	**Rod Fawns, Sophie Arkoudis & Gerry Healy** Signs, Social Ontology and Critical Realism in Science Education *Chair: Carmel Diezmann*
11.15 - 11.55am	**Alister Jones, Judy Moreland & Ann Northover** Developing Teachers' Formative and Summative Assessment Strategies in Technology. *Chair: Mike Forret*	**Marilyn Fleer** An investigation of young children's ideas about Environmental Education. *Chair: Barbara Backshall*	**Ken Appleton & Eleanor Doig** Primary School Teachers' Perceptions of Science Activities That Work *Chair: Gilda Segal*	**Ken Stevens** Two Canadian Approaches to Teaching Biology, Chemistry, Mathematics and Physics to Senior High School Students in Virtual Classes. *Chair: Matthew Kearney*	**Susan Rodrigues** Teaching Science in Context: a case study from the Classroom Learning Project *Chair: Sean Cleary*
12.00 - 12.40pm	**Yvonne Zeegers** Eliciting Students' Questions for Investigation. *Chair: Ann Northover*	**Dick Gunstone, Jennifer Case & Alison Lewis** Mapping Students' Metacognitive Development. *Chair: Malcolm Carr*	**Mal Ward, Bruce Waldrip & Wilf Savage** A school-based science teaching program for pre-service teachers. *Chair: John Longbottom*	**Greg Thomas & Cam McRobbie** Collaborating to Enhance Student Learning: One Teacher's Journey. *Chair: Geoff Swan*	**Sid Chenicheri Nair & Darrell Fisher** Transition from Senior Secondary to Higher Education: A Learning Environment Perspective *Chair: Rod Fawns*
12.45-2.00pm	**Lunch**				
2.00 - 2.40pm	**Vicki Compton & Cliff Harwood** TEALS Research Project: From Directions to Classroom Practice	**Dawn Garbett** Group Memory Work as a Research Method in Science Teacher Education. *Chair: Beverley Bell*	**Bruce Waldrip, Bruce Allan Knight, Grant Webb & Paul Jensen** Student Teachers' Perceptions of Competence to Teach Primary Science and their Understanding of Scientific Words *Chair: Mal Ward*	**Matthew Kearney & David Treagust** Using multimedia to probe student understanding. *Chair: Ken Stevens*	**Carmel Diezmann & James Watters** Achieving social justice for gifted students in the new Queensland Science Syllabus *Chair: Robyn Baker*
2.45 - 3.25pm		**Stephen Ritchie & Donna Rigano** Positioning the Researcher and Subject in Science Education Research. *Chair: John Lockley*	**May Hung Cheng & Beverley Bell** Learning to Teach Science at the Primary Level. *Chair: Robyn Garnett*	**Geoff Swan** Practice Makes Perfect? *Chair: Greg Thomas*	**John Loughran, Amanda Berry, Pam Mulhall & Richard Gunstone** Teaching/Testing about the Nature of Science: problems arising from students' perceptions. *Chair: Brian Lewthwaite*
3.30 - 4.00pm	**Afternoon Tea**				
4.00 - 4.40pm	**Cam McRobbie & Gregory Thomas** They Don't Teach Us How to Explain: They Only Teach Other People's Explanations. *Chair: Susan Rodrigues*	**John Barnett** PCxK: A synthesized model of exemplary science teachers' knowledge. *Chair: Debbie Middleton*	**Gilda Segal & Sandy Schuck** "I don't really feel guilty about science at all. No one does it!" Primary Teachers Teaching Science in Their First Year of Teaching. *Chair: Marilyn Fleer*	**Chi-Yan Tsui** Designing and Developing Computer-based Worksheets in Collaboration with Biology Teachers to Scaffold Classroom Learning of Genetics with GenScope. *Chair: Tony Wright*	

Saturday 10 July					
Times	**Baycrest 1**	**Baycrest 2**	**Delta**	**Summit**	**Annex**
9.00 - 9.40am	**Elizabeth McKinley** Mere, Hori, Mair, Meré and Mary: Maori Women Scientists Reflecting on Science Education. *Chair: Michael Michie*	**Ian Ginns, Sarah Stein & Cam McRobbie** The Key Learning Area of Technology: Asserting its uniqueness. *Chair: Léone Basher*	**Mavis Haigh** Learning to be Investigators. *Chair: Jim Watters*	**Wheijen Chang** An Interactive Teaching Approach in a University Physics Class in Taiwan. *Chair: Mark Hackling*	**Bill Palmer** *Ida Freund*: Teacher, Educator, Feminist and Chemistry Textbook Writer. *Chair: Richard Coll*
9.45 - 10.25am	**Kathryn Scantlebury, Kenneth Tobin, Jane Butler Kahle & Julie Ague** The Quiet Achiever: Enacting Culturally Relevant Science Teaching in an American Urban Middle School. *Chair: Dawn Garbett*	**Kathryn Paige** Investigating Science and Technology in Primary Classrooms. *Chair: Cam McRobbie*		**Peter Fensham** Didaktiks and/or Curriculum: Some research implications of these 1990 conversations. *Chair: Michael Cohen*	**John Wilkinson** An Analysis of Science (Physics) Textbooks for Scientific Literacy Themes. *Chair: Bill Palmer*
10.30-11.00am	**Morning Tea**				
11.00 - 11.40am	**John Longbottom** Science Education for Democracy: Dilemmas, Decisions, Autonomy and Anarchy. *Chair: Gordon Brown*	**Bev France** Asking the 'right ' questions. Identifying issues in a technological solution. *Chair: Beverley Jane*	**James Watters & Ian Ginns** Development of a Learning Community in a Science Classroom. *Chair: Amanda Berry*	**Mark Hackling, Denis Goodrum & Fred Deshon** A feasibility study for a Collaborative Australian Secondary Science Program. *Chair: Peter Aubusson*	**Lydia Austin** Changing ideas about science teaching reflected in 19th century school science books. *Chair: John Wilkinson*
11.45 - 12.25pm	**Joce Jesson** Science Education for a Nation. *Chair: Kathryn Scantlebury*	**Léone Basher** Concepts Of Excellence In Technological Practice - A preliminary profile of students undertaking technological practice through the CREST award programme. *Chair: Kathryn Paige*	**Jongwon Park, Jinwoong Song, Sunggi Kwan & Byunghoon Chung** The Use of Ideal Conditions in Physics Teaching and Learning. *Chair: Judy Moreland*	**Marie Brand** Introducing Microchemistry at Junior Secondary Level: Co-Study in South Africa *Chair: Fred Deshon*	**Jim Woolnough** How do Students Learn to Apply their Mathematical Knowledge to Interpret Graphs in Physics? Student and teacher reflections. *Chair: Ken Appleton*
12.30 - 1.45pm	**Lunch**				
1.45 - 2.25pm	**Sang-Woo Park & Sung-Jae Pak** Students' and Teachers' Views on the Relation between School Science Education and Traditional Science and Technology of Korea. *Chair: Elizabeth McKinley*	**Beverley Jane & Patricia Rowell** Weaving a new Technology Curriculum in Namibia: working from the inside out or the outside in? *Chair: Ian Ginns*	**Beverley Bell** Theorising about Formative Assessment. *Chair: Léonie Rennie*	**Gordon Brown et.al.** The Chance of Little Green Men: Using the SETI project in secondary school science. *Chair: Freya Lucas*	**Chris Arcus & Ally Bull** Integrating the Curriculum - Science and Social Studies: A pilot project. *Chair: Richard White*
2.30 - 3.10pm	**Michael Michie & Mark Linkson** Interfacing Western Science and Indigenous Knowledge: A Northern Territory Perspective. *Chair: Joce Jesson*	**Lindsey Conner** Investigating Cancer Issues: A year 13 project. *Chair: Michèle Whitten*	**Léonie Rennie & Lesley Parker** Teachers' and Students' Perceptions of Quality in Assessment Practice. *Chair: Dick Gunstone*	**Peter Aubusson & Kevin Watson** A snapshot of initiatives in Australian science education. *Chair: Peter Fensham*	**Richard Coll** Mental Models of Chemical Bonding: A cross-age study. *Chair: Marie Brand*
3.10 - 3.30pm	**Afternoon Tea**				
3.30-4.30pm	**ASERA AGM**				

Sunday 11 July					
Times	**Baycrest 1**	**Baycrest 2**	**Delta**	**Summit**	**Annex**
9.00 - 9.40am	**Keith Lucas & Michael Cohen** Changing Approaches to Teaching about the Changing Seasons. *Chair: John Loughran*	**Pat Shanks** Microscale Chemistry in Secondary Schools - the way of the future or a passing fad? *Chair: George Stolarski*	**Donna Satterthwait** Teaching Lesson Planning: constructivist strategies for teaching lesson planning skills. *Chair: Carolyn English*	**John Kearsey** The Contribution Which Bilingualism Can Make to Pupils Understanding of Scientific Language. *Chair: May Hung Cheng*	
9.45 - 10.25am	**Ann-Marie Noble** Using the History of Science to Teach Astronomy in the Primary School. *Chair: Keith Lucas*	**Richard White** Research on Alternative Conceptions: past, present and future. *Chair: Brendon Schollum*	**Bruce Waldrip & Darrell Fisher** Teacher-student interpersonal behaviours and classroom learning environment: Differences in country and city students' perceptions. *Chair: Ian Taylor*	**Jongwon Park & Ikgyun Kim** Classifying Students' Observational Activities. *Chair: Ian Clark*	
10.30–11.00am	**Morning Tea**				
11.00 - 11.40am	**George Stolarski** Students' Ideas in Chemistry Classes: echoes of the past? *Chair: Pat Shanks*	**Sue Ryan** Issues in Genetic Engineering.	**John Loughran, Amanda Berry & Deborah Corrigan** Once were Science Teachers. *Chair: Rosemary Hipkins*	**David Salter & Susan Robertson** Talk about Science Fairs. *Chair: Ian Milne*	
11.45am - 12.25pm	**Brian Lewthwaite** Teacher Perceptions of Factors Influencing Implementation of Science in the New Zealand Curriculum. *Chair: Ann-Marie Noble*	*Chair: Lindsey Conner*	**Slavica Pavlinic, Paul Buckley & Tony Wright** Visualising Molecules – Can Computers Help? *Chair: Leanna Kent*	**Ian Clark & Pat James** Concept Maps and Constructivism in Developing an Introductory Structural Geology Course *Chair: Chris Arcus*	
12.30 - 1.30pm	**Lunch**				

Workshop Abstracts

Day: Friday **Location: Delta**
Chair: Gilda Segal **Session time: 11:15 – 11:55am**

Ken Appleton and Eleanor Doig
k.appleton@cqu.edu.au

Faculty of Education & Creative Arts
Central Queensland University
Rockhampton QLD 4702, Australia
Tel: 07 4930 9520 Fax: 07 4930 9604

Primary School Teachers' Perceptions of Science Activities that Work

Many primary school teachers in Australia tend to be reluctant to teach science, partly because they are not confident in science and have limited science background knowledge. However, quite a number of primary teachers still manage to teach some science. When they plan to teach science, we have heard them use the term "science activities that work" fairly often. We began to recognise that such activities played an important role for primary teachers in their efforts to teach science. In order to better understand what this term means, we interviewed twenty teachers from several local schools and asked what they meant by "activities that work". We also drew on existing data from nine beginning teachers who had also used the expression. In this paper we outline the various characteristics of science activities that work as explained by the teachers and explore some of the implications for curriculum and teacher education.

Day: Saturday **Location: Annex**
Chair: Richard White **Session time: 1:45 – 2:25pm**

Chris Arcus and Ally Bull
chris.arcus@wce.ac.nz
ally.bull@wce.ac.nz

Wellington College of Education
P O Box 17-310
Karori, Wellington, New Zealand
Tel: 04 476 8699

Integrating the Curriculum – Science and Social Studies: A pilot project.

The New Zealand Curriculum Framework includes the requirement for schools to cover seven essential learning areas, eight essential skills under the umbrella on nine curriculum principles and integrating positive attitudes to learning and values, including honesty, reliability, respect for others, aroha, non-sexism and non-racism. Teachers and student teachers are understandably daunted by this prospect. One approach has been the development on an integrated curriculum. Integration offers a practical option for teachers attempting to cover a crowded curriculum. It also offers learners a view of the world that is more realistic and relevant than one viewed through the narrow visor of traditional subject boundaries. As one teacher responded: "science becomes more real to children when you include people".

This pilot project has begun to survey the provision of programmes in science and social studies and the perceptions of co-ordinators of the costs/benefits of and barriers to integrating. It is hoped that the survey will inform the continuing development at Wellington College of Education of a third year integrated science/social studies topic based course.

Day: Saturday **Location: Summit**
Chair: Peter Fensham **Session time: 2:30 – 3:10pm**

Peter Aubusson and Kevin Watson
p.aubusson@uws.edu.au

School of Teaching and Educational Studies
University of Western Sydney, Nepean
PO Box 10
Kingswood, NSW 2747. Australia
Tel: 02-47360445 Fax: 02-47360400

A snapshot of initiatives in Australian science education.

Despite attempts to change school science there remains a dissatisfaction with it. Given this outcome it is appropriate to examine initiatives in science education. This paper reports a summary of a selected sample of these initiatives, current in Australia in the second half of 1998, and identifies trends arising. The emphasis remains on curriculum change associated the official science education agenda in each state rather than local school based initiatives. We may have developed ways to initiate a change and even, in some cases, to sustain specific initiatives. Yet, there is a need to think afresh about what we want by way of initiatives in science education.

Day: Saturday
Chair: John Wilkinson

Location: Annex
Session time: 11:00 – 11:40am

Lydia Austin
lb.austin@auckland.ac.nz

School of Education, University of Auckland
Private Bag 92-019
Auckland, New Zealand
Tel: 09-3737-999 Fax: 09-3737455

Changing ideas about science teaching reflected in 19th Century school science books.

Science books for children have always played an important role in the teaching of science. They have been used as a source of useful scientific knowledge, as a source of information about the principles of science and as an aid to teaching the processes of science. They have also been used as entertainment, as a means of inculcating character traits and in support of religion. This paper will present a study of school science books published and used in the last century and consider how these books reflect changes in the perceived purposes of teaching science.

Day: Friday
Chair: Debbie Middleton

Location: Baycrest 2
Session time: 4:00 – 4:40pm

John Barnett
j.barnett@auckland.ac.nz

School of Education, University of Auckland
Private Bag 92-019
Auckland, New Zealand
Tel: 09-3737-999 Fax: 09-3737455

PCxK: A synthesized model of exemplary science teachers' knowledge.

A codified model of teacher knowledge, situated in school science teaching, called pedagogical context knowledge or PCxK is proposed as a synthesis of a number of models, metaphors and notions previously described in the literature about teachers' knowledge. This model suggests that exemplary science teachers demonstrate four kinds of knowledge: "academic and research knowledge", "pedagogical content knowledge", "professional knowledge", and "classroom knowledge". The model is explored through an examination of data that was collected before development of the model. Analysis of the data showed that the model works well, and is practical and useful for comparison of groups of teachers if the dependent relationship between interview questions and demonstration of knowledge is borne in mind.

Day: Saturday
Chair: Kathryn Paige

Location: Baycrest 2
Session time: 11:45am – 12:25pm

Léone Basher
leone.basher@wce.ac.nz

Wellington College of Education
P 0 Box 17-310
Wellington, New Zealand
Tel: 04 476 8669 Fax: 04 476 1079

Concepts Of Excellence In Technological Practice - A preliminary profile of students undertaking technological practice through the CREST (Creativity and Research in Science and Technology) award programme.

What are the behavioural characteristics of New Zealand students, who excel in technological practice? This paper discusses the nature of technological practice, and what could be thought of as excellence in this area. It uses the term technological practice to describe the holistic process of real life problem solving that underpins the New Zealand Technology curriculum, where learning is tacit, reflective, socially constructed and situated in authentic contexts. Exploration of the nature of excellence uses concepts of intelligence, special ability, giftedness and creativity in a New Zealand context and applies these concepts to observable behavioural characteristics. For example, do these students exhibit high levels of creativity, social leadership, spatial ability, persistence, self-determination, intrinsic motivation, and logical-mathematical or other intelligences? This paper is based on case studies of two students who have achieved gold CREST (Creativity and Research in Science and Technology) awards for design projects. This research focussed on interviews of these students, their teachers, consultants and assessors.

Day: Saturday
Chair: Léonie Rennie

Location: Delta
Session time: 1:45 – 2:25pm

Beverley Bell
b.bell@waikato.ac.nz

School of Education, University of Waikato
Private Bag 3105
Hamilton 2020, New Zealand
Tel: 07 838 4101 Fax: 07 838 4555

Theorising about Formative Assessment.

Recent research in the Learning in Science Project (Assessment) investigated formative assessment in year 7-10 classrooms. In this paper, I will introduce the theorising used in the project to explain the findings which, among other results, showed that formative assessment is a highly contextualised activity. The theorising draws upon socio-cultural and discursive perspectives.

Day: Saturday
Chair: Fred Deshon

Location: Summit
Session time: 11:45am – 12:25pm

Marie Brand
mariefire99@yahoo.com

University of the Witwatersrand
Private Bag 3
Johannesburg 2050, South Africa
Tel: 11 716 2271 Fax: 11 339 7967

Introducing Microchemistry at Junior Secondary Level: Co-Study in South Africa.

This paper concerns the introduction of small-scale chemistry at junior secondary level at a state boys' school in urban Johannesburg in the first few weeks of this year. The apparatus is the 'Radmaste Microchemistry Kit' developed, together with curriculum materials, at WITS.

Data are presented from five of the classes involved, showing brief initial impressions from students and then responses to amore detailed questionnaire administered some weeks later, after about 12 hours of instruction. There are reflections on the Kit and the process of teaching with it from four teachers and the laboratory technician, based on audio-taped interviews. Finally there is discussion of the Radmaste curriculum materials and the modified materials designed for use in that particular school. The 'content' concerned acids, bases, indicators and hydrogen, carbon dioxide and oxygen gas.

Day: Saturday
Chair: Freya Lucas

Location: Summit
Session time: 1:45 – 2:25pm

Gordon Brown, Les Vozzo, Carol Oliver, David Tweeds, Craig Brown, Ken Silburn, Stuart Hazel, Kel Wellington and Frank Stootman
g.brown@uws.edu.au

University of Western Sydney, MacArthur
26 James Road
Mount Kembla NSW 2526, Australia
Tel: 02 4272 6008

The Chance of Little Green Men: Using the SETI project in secondary school science.

This paper reports on a science curriculum development project in NSW, Australia, that uses the US-based SETI Project (Search for Extra-Terrestrial Intelligence). It brings cutting edge science that has broad social interest into the secondary curriculum. The report combines the perspectives of teachers, scientists, teacher educators and the school system.

Day: Saturday **Location: Summit**
Chair: Mark Hackling **Session time: 9:00 – 9:40am**

Wheijen Chang
wheijen@waikato.ac.nz

SMTER Centre, University of Waikato
Private Bag 3105
Hamilton 2020, New Zealand
Tel: 07 858 3228

An Interactive Teaching Approach in a University Physics Class in Taiwan.

This paper is to report on the design and outcomes of an intervention program, which aimed to promote interaction and to stimulate students' intellectual engagement in a university physics class in Taiwan. Two main features of the program design were:

1. Content design highly linked to everyday life phenomena, which may promote learning motivation
2. Teaching adopting a 'questioning before teaching approach', which provided more challenges to the students.

According to students' evaluations, the program appeared to significantly

- improve effective learning outcomes
- activate learning engagement and commitment and
- foster student responsibility for learning.

However, the students' academic performance appeared to be similar when compared with traditional groups of students. Although most lecturers regarded the implementation of such an interactive teaching approach as practically not feasible, the intervention program showed that the existing teaching constraints could be overcome and significant outcomes could be achieved.

Day: Friday **Location: Delta**
Chair: Robyn Garnett **Session time: 2:45 – 3:25pm**

May Hung Cheng and Beverley Bell
maycheng@ied.edu.hk

SMTER Centre, University of Waikato
Private Bag 3105
Hamilton 2020, New Zealand
Tel: 07 858 3228

Learning to Teach Science at the Primary Level.

This paper describes the experience of a group of student teachers in an initial teacher education programme in Hong Kong. In preparing the student teachers to teach science, the programme introduced a module on science teaching that included a discussion of the various approaches to teach science and in particular, teaching based on a constructivist view of learning science. The focus of the study is to look at the development of the student teachers at three phases: before taking the module on science teaching; after taking the module and after their teaching practice period. The student teachers were interviewed at the three phases and their views on science teaching; being a science teacher in school and their own experiences in learning to teach were collected and analysed. Besides presenting the initial findings of this on-going study, the paper concludes with the possible factors that influence the development of the student teachers as they learn to teach.

Day: Sunday **Location: Summit**
Chair: Chris Arcus **Session time: 11:45am – 12:25pm**

Ian Clark and Pat James
ian.clark@unisa.edu.au

Faculty of Engineering & the Environment
University of South Australia
Australia
Tel: 08 8302 5245 Fax 08 8302 5082

Concept Maps & Constructivism In Developing An Introductory Structural Geology Course

For the past several years we have been changing the way we teach structural geology to undergraduate geology students. Two principal modifications to the way we deliver material to students have resulted from our work which was undertaken to try to achieve more meaningful learning in our students (Ausubel 1963; Ausubel 1968; Ausubel, Novak et al. 1978). One is the direct delivery of computer developed material during lectures (James and Clark 1992), and the second is the use of concept maps, which is the topic of this presentation. The use of concept maps in our teaching to encourage students to adopt a deep/holistic approach to learning and to develop a better understanding of the concepts of structural geology is described. Although structural geology is a topic in most introductory courses, its treatment in second year undergraduate courses involves many new concepts. An attempt has been made to present these concepts most effectively by using concept maps as a teaching tool and a learning tool and in curriculum planning. The outcomes of this approach will be described.

Day: Saturday **Location: Annex**
Chair: Marie Brand **Session time: 2:30 – 3:10pm**

Richard Coll
r.coll@waikato.ac.nz

School of Science & Technology
University of Waikato, Private Bag 3105
Hamilton 2020, New Zealand
Tel: 07 838 4100 Fax: 07 838 4218

Mental Models of Chemical Bonding: A cross-age study.

Learners' mental models of chemical bonding were probed using a three-phase interview protocol. The data revealed that learners prefer simple realistic models despite their level of education.

Day: Friday **Location: Baycrest 1**
Chair: Alistair Jones **Session time: 2:00 – 3:25pm**

Vicki Compton[1] and Cliff Harwood[2]
vicandgarry@xtra.co.nz
c.d.harwood@massey.ac.nz

[1]Auckland College of Education - Tai Tokerau Campus
Whangarei, New Zealand
[2]Massey University
Private Bag 11-222
Palmerston North, New Zealand
Tel 06 3569099 Fax: 06 3513385

TEALS Research Project: From Directions to Classroom Practice.

Technology Education Assessment in Lower Secondary (TEALS) is a New Zealand Ministry of Education funded research project which aims to provide informed research based guidance to teachers for the assessment of technology education. This project is focused on the lower secondary school - years nine and ten (forms three and four).

This paper provides a brief outline of the project and a summary of progress to date. The theoretical framework which has been developed to support the assessment of student's technological practice is discussed and illustrated with examples of unit frameworks developed. Some of these units which are presently under trial in classrooms will be focused on with early data being presented and discussed.

Day: Saturday **Location: Baycrest 2**
Chair: Michèle Whitten **Session time: 2:30 – 3:10pm**

Lindsey Conner
lindsey.conner@weka.cce.ac.nz

Christchurch College of Education
P O Box 31-065
Christchurch 8015, New Zealand
Tel: 04 343 7780

Investigating Cancer Issues: A year 13 project.

This paper outlines a preliminary analysis of students' thinking in a year 13 unit on cancer issues in a Christchurch co-educational school. A preliminary analysis of 15 case studies shows that some year 13 students, when prompted, use learning strategies which help them reflect on their own learning and clarify their ideas on some bioethical issues. This paper reports on how pre-unit interviews, questionnaires on bioethical thinking before and after the unit of work, thinking journals, classroom observations, end of unit essays and interviews about aspects of the unit can be triangulated to provide a framework for data analysis.

Day: Friday
Chair: Robyn Baker

Location: Annex
Session time: 2:00 – 2:40pm

Carmel M Diezmann and James J Watters
j.watters@qut.edu.au

Faculty of Education, Queensland University of Technology
Victoria Park Road, Kelvin Grove
Brisbane QLD 4059, Australia
Tel: 07 3864 3339 Fax: 07 3864 3985

Achieving social justice for gifted students in the new Queensland Science Syllabus

The education of gifted children in science receives scant attention from policy makers, teachers and science education researchers. A perception publicly stated by some of these stakeholders is that children gifted in science do not need any special provisions or considerations. This perception stems from apathy and an ignorance of many of the ramifications of not providing appropriate educational experiences for these children. Gifted education in the State of Queensland has in recent years been acknowledged as a social justice priority in the Wiltshire Report and has received relatively substantial funding. However, in the 1999 science syllabus, despite assertions about catering for individual learners, gifted education principles have been ignored. Despite this lack of guidance in the documentation, the syllabus does provide scope for teachers to implement worthwhile initiatives for the gifted. However, it requires a further commitment on the part of many teachers to reform of their practices. Assumptions underpinning the new syllabus are radical enough for classroom teachers to accept and enact without consideration of assumptions of gifted education. However, it is possible to articulate the congruences between the new science syllabus and gifted education. This paper will address if and how gifted children can be catered for within the outcomes based framework of the 1999 Queensland Science Syllabus by drawing upon principles of enrichment for gifted children.

Day: Friday
Chair: Debbie Corrigan

Location: Delta
Session time: 10:30 – 11:10am

Carolyn English and Rosemary Hipkins
carolyn.english@wce.ac.nz
rosemary.hipkins@wce.ac.nz

Wellington College of Education
P O Box 17-310
Karori, Wellington, New Zealand
Tel: 04 476 8699

Supporting Primary Teachers in their Understanding of Some Key Science Concepts while Focusing on the Development of Provisional Concepts.

This paper will report on the rationale we have developed and research we have used to support the MOE contract for the revision of the primary science booklets. We argue for the development of a purposeful and coherent vision for the teaching of primary science. By providing teachers with conceptual frameworks that show how children may build their provisional ideas towards a more complete understanding of science concepts, we hope to support teachers in building their own personal understandings, whilst simultaneously providing them with a very structured support for their classroom teaching and decision making. In presenting our work we would also like to initiate a debate about the purpose of primary science in New Zealand.

Day: Friday
Chair: Carmel Diezmann

Location: Annex
Session time: 10:30 – 11:10am

Rod Fawns, Sophie Arkoudis and Gerry Healy
r.fawns@edfac.unimelb.edu.au

Department of Science & Mathematics Education
University of Melbourne
Parkville VIC 3052, Australia
Tel: 03 9344 8263 Fax: 03 9344 8739

Signs, Social Ontology and Critical Realism in Science Education.

Signs and representations are clearly fundamental to science education research as they are to social life. Yet, despite valuable insights into the nature of science education which would honour the features of the genetic model of knowledge, and contributions to critical realist models of structural, social and cultural transformation, the domain has not provided an adequate account of it's signs and representations even though without signs, meanings are literally unthinkable. The undertheorization of signs results in theoretical and political difficulties. For example, the exact ontological status of signs and meanings is unclear, which casts doubt over any larger ontological frame, especially since we hold that society is concept dependent. Given the dominance of poststructualist ideas in educational research, exactly this area (whether through semiology, discourse theory, deconstruction, psychoanalysis, linguistic or literary analogies), it is unlikely that science education research will make much headway among either education or cultural theorists unless it provides a satisfactory account of its signs.

In this article I will take up Bhaskar's few comments on the sign and develop them further by appropriating the ideas of C S Peirce. Obviously a complete analysis of signs is not feasible here, but it is possible to lay fuller foundations for a critical realist semiotics. Those foundations, however, force revision of ontological strata. I will then pursue that revision to explore the significance of signs for the ontology of society (an issue that has several analytical and methodological implications) and for a general picture of the dimensions of practice in science education.

Day: Saturday **Location: Summit**
Chair: Michael Cohen **Session time: 9:45 – 10:25am**

Peter Fensham
peter.fensham@education.monash.edu.au

Faculty of Education, Monash University
Wellington Road
Clayton VIC 3168, Australia
Tel: 03 9905 2847 Fax: 03 9905 2779

Didaktiks and/or Curriculum: Some research implications of these 1990 conversations.

Many members of ASERA will be aware of the research studies associated with the concept of pedagogical content knowledge. Few, however, will know that this research initiated a series of invited conversations between scholars from the Anglo-American tradition of Curriculum (in which most ASERA members have been socialised) and scholars from the continental European tradition of Didaktiks. This paper will highlight some important differences between the traditions and draw some implications from them for research in science education. An example from chemical stoichiometry will be used to illustrate how the problematic nature of a topic in school science has been investigated by researchers in these traditions. A current study that seeks to bridge the traditions will be presented.

Day: Friday **Location: Baycrest 2**
Chair: Barbara Backshall **Session time: 11:15 – 11:55am**

Marilyn Fleer
fleer@education.canberra.edu.au

Department of Education,
University of Canberra
Canberra ACT 2616, Australia
Tel: 06 2012438 Fax: 06 201 5065

An investigation of young children's ideas about Environmental Education.

Major Government reports on the environment, such as the National Green House Strategy, include education as an important contributor for remedying environmental problems. Yet very little is understood about young children's views, their knowledge base, and their capacity to act for the environment. A significant proportion of the environmental education literature is devoted to defining, describing and evaluating programs and conjecturing on environmental education generally. Base line research into children's understandings and capabilities in relation to environmental education is limited. Yet there is evidence, which suggests that children need to be aware of their own beliefs and capabilities before they can act for the environment. It can be argued that without a systematic investigation of what is of value to children and what knowledge base children need in order to act responsibly, it is difficult to plan meaningful programs for children in environmental education. This paper details a study, which researched young children's views of the environment, their knowledge base, and their perceived capacity to act.

Day: Saturday **Location: Baycrest 2**
Chair: Beverley Jane **Session time: 11:00 – 11:40am**

Bev France
b.france@ace.ac.nz

Auckland College of Education
Private Bag 92-601 Symonds Street
Auckland 1035, New Zealand
Tel: 09 623 8899 Fax 09 623 8898

Asking the 'right ' questions. Identifying issues in a technological solution.

It is well established that technological education is not just about the development of technical expertise. A humanist view of technological literacy aims to demonstrate that the culture of technology is set within a social framework. Technology education as expressed in the New Zealand curriculum provides an opportunity for societal issues to have an equal space with technological capability and technological knowledge. However when technological solutions focus on outcomes it is all too easy for a stakeholder's position to be assumed.

There is a need for a teaching approach to engage in a liberating technological literacy discourse where values and beliefs of all participants directly and indirectly involved in the activity are examined. This research monitored a professional development programme where a familiar object was analysed to identify the values it represents. This analysis provided a model for discussion and the development of a teaching environment that promoted problem-solving where values issues were to the fore. The data has been collected from primary school teachers who developed teaching programmes for years 1 to 8 (5 - 12 years).

Day: Friday
Chair: Beverley Bell

Location: Baycrest 2
Session time: 2:00 – 2:40pm

Dawn Garbett
gohome@ihug.co.nz

Auckland College of Education
Private Bag 92-601 Symonds Street
Auckland 1035, New Zealand
Tel: 09 623 8899 Fax: 09 623 8875

Group Memory Work as a Research Method in Science Teacher Education.

Group memory work has been used in a variety of settings as a powerful research method to analyse and interpret lived experience. The focus of memory work has been to uncover the social constructions of experiences as they contribute to self-identity. For example, Haug (1987) explored female sexualisation, Schratz (1996) examined personal and institutional racism, while Friend (1997) used group memory work to look at consumers retail experiences. It provides a way of investigating memories using the participants themselves to collectively analyse the meaning of their memories. This presentation will outline group memory work as a research strategy with the potential to uncover some of the common reasons why Science is viewed by many student teachers in a negative and/or threatening light.

Day: Saturday
Chair: Léone Basher

Location: Baycrest 2
Session time: 9:00 – 9:40am

Ian Ginns, Sarah Stein and Cam McRobbie
i.ginns@qut.edu.au

Queensland University of Technology
Victoria Park Road, Kelvin Grove
Brisbane QLD 4059, Australia
Tel: 07 3864 3339 Fax: 07 3864 3985

The Key Learning Area of Technology: Asserting its uniqueness.

The teaching of the key learning area of technology could be seen as 'fitting' easily into other key learning areas, thus losing its identity. Hence, there is a need to establish the uniqueness of the technology area with its own content, skills and capacity to engage children in higher level thinking and reasoning. The purpose of this paper is to compare the search for understanding of the learning area of technology by two teachers, one an experienced primary school teacher, the other a postgraduate, preservice teacher education student. The experienced teacher grappled with the many problems associated with fitting a new curriculum area into an already crowded classroom program. The preservice teacher was confronted with the tasks of learning about the new curriculum area and learning how to teach. The paper documents and analyses how both reached an understanding, in their respective ways, of the concept of technology and how they believed technology should be taught in the classroom. The analysis will be used to shed light on how teachers recognise that technology can make unique, but important contributions to the all round development of primary school students.

Day: Friday
Chair: Malcolm Carr

Location: Baycrest 2
Session time: 12:00 – 12:40pm

Dick Gunstone[1], Jennifer Case[2] and Alison Lewis[2]
dick.gunstone@education.monash.edu.au

[1]Monash University [2]University of Cape Town
Faculty of Education, Monash University
Clayton VIC 3168, Australia
Tel: 03 9905 2857 Fax: 03 9905 9197

Mapping Students' Metacognitive Development.

In this paper the metacognitive development of students in a second year chemical engineering course (which had such development as an explicit aim) is investigated. Journal and interview data were used to develop a possible framework for describing metacognitive development in this context. The framework comprises four categories: 1. conception of learning; 2. organising ones learning; 3. assessment of learning; 4. purpose of learning: personal development. It is suggested that these four categories might represent a possible hierarchical sequence of metacognitive development in this course context. A description of aspects of development within each of the categories is provided, and further sub-hierarchies of development are identified. That there is evidence of some students at the end of the course having developed a personal purpose for learning (category 4) suggests there was, for these students, a significant coherence in the course intentions of the lecturer and learning outcomes.

Day: Saturday **Location: Summit**
Chair: Peter Aubusson **Session time: 11:00 – 11:40am**

Mark Hackling[1], Denis Goodrum[1] and Fred Deshon[2]
m.hackling@cowan.edu.au
fred.deshon@eddept.wa.edu.au

[1]Edith Cowan University
Bradford Street
Mount Lawley WA 6050, Australia
Tel: 08 9370 6339

[2]Education Department of Western Australia
151 Royal St
East, Perth WA 6004, Australia
Tel: 08 9264 4824 Fax: 08 9264 4011

A feasibility study for a Collaborative Australian Secondary Science Program.

In 1998, the Australian Academy of Science, Education Department of Western Australia and Edith Cowan University sponsored a feasibility study to explore the potential for a Collaborative Australian Secondary Science Program that would improve the quality of science teaching and learning in the compulsory years of secondary schooling. This paper describes the feasibility study and the proposal that was developed including the conceptual design for the Program and its key principles that were negotiated with and supported by key stakeholders.

Day: Saturday **Location: Delta**
Chair: Jim Watters **Session time: 9:00 – 9:40am**

Mavis Haigh
m.haigh@ace.ac.nz

Auckland College of Education
Private Bag 92-601, Symonds Street
Auckland 1035, New Zealand
Tel: 09 623 8899 Fax: 09 623 8875

Learning to be Investigators.

If the process of learning is conceived as the development of expertise within a community of practice, then expertise in scientific investigation is not expected to be easily achieved by students working by themselves. Rather, the cultural conventions which make up the processes of science are learned and perfected in interaction with those who already possess and practice them. In this paper I report on findings from a long term study of students and teachers working together at investigative practical work in senior school Biology programmes. The multiple activities of the teachers and students before, during and after the investigation will be outlined. The role of the teacher was found to be crucial to the learning of the students as they engaged in the complexity of investigative practical work, with the teachers providing the students with the means to become autonomous and self-regulating.

Day: Saturday **Location: Baycrest 2**
Chair: Ian Ginns **Session time: 1:45 – 2:25pm**

Beverley Jane and Patricia Rowell
bljane@deakin.edu.au

Deakin University
221 Burwood Highway
Burwood VIC 3125, Australia
Tel: 03 9244 6394 Fax: 03 9244 6834

Weaving a new Technology Curriculum in Namibia: workin from the inside out or the outside in?

Craft and Technology (NIED, 1996) is a new subject in the Namibian curriculum. In 1998 the lower primary phase was introduced for the first time in Grade 3. We observed technology classes during our stay in the northern regions of Namibia, where the majority of the country's children live. International aid donors are working there to raise the standard of education. As part of the USAID Basic Education Project (BES), materials are being developed, such as the Systematic-designed, Structured Instructional Materials (SIMS) which include lesson plans, posters and assessment. Through the BES project, Peace Corps Volunteers work with teachers in schools. We observed one, Peace Corps Volunteer, delivering core training to the teachers in her cluster of schools in the form of workshops and providing feedback to individual teachers in order to improve their classroom teaching. In this paper we describe, from our perspective, the complex and problematic nature of implementing a new technology curriculum in a developing country with outsiders as facilitators. Simultaneously, we celebrate the successes which indicate that Namibian teachers are moving in the right direction.

Day: Saturday
Chair: Kathryn Scantlebury

Location: Baycrest 1
Session time: 11:45am – 12:25pm

Joce Jesson
j.jesson@ace.ac.nz

Auckland College of Education
Private Bag 92-601
Auckland 1035, New Zealand
Tel: 09 623 8899 Fax: 09 623 8875

Science Education for a Nation.

The MORST Strategic Plan "Blueprint for Change" sets a goal for New Zealanders to become innovative and forward looking people well able to develop a knowledge culture. This should involve New Zealand actively building a sense of our nation. That sense of nation-hood is developed or supported through schooling. Science curriculums are state-sanctified documents that reflect the consciousness that those people making selections have about what is important in science for the next generation. How they are put into action however reflects the consciousness of the teacher. This paper examines some learning activities often used in the New Zealand science curriculum both in primary and secondary schools and raises questions as to what is the nationality and nation- consciousness of the curriculum in action. Using various anecdotal and historical examples, the discussion relates science curriculum to the development of a personal social national reality and asks how does science education contribute to identity formation as a citizen of New Zealand and its contribution to New Zealand as an innovative society.

Day: Friday
Chair: Mike Forret

Location: Baycrest 1
Session time: 11:15am – 12:40pm

Alister Jones, Judy Moreland and Ann Northover
a.jones@waikato.ac.nz

SMTER Centre, University of Waikato
Private Bag 3105
Hamilton 2020, New Zealand
Tel: 07 838 4245 Fax: 07 838 4272

Developing Teachers' Formative and Summative Assessment Strategies in Technology.

This paper will outline the new research project, Learning in Technology Education (Assessment) Project, the aim of which is the development and enhancement of primary school teachers' formative and summative assessment strategies in technology, and which is funded by the Ministry of Education for one year.

The project builds on previous work in technology education assessment (Jones and Moreland, 1998) and the work of the earlier Learning in Technology Education Project (Jones, Mather and Carr, 1995). The workshop will report on the background interviews and case studies undertaken in 1998 and will examine existing classroom practice in technology assessment. It was found that teachers mainly focused in social and managerial aspects of technology tasks rather than technological outcomes.

An intervention strategy was designed to enhance the procedural, conceptual and technical aspects of technology education. This will be discussed along with the current models of assessment that we are developing. The intervention strategy is currently being trialed in schools by 14 teachers. The preliminary results look very encouraging and appear to have also influenced teaching and assessment practices in other curriculum areas, such as science.

Day: Friday
Chair: Ken Stevens

Location: Summit
Session time: 2:00 – 2:40pm

Matthew Kearney[1] and David F Treagust[2]
matthew.kearney@uts.edu.au

[1]Faculty of Education [2]Curtin University
University of Technology, Sydney
P O Box 222,
Lindfield NSW 2070, Australia
Tel: 02 9514 5165 Fax: 02 9514 5556

Using multimedia to probe student understanding.

This paper discusses the use of digital video clips to encourage student discussion about their own ideas and to elicit students' science preconceptions prior to instruction in physics in Year 10 and 11. The video clips showed difficult, expensive, time consuming or dangerous demonstrations of real, observable events. A predict-observe-explain (POE) format supported the students' interaction with the video clips. In this computer learning environment, students worked in pairs and were required to type full sentence responses that were recorded by the computer for later analysis by the researcher. Data sources for this study included the computer generated responses, interviews with selected students and their teachers, classroom observations, and student questionnaires. This paper will report on preliminary findings from the study, including student and teacher perceptions of the POE computer tasks. The findings have implications for the effective use of multimedia to enhance meaningful learning in science classrooms.

Day: Sunday **Location: Summit**
Chair: May Hung Cheng **Session time: 9:00 – 9:40am**

John Kearsey
jkearsey@dmu.ac.uk

School of Education
De Montford University, Polhill Campus
Polhill Avenue, Bedford MK41 9EA, England
Tel: 01234 783081

The Contribution Which Bilingualism Can Make to Pupils' Understanding of Scientific Language.

Learning the language of science is an important aspect of learning science. Scientific language enables pupils to understand the information presented to them in science lessons, to communicate effectively in science and to think in a scientific way. In these circumstances, being bilingual may be an advantage in learning science, if it confers additional linguistic skills on the learner, or a disadvantage if it contributes to the learners' confusion about scientific language. In this paper I will consider the implications of research which I carried out in the UK which will support this view of the value of bilingualism to learning the language of science. I hope the discussion will bring out the similarities and differences between multicultural science education environments in the UK and Australasia and point to potential areas for future research collaborations on the language of science and bilingual students.

Day: Sunday **Location: Baycrest 1**
Chair: Ann-Marie Noble **Session time: 11:45am – 12:25pm**

Brian Lewthwaite
b.e.lewthwaite@massey.ac.nz

Massey University College of Education
Private Bag 11-035
Palmerston North 5030, New Zealand
Tel: 06 357 9104 Fax: 06 3569032

Teacher Perceptions of Factors influencing Implementation of Science in the New Zealand Curriculum.

The recent release of findings from New Zealand's participation in TIMSS has revealed not only the disturbing level of science achievement by Form 2 and Form 3 students , but also associated concerns with science programme delivery in general. This report further examines this result and is based on a survey of 122 primary/intermediate/Kura Kaupapa teachers in the Central Districts of the North Island of New Zealand. The report includes an analysis of (1) concept areas teachers receive as difficult to teach, (2) factors contributing to and/or inhibiting effective implementation of the primary science curriculum and (3) biographical details of survey participants. Also included is a discussion of the appropriateness of recent Ministry of Education's efforts to address the malady in New Zealand primary science education.

Day: Saturday **Location: Baycrest 1**
Chair: Gordon Brown **Session time: 11:00 – 11:40am**

John Longbottom
john.longbottom@weka.cce.ac.nz

Science Departmen
Christchurch College of Education
P O Box 31-065
Christchurch 8030, New Zealand

Science Education for Democracy: Dilemmas, Decisions, Autonomy and Anarchy.

The pursuit of scientific knowledge, and the need to control the applications of science, link democracy with science. The social goals of general education, and the need to respect learners, link democracy with science education. The focus of this paper is on the problems of teaching authoritative science without being authoritarian, and of allowing teachers a high level of autonomy without creating educational anarchy. Many previous reforms of science education have prescribed how science should be taught or what science should be taught. However, in making decisions, teachers often face legitimate but conflicting classroom demands, and this situation creates dilemmas that cannot be resolved by prescription. A teaching model is developed which acknowledges these dilemmas, and grants to teachers a high degree of autonomy in resolving them. Realist views of science and the world, and broad social goals, are combined to specify aims for science education. These aims prevent any slide into anarchy.

Day: Sunday
Chair: Rosemary Hipkins

Location: Delta
Session time: 11:00 – 11:40am

John Loughran, Amanda Berry and Deborah Corrigan
john.loughran@education.monash.edu.au

Faculty of Education, Monash University
Wellington Road
Clayton VIC 3168, Australia
Tel: 03 9905 2847 Fax: 03 9905 2779

Once were Science Teachers.

How does an understanding of science teaching change and develop when one moves from being a high school science teacher to a university science educator? This paper will explore this question through the authors' reflections on their developing understanding of science teaching and learning in light of their previous experience as high school teachers and their current experience as science educators. Through teaching about science teaching and learning in a pre-service teacher education program (Grad.Dip.Ed) the authors have reconceptualised both their teaching practice and their understanding of science learning as they have come to better understand the nature of this complex enterprise; further challenged through the link to teaching about teaching. This paper will offer insights into the authors' reflections on their developing understanding of science teaching and learning and begins to highlight the importance of teacher educators' professional knowledge being explicit, articulable and accessible – to both themselves and their students.

Day: Friday
Chair: Brian Lewthwaite

Location: Annex
Session time: 2:45 – 3:25pm

John Loughran, Amanda Berry, Pam Mulhall and Richard Gunstone
john.loughran@education.monash.edu.au

Faculty of Education, Monash University
Wellington Road
Clayton VIC 3168, Australia
Tel: 03 9905 2857 Fax: 03 9905 9197

Teaching/Testing about the Nature of Science: Problems arising from students' perceptions.

A year after experiencing science classes in Grade 10 that had a strong focus on learning about aspects of the practice of science, students answered a test of their understanding of these practices. We report on this test, student responses, and the ways student perceptions of both the test and the content of school science shaped their responses.

Day: Sunday
Chair: John Loughran

Location: Baycrest 1
Session time: 9:00 – 9:40am

Keith Lucas[1] and Michael Cohen[2]
k.lucas@qut.edu.au
cohen007@iupui.edu

[1]Queensland University of Technology
Victoria Park Road
Kelvin Grove QLD 4059, Australia
Tel: 07 3864 3332

[2]Indiana University
Purdue University Indianapolis
902 West New York St
Indianapolis IN 46202-5155, USA

Changing Approaches to Teaching about the Changing Seasons.

Seasons are part of most school science curricula, yet many children and adults, including pre-service teachers, have a limited understanding of underlying causes of seasonal changes and their relation to climate in different regions. Using textbook resources available in North America and Australia over the past two hundred years, this paper will review the approaches used in teaching seasons to primary and lower secondary school pupils. From the early 1800s, we have used the same diagrams to teach about the seasons. However, the background knowledge and explanations have changed dramatically. What once may have taken twenty or more pages to explain, is no often explained on one page with one diagram. What insights can we gain from looking at older explanations and approaches? What do these older textbooks teach us about seasons that we have forgotten? How well do old approaches fit with the latest educational ideas and approaches?

Day: Friday **Location: Baycrest 1**
Chair: Susan Rodrigues **Session time: 4:00 – 4:40pm**

Campbell J. McRobbie and Gregory P. Thomas
c.mcrobbie@qut.edu.au
gp.thomas@qut.edu.au

Centre for Mathematics and Science Education
Queensland University of Technology
Victoria Park Rd, Kelvin Grove
Brisbane QLD 4059, Australia
Tel: 07 3864 3640 Fax: 07 3864 3643

They Don't Teach us How to Explain: They Only Teach us Other Peoples' Explanations.

Internationally there is concern with the traditional learning environments evident in many science classrooms and the levels of understanding of science and science reasoning developed by students in such environments. The majority of research on classroom environments has focussed on characterising the learning environment in classrooms rather than monitoring changes to a class's or individuals' perceptions of changes in their learning environments. This study reports on an attempt to change the learning environment in a Year 12 chemistry classroom and documents changes in participants' perceptions of their learning environments and the corresponding changes in a teacher's and her students' perceptions of their science reasoning and understanding that such changes facilitated. The results are discussed in terms of a community of learners in which students and teachers began to understand the processes and the value of science reasoning in terms of theories or models and evidence.

Day: Saturday **Location: Baycrest 1**
Chair: Michael Michie **Session time: 9:00 – 9:40am**

Elizabeth McKinley
e.mckinley@waikato.ac.nz

SMTER Centre, University of Waikato
Private Bag 3105
Hamilton 2020, New Zealand
Tel: 07 838 4245 Fax: 07 838 4272

Mere, Hori, Mair, Meré and Mary: Maori Women Scientists Reflecting on Science Education.

Science, and its practice, has always marginalized some groups since it became a formal institution. These groups, historically, have included people from cultures other than that through which science emerged and women. This paper will explore the experiences of Maori women scientists in science education, drawing from a wider postcolonial study, examining the effects of colonization on the participation of Maori women in science. The women cover a wide range of ages and education types, such as single sex schools (state and private, Maori and non-Maori), English medium and Maori medium schooling. The paper will explore the issues raised by the sixteen Maori women scientists in relation to schooling generally and, in particular, science education and discuss the implications for classroom research.

Day: Saturday **Location: Baycrest 1**
Chair: Joce Jesson **Session time: 2:30 – 3:10pm**

Michael Michie and Mark Linkson
mmichie@ozemail.com.au

Northern Territory Department of Education
321 Trower Road
Nakara NT 0810, Australia
Tel: 08 8927 3882

Interfacing Western Science and Indigenous Knowledge: A Northern Territory Perspective.

Three initiatives for the implementation of primary science education in Aboriginal schools in the Northern Territory are described. These attempt to value Indigenous knowledge alongside Western science learning. These are

1. A curriculum which places a higher value on Indigenous knowledge other than simply 'enrich' Western science
2. Resource materials which parallel the experiences of Indigenous learners with Western understandings and which are inclusive of Indigenous cultural considerations
3. An attempt to facilitate profiling of Western science learning outcomes in the context of a holistic curriculum.

Day: Friday
Chair: Vicki Compton

Location: Baycrest 1
Session time: 10:30 – 11:10am

Judy Moreland and Alister Jones
j.moreland@waikato.ac.nz

SMTER Centre, University of Waikato
Private Bag 3105
Hamilton 2020, New Zealand
Tel: 07 838 4245 Fax: 07 838 4272

Emerging Assessment Practices in an Emergent Curriculum: Implications for Science and Technology.

This paper reports on a detailed case study into emerging assessment practices in technology in two schools with nine teachers. This research is part of the Research in Assessment of Primary Technology and formed the basis for the Learning in Technology Education (Assessment) project. The paper discusses emerging classroom practices in new subject areas. Impacting on teachers' assessment practices are existing subcultures in schools, subject expertise and school-wide policies. Assessment is often seen in terms of aspects, such as social, managerial, team work, turn taking and information skills rather than procedural and conceptual. Therefore, formative interaction with students distorts the learning away from procedural and conceptual aspects of the subject. Hence, the learning focuses on generic skills rather than students' understanding. This paper highlights the importance of developing teacher expertise in three dimensions of: knowledge about the subject, knowledge in the subject and general pedagogical knowledge. The findings from this research, therefore, have implications for thinking about teaching, learning and assessment in science and technology.

Day: Friday
Chair: Rod Fawns

Location: Annex
Session time: 12:00 – 12:40pm

Sid Chenicheri Nair and Darrell Fisher
snair@dynamite.com.au

National Key Centre for School Science and Mathematic
Curtin University of Technology
GPO Box U1987, Perth WA 6156, Australia
Tel: 08 9266 7484 Fax: 08 9266 2503

Transition from Senior Secondary to Higher Education: A Learning Environment Perspective

The purpose of this study was to modify and validate a new form of the Colleges and Universities Classroom Environment Inventory (CUCEI), and to then use it to compare students' actual and preferred perceptions of their classroom learning environments at the senior secondary and tertiary levels of education. The study also examined differences in perceptions according to the student's sex. A sample of 504 students participated in the study. The reliabilities of the scales of the modified CUCEI ranged from 0.73 to 0.94. When the two levels were compared, students at the higher education level had a less favourable perception of their learning environment. Previous research was replicated in that females were found generally to perceive their learning environments in a more positive way than did males and that all students generally preferred a more positive learning environment in their classes.

Day: Sunday
Chair: Keith Lucas

Location: Baycrest 1
Session time: 9:45 – 10:25am

Ann-Marie Noble
ann-marie.noble@xtra.co.nz

Advisory – Auckland College of Education
(seconded from Maungawhau School)
42 Ripon Crescent, Meadowbank,
Auckland 1005, New Zealand
Tel: 09 521 1839

Using the History of Science to Teach Astronomy in the Primary School.

The use of an historical approach to teach science draws on research in the history and philosophy of science, whereby a parallel has been identified between children's naïve views or misconceptions and the quest for answers in science, investigated by scientists throughout history. Investigators have proposed that the restructuring required of science students is similar to that which occurs in scientific revolutions.

Research, using the history of science as a vehicle for teaching science, however, has been applied primarily to secondary and tertiary students. The present research focuses on a new field with year 3 primary students. The context studied was the solar system and a unit of work was written whereby complex and abstract ideas in astronomy are introduced to the children and thought experiments and ideas held by early astronomers are discussed and 'replicated'. The investigation showed that, exposing young children to the limitations of prescientific and historical (geocentric and heliocentric) approaches to phenomena in astronomy, can assist their development of a sidereal or scientifically acceptable explanatory framework.

Day: Friday **Location: Baycrest 2**
Chair: Stephen Ritchie **Session time: 10:30 – 11:10am**

Wonkun Oh and Jaewoo Kim
wkoh@netsgo.com

Department of Physics Education , Seoul National University
KwanAk-Gu, Silim-Dong 151-742
Seoul, South Korea
Tel: 880 8817 Fax: 880 9754

Conceptual Change in Galilean Relativity with the Help of Idealisation.

Understanding Galilean relativity is required for secondary students, since they have the tendency to discriminate between 'moving' and 'rest' state of a body. This habit of thinking leads them to think that it needs a certain force to make a body keep 'moving', but not for keeping 'rest'. Hence, many of them feel difficulty in understanding Newtonian mechanics, especially for understanding the law of inertia. In this presentation, we report a result of a teaching strategy and its result to overcome the tendency and, consequently for conceptual change in Galilean relativity of some Korean secondary students. The strategy includes three phases; arising cognitive conflict via 'contrastive discussion' with thought experiments on idealised context, observation of relative motions in a simulation and in movies, and some practical work to experience relative motions in everyday context.

Day: Saturday **Location: Baycrest 2**
Chair: Cam McRobbie **Session time: 9:45 – 10:25am**

Kathryn Paige
kathy.paige@unisa.edu.au

University of South Australia
Holbrooks Road
Underdale SA 5032, Australia
Tel: 8302 6334 Fax: 8302 6239

Investigating Science and Technology in Primary Classrooms.

The research is aimed at ascertaining the perception of science and technology held by a group of primary teachers. The relationship between science and technology is problematic and, with current trends encouraging an holistic approach to teaching and learning in primary schooling, it has become even more important to know what teachers believe is involved in scientific and technological investigations and in particular how they differ.

This paper will describe the early stages of a doctoral research program. Data collected during interviews with primary classroom teachers will be presented along with initial attempts at analysis.

Day: Saturday **Location: Annex**
Chair: Richard Coll **Session time: 9:00 – 9:40am**

Bill Palmer
bill.palmer@darwin.ntu.edu.au

Faculty of Education
Northern Territory University
Darwin NT 0909, Australia
Tel: 08 8946 6148 Fax: 08 8946 6151

IDA FREUND: Teacher, Educator, Feminist and Chemistry Textbook Writer.

In the early/middle nineteenth century the importance of the following women textbook writers deserves recognition: Jane Marcet – Natural philosophy: Mary Somerville - Physical sciences: and Mrs Lincoln Phelps - Chemistry. They were all prolific writers who were accepted in the highest scientific circles. Ida Freund, in the early twentieth century, was another textbook writer in this tradition: she wrote two major chemistry books but these were virtually her total life's work. However, a well known historian of chemistry said that her work "is to be classed among the really great works of chemical literature".

This paper will relate to the life and work of this great woman chemist and educationalist, whose ideas on physical and chemical change and of the value of practical work in teaching chemistry seem to be ahead of her time. However, she did not move in high society and does not leave a massive literature behind her, so her name is relatively unknown.

Day: Sunday
Chair: Ian Clark

Location: Summit
Session time: 9:45 – 10:25am

Jongwon Park and Ikgyun Kim*
igsci@cbucc.chungbuk.ac.kr

Chunam National University
*Chungbuk National University
School of Science Education
Chungbuk National University, South Korea

Classifying Students' Observational Activities.

Observation is one of the important aspects in physics and physics education. However, observation has so many varieties that the purpose and the meaning of observations used in physics education are different in persons, contexts and subjects. In this study, we tried to understand the natures of observations and investigated students' observational activities using three observational tasks, candle, double pendulum and electric bulbs connected in series. We required the subjects to observe the given tasks and describe what did they observe. From their descriptions, students' observational statements could be classified into three categories: interpretative observation, interfering observation and operational observation. Also we could find that some of the statements were non-observational such as prediction and question. Finally, implications for the teaching of observation in physics education are suggested.

Day: Saturday
Chair: Judy Moreland

Location: Delta
Session time: 11:45am – 12:25pm

Jongwon Park, Jinwoong Song, Sunggi Kwon and Byunghoon Chung
Chonnam National University, Taegu University, Taegu National Teachers University of Education, Cheongju National University of Education, Korea
jwpark94@chonnam.chonnam.ac.kr

Department of Physics Education
Chonnam National University
Kwangju 500-757, South Korea
Tel: 530 2485 Fax: 530 2489

The Use of Ideal Conditions in Physics Teaching and Learning.

Idealization plays important roles in physics learning and in the construction of the world of physics, especially, in the context of discovery. In this study, we will first summarize some general features of generating the idealization in physics and will suggest a model showing how the idealization is used in physics. As the implications for physics teaching and learning, we will also explain why the understanding of ideal conditions in physics learning is important in relation to the following aspects: (1) various types of ideal conditions are included in the physics terms, concepts, the derivation process of physics laws, the explanation of natural phenomena, and problem solving, (2) ideal conditions are used to understand the relationship between the world of physics and real world, (3) ideal conditions are used in creative inquiring activities in physics. Finally, some results obtained from our previous researches for investigating the students' understanding about the ideal conditions will be presented.

Day: Saturday
Chair: Elizabeth McKinley

Location: Baycrest 1
Session time: 1:45 – 2:25pm

Sang-Woo Park and Sung-Jae Pak
pk1966@chollian.net

Department of Physics Education
Seoul National University, KwanAk-Gu
Silim-Dong 151-742, Seoul, South Korea
Tel: 880 8817 Fax: 880 9754

Students' and Teachers' Views on the Relation between School Science Education and Traditional Science and Technology of Korea.

Science education in Korea is modelled on that of the West, since modern western science was introduced to Korea for industrialising the country in the 1960's in earnest. The purpose of this study was to find out students' and teachers' views on the relation between school science education and traditional science and technology of Korea. For this study, 72 middle school students were surveyed and 12 of them and 4 teachers were interviewed. Consequently, most students and teachers expressed that traditional science and technology is very unique, originative, and useful. It is also helpful to understand our traditional culture. On the other hand, some students thought that it is not related to school science and not useful to learn a scientific concept.

Day: Sunday **Location: Delta**
Chair: Leanna Kent **Session time: 11:45am – 12:25pm**

Slavica Pavlinic, Paul Buckley and Tony Wright

Massey University
Private Bag 11-222
Palmerston North 5320, New Zealand
Tel: 06 350 4817 Fax: 06 350 5682

Visualising Molecules - Can Computers Help?

Students need variety in the way molecules are represented if they are to develop the three dimensional visualisation skills used by chemists. This is one of the major conclusions of this qualitative study looking at how students learn stereochemistry when interacting with a computer based task. Presented with different representations, students quickly learn to select those that best suit the problem they are addressing.

Stereochemistry has been identified as being particularly difficult to understand because it requires students to have 3D visualisation skills and to be able to switch between symbolic chemical formulae and various microscopic 3D models. Adding the complexity of the chemical language describing stereochemical concepts makes the task even more difficult.

A computer-based stereochemistry tutorial was authored for the study, taking advantage of the interactive molecular modeling software now available on the web. Volunteers were videotaped while using the software and interviewed using a stimulated recall interview technique. Data from video-transcripts were combined with nonverbal data from the videos and analysed to examine the student-software interaction.

The study demonstrated that the nonlinear design of the software and the adaptive feedback available were welcomed by the students who had very different learning experiences when interacting with the task. The results of the study will be described in terms of the implications for teaching stereochemistry and for the design of the software.

Day: Saturday **Location: Delta**
Chair: Dick Gunstone **Session time: 2:30 – 3:10pm**

Léonie J. Rennie and Lesley H. Parker
l.rennie@info.curtin.edu.au

SMEC, Curtin University
GPO Box U1987
Perth WA 6156, Australia
Tel: 08 9266 7484 Fax: 08 9266 2503

Teachers' and Students' Perceptions of Quality in Assessment Practice.

Western Australia has recently adopted an outcomes-focused curriculum framework for science, K - 12, and consequent rethinking of the nature and purposes of assessment have fore-fronted the issue of equity. This study examines teachers' and students' perceptions of the assessment practice in Western Australian schools using a conceptual framework which postulates three prerequisites for fair and equitable assessment: curriculum fidelity, diversity and opportunity, and values and ethics. The sample was the entire Year 10 cohort and their teachers in two coeducational and two single-sex schools.. Data were collected by interview from 10 teachers, 34 boys and 30 girls, and by questionnaire from 668 students. The results indicate some between-school differences in assessment practice, but overall., assessment rarely met the criteria for fair and equitable practice. Both students and teachers had views about how assessment practice could be improved, but there are significant barriers to change.

Day: Friday **Location: Baycrest 2**
Chair: John Lockley **Session time: 2:45 – 3:25pm**

Stephen M. Ritchie and Donna L. Rigano
stephen.ritchie@jcu.edu.au

School of Education
James Cook University
Townsville, QLD 4811, Australia
Tel: 07 4781 4918 Fax: 07 4725 1690

Positioning the Researcher and Subject in Science Education Research.

As science education researchers become more interested in the social dynamics of science classrooms, and rely more heavily on discourse analysis, it is timely to consider the interrelationships between researchers and their subjects. Positioning theory focuses attention on the position/Act-action/storyline triad in conversations. We have found positioning theory helpful in understanding conversations between us (as researchers) and our research subjects, namely, classroom science teachers. We not only illustrate how we have used positioning theory in our research, but also discuss the implications of positioning for researchers who rely on interview data in their studies.

Day: Friday
Chair: Sean Cleary

Location: Annex
Session time: 11:15 – 11:55am

Susan Rodrigues
s.rodrigues@edfac.unimelb.edu.au

Department of Science & Mathematics Education
University of Melbourne
Parkville VIC 3052, Australia
Tel: 03 9344 8550 Fax: 03 9344 9344

Teaching Science in Context: A case study from the Classroom Learning Project.

The Classroom Learning Project is a qualitative study of learning in classroom settings. The current database for the project consists of videotape records for 55 secondary mathematics and science lessons obtained using two video cameras. The case study described in this article is explored in terms of the agency of context in facilitating learning. Two datasets of video records, interviews with teachers and interviews with students are used to explore the materials context used during two classes. Analysis would indicate that the lesson on materials had limited impact in terms of student relevancy.

Day: Sunday
Chair: Lindsey Conner

Location: Baycrest 2
Session time: 11:00am – 12.25pm

Sue Ryan
sr.ryan@massey.ac.nz

College of Education, Massey University
Private Bag 11-222
Palmerston North, New Zealand
Tel: 06 357 9104 Fax: 06 351 3385

Issues in Genetic Engineering.

An introduction to genetic engineering and the genetic engineering debate. This workshop examines the biological, ecological, social, economic and ethical issues involved from a global and New Zealand perspective and looks at who is leading the debate. Special attention will be paid to the current status of scientific research in this field and how this is being communicated to the public.

Day: Sunday
Chair: Ian Milne

Location: Summit
Session time: 11:00 – 11:40am

David Salter and Susan Robertson
d.salter@auckland.ac.nz

School of Education, University of Auckland
Private Bag 92019
Auckland, New Zealand
Tel: 09-3737-999 Fax: 09-3737455

Talk about Science Fairs.

Many schools throughout New Zealand annually participate in science fair competitions. These competitions have grown over the last three decades from small regional events into a major nation-wide activity backed by significant corporate sponsporship. A project critically examining science fairs in New Zealand schools is currently being carried out. The methodological framework for this project is grounded in a critical theory approach, from which we seek to gain a better understanding of the factors that operate in a science fair competition. This paper discusses some preliminary findings of a qualitative study into the experiences and practices of selected teachers regarding their involvement in science fair competitions at the Intermediate school level. The value and consequences for students, teachers and schools participating in this competition are explored.

Day: Sunday **Location: Delta**
Chair: Carolyn English **Session time: 9:00 – 9:40am**

Donna Satterthwait
d.satterthwait@mailbox.uq.edu.au

Graduate School of Education
University of Queensland
St Lucia QLD 4072, Australia
Tel: 07 3365 6505 Fax: 07 3365 7199

Teaching Lesson Planning: constructivist strategies for teaching lesson planning skills.

Lesson planning skills are taught to science student teachers through a series of workshop activities that are constructivist in design. These activities focus the student teacher's attention on student-centred approaches through theory, process and by observing the behaviour of their instructors and their peers. The specific learning activities can be arranged into a constructivist conceptual matrix by identifying the processes of meaningful learning, episodes of knowledge re-structuring and opportunities for conceptual change within a curriculum covering three topic strands of pre-service teacher knowledge: knowledge of how children learn, meta-cognitive knowledge of their own learning and essential pedagogic knowledge. This approach enables the science teacher educator to explicitly design curriculum that addresses the student teachers' needs in a way that is in itself, constructivist in approach. This paper illustrates how constructivism can be used as the subject of and the process by which student teachers acquire knowledge about lesson planning.

Day: Saturday **Location: Baycrest 1**
Chair: Dawn Garbett **Session time: 9:45 – 10:25am**

Kathryn Scantlebury[1], Kenneth Tobin[2], Jane Butler Kahle[3] and Julie Ague[3]
kscantle@udel.edu

[1]University of Delaware, [2]University of Pennsylvania, [3]University of Miami
Department of Chemistry & Biochemistry
University of Delaware
Newark DE 19716, USA
Tel: 302n 8314546 Fax: 302 8316335

The Quiet Achiever: Enacting Culturally Relevant Science Teaching in an American Urban Middle School.

The purpose of the study is to examine culturally pedagogy in a context of the teaching of science in an American, urban, middle school. In particular, this study endeavours to provide a thick description of how a middle class white female used culturally relevant pedagogy in her teaching of African American students. Janet is a petite, white woman with an inner strength and a quiet sense of humor and fun that come out in her teaching. Her approach to teaching and personal style is reminiscent of a "Quiet Achiever." Janet's belief that her students can learn science is reflected in her teaching practices and caring attitude towards her students. Her excellent classroom management provides an infrastructure for students to succeed and recognise their academic and personal potential. From Janet, her students are developing the cultural tools they need to remain successful in science. The state and district where in Janet teaches is conservative body. The district mandates the science curriculum, and that curriculum is reflective of the 'politics of assimilation' that continues to support an educational infrastructure that views school science as a subculture of Western society. Within this context, Janet teaches her students with respect, so that they can succeed in science.

Day: Friday **Location: Delta**
Chair: Marilyn Fleer **Session time: 4:00 – 4:40pm**

Gilda Segal and Sandy Schuck
gilda.segal@uts.edu.au

University of Technology, Sydney
P 0 Box 222
Lindfield NSW 2070, Australia
Tel: 02 9514 5264 Fax: 02 9514 5265

"I don't really feel guilty about science at all. No one does it!" Primary Teachers Teaching Science in their First Year of Teaching.

This paper reports on a one year case study that investigated the experiences of 8 primary teachers in their first of teaching science. The investigation was conducted through analysis of workshop discussions, interviews, journals and life histories. The teachers faced various constraints in implementing the social constructivist perspective that had framed their science teacher education course. Constraints included: uncertainty about aspects of social constructivist pedagogy; lack of resources; lack of time for science teaching and, hence, little increase in expertise and self-confidence in science teaching; dilemmas in classroom management; the need to teach from another teacher's program. Facilitating factors included: knowledge of approaches to science teaching; experiments undertaken at university and personal teaching philosophies. One implication of the study is that beginning teachers need support in making critically reflective choices about how to implement their philosophy of teaching and learning science. This insight will provide information of value in developing an epistemology of science teacher education.

Day: Sunday
Chair: George Stolarski

Location: Baycrest 2
Session time: 9:00 – 9:40am

Pat Shanks

Glenfield College
P 0 Box 40-176, Glenfield
Auckland 1330, New Zealand
Tel: 09 444 9066 Fax: 09 444 7198

Microscale Chemistry in Secondary Schools - The way of the future or a passing fad?

The smaller quantities of chemicals in microscale chemistry experiments result in greater safety in the laboratory, less waste to dispose of and lower chemical bills. Other considerations are the availability of the equipment, the ease of cleaning it, the ability of the students to manipulate it and the relevance of some of the experiments. Its implementation in a secondary school has an effect on student interest and storage and handling of chemicals.

Day: Friday
Chair: Matthew Kearney

Location: Summit
Session time: 11:15 – 11:55am

Ken Stevens
stevensk@morgan.ucs.mun.ca

Faculty of Education
Memorial University of Newfoundland
St Johns NF A1C 5S7, Canada
Tel: 0709-737-4847 Fax: 0709-737-8582

Two Canadian Approaches to Teaching Biology, Chemistry, Mathematics and Physics to Senior High School Students in Virtual Classes.

This paper outlines two approaches to teaching Biology, Chemistry, Mathematics and Physics to senior students in rural Canadian high schools. The first approach outlines teaching and learning within a closed electronic teaching and learning structure, while the second approach examines the teaching of these science subjects within the more open environment of a digital intranet. It is argued in this paper, on the basis of current research in Atlantic Canada, that the successful integration of information and communication technologies in the teaching of Biology, Chemistry, Mathematics and Physics is in part dependent on the transition from closed to open teaching and learning environments. In each approach to the teaching and learning of science in virtual classes, management and policy issues at the school level are considered. The paper will conclude with a consideration of the implications of teleteaching and telelearning using virtual classes for the professional education of science teachers, drawing on both Canadian and New Zealand research.

Day: Sunday
Chair: Pat Shanks

Location: Baycrest 1
Session time: 11:00 – 11:40am

George Stolarski

Wilson Park Secondary College
P O Box 2344
Melton South VIC 3338, Australia
Tel: 03 9743 4622 Fax: 03 9747 8408

Students' Ideas in Chemistry Classes: Echoes of the past?

Students in a Melbourne suburban high school were probed to elicit their understanding of fundamental concepts found in chemistry, such as elements, atoms and molecules, gasses and combustion. The phenomenographic method was used to explore the different ways in which students understood these concepts. A scheme for comparing students' ideas with those found in the history of chemistry was developed. This historical approach was used to structure teacher – students discourse in the classroom. Examples of this type of discourse were recorded and analysed.

Day: Friday
Chair: Greg Thomas

Location: Summit
Session time: 2:45 – 3:25pm

Geoff Swan
g.swan@eagle.fste.ac.cowan.edu.au

Physics Program, Edith Cowan University
2 Bradford St, Mount Lawley
Perth WA 6050, Australia
Tel: 08 9370 6425 Fax: 08 9370 6105

Practice Makes Perfect?

Students identified with conceptual difficulties in rotational kinematics were given the opportunity to freely interact with an interactive multimedia module for 40 minutes. Each student was given a pre- and post-test and asked to evaluate the module. A total of 17 students, working in small groups or individually, were observed while they worked through the module in a multimedia research laboratory with videotape facilities. An analysis of this data will be presented together with implications for the design of educational multimedia software and the environments in which they should be used. In particular, students spent more time than anticipated on drill like mathematical exercises rather than activities designed to aid conceptual development. Students expressed a clear preference on the type of activities that help them learn physics. It would seem that practice makes perfect.

Day: Friday
Chair: Geoff Swan

Location: Summit
Session time: 12:00 – 12:40pm

Greg Thomas and Campbell McRobbie
gp.thomas@qut.edu.au
c.mcrobbie@qut.edu.au

Centre for Mathematics and Science Education
Queensland University of Technology
Victoria Park Rd, Kelvin Grove
Brisbane QLD 405, Australia
Tel: 07 3864 3640 Fax: 07 3864 3643

Collaborating to Enhance Student Learning: One Teacher's Journey.

While there is ongoing debate about the appropriateness of constructivism as a referent for science teaching, the adoption of such a referent has potential benefits. Much is reported about teachers' actions often reflecting non-constructivist referents, however, less is reported regarding means of assisting teachers to become more constructivist of the conditions necessary for such a change. This paper reports on collaborative, two-year research involving two researchers and a classroom chemistry teacher. The researchers investigated the teacher's teaching and her students' learning and sought to promote increased theory-evidence co-ordination as one element of a shift towards an increasingly constructivist classroom. The teacher's beliefs and practice became increasingly constructivist. The teacher and students reported benefits as a consequence of this change. Key factors enabling this change included changes in the teacher's (a) perception of students' abilities, (b) beliefs in relation to constructivism, (c) understanding of chemistry concepts and researcher modeling of target practices.

Day: Friday
Chair: Tony Wright

Location: Summit
Session time: 4:00 – 4:40pm

Chi-Yan Tsui
c.tsui@auckland.ac.nz

University of Auckland
Private Bag 92019
Auckland, New Zealand

Designing and Developing Computer-based Worksheets in Collaboration with Biology Teachers to Scaffold Classroom Learning of Genetics with GenScope.

This paper describes a case study exploring classroom use of GenScope, a computer-based manipulative program, and its impact on students' learning of genetics in an Auckland school. The methodology follows the SECAL (Situated Evaluation of Computer-Assisted Learning) framework. The researcher collaborated with the biology teachers to design and develop the GenScope-based worksheets which were first used by Year 12 students (N=76) in 1998. The improved worksheets based on the preliminary findings, were used by the 1999 cohort (N=68). Latest findings indicated that the worksheets were well-received by the students in 1999 who had better attitudes than their 1998 peers. Further, their posttest scores were slightly higher than those obtained by the 1998 cohort with similar prior knowledge. One emergent theme is that higher-order learning of genetics in the classroom has been scaffolded by the worksheets and the teacher's support alongside the social interactions in the context of GenScope.

Day: Friday **Location: Delta**
Chair: Mal Ward **Session time: 2:00 – 2:40pm**

Bruce G Waldrip[1], Bruce Allan Knight[2], Grant Webb[3], and Paul Jensen[4]
b.waldrip@bendigo.latrobe.edu.au

[1]La Trobe University, [2]Central Queensland University, [3]Education Queensland, Mackay and Hinterland District Office, [4]Education Queensland, Mackay North District Office
Department of Education, La Trobe University
P O Box 199, Bendigo VIC 3552, Australia
Tel: 03 5444 7485 Fax: 03 5444 7800

Student Teachers' Perceptions of Competence to Teach Primary Science and their Understanding of Scientific Words

The purpose of this study was to:

- document prospective primary science teachers meanings for scientific words used in primary schools;
- examine the quality of their responses to explanations of scientific physical phenomena, their perceived self-competence in teaching primary science and the relationship between their meanings of words and perceived self-competence in teaching primary science.

The study utilised a questionnaire to examine first-year primary teaching students' perceptions before they had received any formal science education training at the tertiary level. Correlations existed between perceptions of their self-competence to teach primary science and perceptions to explain selected words used in primary science. Similar correlations existed between their explained meanings of these words and their ability to explain selected phenomena. Low correlations existed between their perceived ability and actual performance. Interviews were used to explore their perceptions, understandings and explanations. Students' uses of genres were examined. Finally, areas of greatest assistance in developing students' further understanding of science were identified.

Day: Sunday **Location: Delta**
Chair: Ian Taylor **Session time: 9:45 – 10:25am**

Bruce G Waldrip[1], Darrell L. Fisher[2]
b.waldrip@bendigo.latrobe.edu.au

[1]La Trobe University [2]Curtin University
Department of Education, La Trobe University
P O Box 199, Bendigo VIC 3552, Australia
Tel: 03 5444 7485 Fax: 03 5444 7800

Teacher-student interpersonal behaviours and classroom learning environment: Differences in country and city students' perceptions.

The purpose of this study was to examine differences in metropolitan, provincial, rural and mining town students' perception of student-teacher interactions and their classroom learning environment. The study utilised a questionnaire, Cultural Learning Environment Questionnaire, that had previously been validated to assess culturally-sensitive factors of science students' learning environments. The student-teacher interactions were measured with the instrument, Questionnaire of Teacher Interaction. With a sample of over 2,000 secondary science students, the reliability of the CLEQ scales ranged from 0.70 to 0.84 and showed acceptable discrimination between the scales. The construct validity of the questionnaire was confirmed through interviews with students that are reported in the paper. While some aspects of the learning environment were similar, differences were found between students from metropolitan, provincial, rural and mining town schools. Overall, the greatest differences in perceptions occurred between metropolitan and rural students. Mining town school students had quite unique perceptions that might be due to the transient population of many mining towns. Student gender affected these students' perceptions of their learning environment and teacher-student interactions.

Day: Friday **Location: Delta**
Chair: John Longbottom **Session time: 12:00 – 12:40pm**

Mal Ward, Bruce Waldrip and Wilf Savage
m.ward@bendigo.latroe.edu.au

La Trobe University, P 0 Box 199
Bendigo VIC 3550, Australia
Tel: 054 447800

A school-based science teaching program for pre-service teachers.

The study was an examination of pre-service teachers' reflections on involvement in a school-based primary science teaching program. The objectives of the program were to determine whether the program altered students': (i) personal attitudes towards science teaching; (ii) ideas about methods and approaches to teaching of science; and (iii) ideas about participating in team teaching.

The major data sources used were questionnaires and interviews. As a result of the program, the research results indicate that students perceived that they were more confident in their knowledge of science; had improved their teaching strategies including planning and teaching skills; and increased their enthusiasm for teaching science and their attitudes towards science. The limitations and benefits of the program are discussed.

Day: Saturday
Chair: Amanda Berry

Location: Delta
Session time: 11:00 – 11:40am

James J Watters and Ian S Ginns
j.watters@qut.edu.au and i.ginns@qut.edu.au

Queensland University of Technology
Victoria Park Road, Kelvin Grove
Brisbane QLD 4059, Australia
Tel: 07 3864 3339 Fax: 07 3864 3985

Development of a Learning Community in a Science Classroom.

Extensive research has shown that school practices in teaching science are alien to the routine processes of scientific endeavour in the real world and hence school science lacks interest for many children. Advocates of authentic science argue that school science should seek to redress this situation through the development of the discourse of science manifested in such notions as a community of learners. This paper reports on a study that explored pedagogical practices that emphasised the collaborative and communal nature of knowledge construction in science. The challenge was to develop strategies by which children become effective learners of science and enculturated into a community of scientific practice. A science program was conducted in a grade 8 class of 32 children over a term. During these 27 lessons, students were engaged in exploring ways of colonising Mars and investigating the planning and establishment of a space colony on Mars. Analysis of videotapes of the lessons, survey data and interviews with the participants provided insights into the dynamics of establishing a community of learners, and identified constraints and expectations held by stakeholders of what science teaching should be about. The implications for teaching science using these pedagogical practices are examined.

Day: Sunday
Chair: Brendan Schollum

Location: Baycrest 2
Session time: 9:45 – 10:25am

Richard White
richard.white@education.monash.edu.au

Faculty of Education
Monash University
Clayton VIC 3168, Australia
Tel: 03 9905 3168

Research on Alternative Conceptions: Past, present and future.

Studies of alternative conceptions have dominated research science education for around twenty years. These studies fit into several phases, which are useful to identify in order to gain a sense of what research should next be done. There is a prehistory phase, in which isolated studies in the 1940s and 1960s failed to inspire others. In the 1970s, the first phase of mass research into alternative conceptions began, of identifying their prevalence in various topics. The paper suggests explanations for why the 1970s research flourished and the earlier work did not and on why most research concerned mechanics, heat, optics and electricity. The second phase saw attempts, largely unsuccessful, to eradicate alternative conceptions. The third phase is theoretical, dealing with accounts of the origins of beliefs. The fourth consists of longitudinal studies of the growth of beliefs. The paper concludes with suggestions for future research.

Day: Saturday
Chair: Bill Palmer

Location: Annex
Session time: 9:45 – 10:25am

John Wilkinson
w.wilkinson@bendigo.latrobe.edu.au

La Trobe University
P 0 Box 199
Bendigo VIC 3550, Australia
Tel: 054 447800

An Analysis of Science (Physics) Textbooks for Scientific Literacy Themes.

Over the past few decades our view of scientific literacy has changed with the changing image of science in the world. This session reports on research that involved an examination of physics textbooks for curriculum balance and emphasis on four themes of scientific literacy. In particular, the research focused on the emphasis given to the "science, technology and society" in the textbooks analysed.

Day: Saturday
Chair: Ken Appleton

Location: Annex
Session time: 11:45am – 12:25pm

Jim Woolnough
jwoolno@atrax.net.au

Dickson College
48 Euree Street
Reid ACT 2612, Australia
Tel: 02 6248 8349

How do Students Learn to Apply their Mathematical Knowledge to Interpret Graphs in Physics? Student and teacher reflections.

We have previously reported on the development of skills relating to the interpretation of graphs by senior physics students. We have specifically described problems experienced in the application of mathematical skills to experimental work in physics. In this paper I describe student reflections on how they have successfully overcome these conceptual difficulties. Teacher reflections are also described. I also describe our attempts to reconcile our findings with current theories in learning, and how we might be able to apply these to improve our teaching methods.

Day: Friday
Chair: Yvonne Zeegers

Location: Summit
Session time: 10:30 – 11:10am

Tony Wright, Paul Buckley and Slavica Pavlinic
a.h.wright@massey.ac.nz

Massey University
Private Bag 11-222
Palmerston North 5320, New Zealand
Tel: 06 350 4817 Fax: 06 350 5682

Towards a Method for Evaluating Computer-Assisted Learning Software.

The torrent of new computer-aided learning software is threatening to engulf educators in most science subjects, but the methods for evaluating the offerings lag far behind. This paper will describe a project developing a new method of evaluating software.

Underlying the project is the data collection technique of stimulated recall interviewing. This technique gives rich data of student performance on a task and insights into students understanding and learning.

This data is being used to develop new software that more closely matches students' learning needs in an iterative process in which both the software and the evaluation methodology are being refined.

In the current iteration, the topic of organic chemistry has been selected because of the power of the computer to display molecular graphics, bridging the gap between the microscopic/macroscopic worlds of chemistry. At the same time ways of expanding the evaluation methodology to record quantitative as well as qualitative data are being explored.

Day: Friday
Chair: Ann Northover

Location: Baycrest 1
Session time: 12:00 – 12:40pm

Yvonne Zeegers
y.zeegers@unisa.edu.au

University of South Australia
St Bernards Road
Magill SA 5072, Australia
Tel: 08 302 4470 Fax: 08 302 4536

Eliciting Students' Questions for Investigation.

Curriculum documents such as the 'statement on science for Australian Schools' (AEC, 1994) made an assumption that teachers can automatically incorporate the framework into their current practice, however, for many it requires a wholesale change in beliefs about teaching and learning. Statements which suggest that students should be able 'to use the skills of scientific investigation, reflection and analysis to generate or refine knowledge, find solutions and pose more questions", (p.5) appear innocuous, however, the inclusion of phrases such as "use the skills of scientific investigation" and "pose more questions" has major implications for the teaching of science. Rote learning, adherence to text books and note taking are clearly not the recommended teaching methods, however, encouraging students to raise and the investigate questions is problematic for many teachers. This paper will address the initial stages of a research project which focuses on how some teachers encourage their students to ask questions which lead to investigations in science.

Conference Attendees (alphabetical order)

A

Ken Appleton
Central Queensland University, Faculty of Education & Creative Arts
Central Queensland Mail Center
Rockhampton, QLD 4702
AUSTRALIA
Ph: 07 4930 9531 F: 07 4930 9604

Chris Arcus
Wellington College of Education
P O Box 17-310
Karori, Wellington 6033
NEW ZEALAND
Ph: 04 476 8699

Peter Aubusson
University of Western Sydney
34 Chesterfield Rd
Epping, NSW
AUSTRALIA
Ph: 02 4736 0445 F: 02 4736 0400

Lydia Austin
University of Auckland
Private Bag 92-019
Auckland 1030
NEW ZEALAND

B

Barbara Backshall
Auckland College of Education
Private Bag 92-601
Symonds St, Auckland 1035
NEW ZEALAND
Ph: 09 623 8899 F: 09 623 8875

Robyn Baker
Wellington College of Education
P O Box 17-310
Karori, Wellington 6033
NEW ZEALAND
Ph: 04 476 8699

John Barnett
University of Auckland
Private Bag 92-019
Auckland 1030
NEW ZEALAND

Leone Basher
Wellington College of Education
P O Box 17-310
Karori, Wellington 6033
NEW ZEALAND
Ph: 04 476 8699 F: 04 476 1079

Beverley Bell
University of Waikato
Private Bag 3105, Hamilton 2020
NEW ZEALAND

Amanda Berry
Monash University
Faculty of Education
Clayton, VIC 3168
AUSTRALIA

Marie Brand
University of the Witwatersrand
Private Bag 3 , Johannesburg 2050
SOUTH AFRICA
Ph: 011 716 5370 F: 011 339 3956

Gordon Brown
University of Western Sydney
26 James Rd
Mount Kembla, NSW 2526
AUSTRALIA
Ph: 02 4272 6088

Ally Bull
Wellington College of Education
P O Box 17-310
Karori, Wellington 6033
NEW ZEALAND
Ph: 04 476 8699

John Bullivant
University of Sydney, Faculty of Nursing
Camperdown
Sydney, NSW 2006
AUSTRALIA
Ph: 02 9351 0545

Denis Burchill
Auckland College of Education
Private Bag 92-601
Symonds St, Auckland 1035
NEW ZEALAND
Ph: 09 623 8899, F: 09 623 8875

C

Rosemary Cameron
Dickson College
29 Guilfoyle St
Yarralumba, ACT 2600
AUSTRALIA
Ph: 02 6205 6469 F: 02 6205 6462

Malcolm Carr
University of Waikato
Private Bag 3105, Hamilton 2020
NEW ZEALAND

Wheijen Chang
University of Waikato
SMTER Centre
Private Bag 3105, Hamilton 2020
NEW ZEALAND
Ph: 07 858 3228

May Hung Cheng
via University of Waikato
SMTER Centre
Private Bag 3105, Hamilton 2020
NEW ZEALAND

Angela Christie
Royal Society of New Zealand
P O Box 598, Wellington 6015
NEW ZEALAND
Ph: 04 472 7421

Ian Clark
University of South Australia
Warrendi Road
Mawson Lakes, SA 5095
AUSTRALIA
Ph: 08 302 5082

Sean Cleary
Avondale College
Victor St, Avondale
Auckland 1007
NEW ZEALAND
Ph: 09 828 7024 F: 09 820 0183

Michael Cohen
University of Indiana (Perdue University)
902 W New York St
Indianapolis, IN 46202-5155
USA
Ph: 317 274 6814

Richard Coll
University of Waikato
SMTER Centre
Private Bag 3105, Hamilton 2020
NEW ZEALAND

Vic Compton
Te Kura Akoranga o te Tai Tokerau
P O Box 1326
Whangarei O115
NEW ZEALAND

Lindsey Conner
Christchurch College of Education
Science Department
P O Box 31-065, Christchurch 8015
NEW ZEALAND

Debbie Corrigan
Monash University
Faculty of Education
Clayton, VIC 3168
AUSTRALIA

Ants Cotton
Waitakere College
23 Chester Ave
Westmere, Auckland 1002
NEW ZEALAND
Ph: 09 360 0211

D

Fred Deshon
Educational Dept of Western Australia
151 Royal Street
East Perth, WA 6004
AUSTRALIA
Ph: 08 9264 4824 F: 08 9264 4011

Carmel Diezmann
Queensland University of Technology
Center for Maths & Science Education
Victoria Park Rd, Kelvin Grove
QLD 4059, AUSTRALIA
Ph: 07 3864 3989 F: 07 3864 3803

E

Carolyn English
Wellington College of Education
P O Box 17-310
Karori, Wellington 6033
NEW ZEALAND
Ph: 04 476 8699

Graeme Ennor
John Paul College Rotorua
P O Box 5040
Rotorua West 3215
NEW ZEALAND
Ph: 07 347 8795 F: 07 346 1271

F

Garry Falloon
Te Kura Akoranga o te Tai Tokerau
P O Box 1326
Whangarei O115
NEW ZEALAND

Rod Fawns
University of Melbourne
Dept of Science & Mathematics Education
Parkville, VIC 3052
AUSTRALIA
Ph: 03 9344 8263 F: 03 9344 8739

Peter Fensham
Monash University
Faculty of Education
Clayton, VIC 3168
AUSTRALIA

Marilyn Fleer
University of Canberra
Department of Education
Canberra, ACT 2616
AUSTRALIA
Ph: 06 201 2438 F: 06 201 5065

Michael Forret
University of Waikato
SMTER Centre
Private Bag 3105, Hamilton 2020
NEW ZEALAND

Beverley France
Auckland College of Education
Private Bag 92-601
Symonds St, Auckland 1035
NEW ZEALAND
Ph: 09 623 8899 F: 09 623 8875

G

Dawn Garbett
Auckland College of Education
Private Bag 92-601
Symonds St, Auckland 1035
NEW ZEALAND
Ph: 09 623 8899 F: 09 623 8875

Robin Garnett
The Science Centre & Manuwatu Museum
Private Bag 11-055
Palmerston North 5320
NEW ZEALAND
Ph: 06 351 4496

Ian Ginns
Queensland University of Technology
Victoria Park Rd, Kelvin Grove
Brisbane, QLD 4059
AUSTRALIA
Ph: 07 3864 3339 F: 07 3864 3985

Dick Gunstone
Monash University
Faculty of Education
Clayton, VIC 3168
AUSTRALIA
Ph: 03 9905 2857 F: 03 9905 9197

Sandie Gusscott
Auckland College of Education
Private Bag 92-601
Symonds St, Auckland 1035
NEW ZEALAND
Ph: 09 377 0881

H

Mark Hackling
Edith Cowan University
2 Bradford St
Mt Lawley, WA 6050
AUSTRALIA

Mavis Haigh
Auckland College of Education
Private Bag 92-601
Symonds St, Auckland 1035
NEW ZEALAND
Ph: 09 623 8899 F: 09 623 8875

Gerry Healy
University of Melbourne
Xavier College
Kew, VIC 3101
AUSTRALIA
Ph: 03 9854 5442 F: 03 9854 5447

Rosemary Hipkins
Wellington College of Education
P O Box 17-310
Karori, Wellington 6033
NEW ZEALAND
Ph: 04 476 8699

J

Beverley Jane
Deakin University
221 Burwood Highway
Burwood, VIC 3125
AUSTRALIA
Ph: 03 9244 6394 F: 03 9244 6834

Joce Jesson
Auckland College of Education
Private Bag 92-601
Symonds St, Auckland 1035
NEW ZEALAND
Ph: 09 623 8899 F: 09 623 8875

Alister Jones
University of Waikato
SMTER Centre
Private Bag 3105, Hamilton 2020
NEW ZEALAND

Lone Jorgensen
Massey University
Private Bag 11-222
Palmerston North, Manuwatu 5320
NEW ZEALAND
Ph: 06 357 9104 F: 06 351 3383

K

Matthew Kearney
Sydney University of Technology
P O Box 222
Lindfield, NSW 2070
AUSTRALIA

John Kearsey
De Montford University, School of Education
Polhill Campus & Avenue
Bedford, MK41 9EA
UNITED KINGDOM
Ph: 01234 783081

Stephen Keast
Monash University
Faculty of Education
Clayton, VIC 3168
AUSTRALIA

Leanna Kent

Ikgyun Kim
Chungbuk National University
School of Science Education
ChungBuk
SOUTH KOREA
Ph: 0431 261 2741

L

Brian Lewthwaite
Massey University
Private Bag, Palmerston North
Manuwatu 5320
NEW ZEALAND
Ph: 06 357 9104

Mark Linkson
Northern Territory Dept of Education
P O Box 4821
Darwin, NT 0801
AUSTRALIA
Ph: 08 8999 6441

John Lockley
University of Waikato
SMTER Centre
Private Bag 3105, Hamilton 2020
NEW ZEALAND

John Longbottom
Christchurch College of Education
Science Department
P O Box 31-065, Christchurch 8015
NEW ZEALAND

John Loughran
Monash University
Faculty of Education
Clayton, VIC 3168
AUSTRALIA

Keith Lucas
Queensland University of Technology
Victoria Park Rd, Kelvin Grove
Brisbane, QLD 4059
AUSTRALIA

Freya Lucas
Auckland College of Education
Private Bag 92-601
Symonds St, Auckland 1035
NEW ZEALAND
Ph: 09 623 8899 F:09 623 8875

M

Elizabeth McKinley
University of Waikato
SMTER Centre
Private Bag 3105, Hamilton 2020
NEW ZEALAND

Cam McRobbie
Queensland University of Technology
Victoria Park Rd, Kelvin Grove
Brisbane, QLD 4059
AUSTRALIA
Ph: 07 3864 3333 F: 07 3864 3643

Michael Michie
Northern Territory Dept of Education
P O Box 4821
Darwin, NT 0801
AUSTRALIA
Ph: 08 8999 6441

Debbie Middleton
Wellington College of Education
P O Box 17-310
Karori, Wellington 6033
NEW ZEALAND
Ph: 04 476 8699

Ian Milne
Auckland College of Education
Private Bag 92-601
Symonds St, Auckland 1035
NEW ZEALAND
Ph: 09 623 8899 F: 09 623 8875

Judy Moreland
University of Waikato
SMTER Centre
Private Bag 3105, Hamilton 2020
NEW ZEALAND

N

Sid Nair
Curtin University
GPO Box U1987
Perth, WA 6156
AUSTRALIA
Ph: 08 9266 7484 F: 08 9266 2503

Ann-Marie Noble
via Maungawhau School
42 Ripon Cres, Meadowbank
Auckland1005
NEW ZEALAND
09 521 1893

Ann Northover
University of Waikato
SMTER Centre
Private Bag 3105, Hamilton 2020
NEW ZEALAND

O

Wonkun Oh
Seoul National University
Jongno-Gu, Ok?-Dong 157-1 1F
Seoul 110-035
SOUTH KOREA

P

Kathryn Paige
University of South Australia
Holbrooks Rd
Underdale, SA 5032
AUSTRALIA
Ph: 8302 6334 F: 8302 6239

Bill Palmer
Northern Territory University
Faculty of Education
Darwin, NT O909
AUSTRALIA
Ph: 08 8946 6148F: 08 8946 6151

Sang-Woo Park
Seoul National University
Jongno-Gu, Ok?-Dong 157-1 1F
Seoul 110-035
SOUTH KOREA
Ph: 02 880 8817 F: 02 880 7754

Jongwon Park
Chonnam National University
Department of Physics Education
Kwangju 500-757
SOUTH KOREA
Ph: 062 530 2485, F: 062 530 2489

Slavica Pavlinic
Massey University
Private Bag, Palmerston North
Manuwatu 5320
NEW ZEALAND
Ph: 06 350 4805

Rudy Petersen
Auckland College of Education
Private Bag 92-601
Symonds St, Auckland 1035
NEW ZEALAND
Ph: 09 623 8899 F: 09 623 8875

R

Leonie Rennie
Curtin University
GPO Box U1987
Perth, WA 6156
AUSTRALIA
Ph: 08 9266 7484 F: 08 9266 2503

Stephen Ritchie
James Cook University
School of Education Studies
Townsville, QLD 4811
AUSTRALIA

Susan Rodrigues
University of Melbourne
Dept of Science & Mathematics Education
Parkville, VIC 3052
AUSTRALIA
Ph: 03 9344 8550 F: 03 9344 8739

Sue Ryan
Massey University
Private Bag, Palmerston North
Manuwatu 5320
NEW ZEALAND

S

David Salter
University of Auckland
Private Bag 92-019
Auckland 1030
NEW ZEALAND
Ph: 09 373 7599

Donna Satterthwait
University of Queensland
Graduate School of Education
St Lucia, QLD 4072
AUSTRALIA
Ph: 07 3365 6505 F: 07 3365 7199

Kate Scantlebury
University of Delaware
Department of Chemistry
Newark
DE 19716-2522
USA

Brendan Schollum
Sacred Heart College
250 West Tamaki Rd
Glen Innes, Auckland 1006
NEW ZEALAND
Ph: 09 575 2570 F: 09 575 2571

Gilda Segal
Sydney University of Technology
P O Box 222
Lindfield, NSW 2070
AUSTRALIA
Ph: 02 9514 5264 F: 02 9514 5265

Pat Shanks
Glenfield College
39 Marellen Drive
Orewa, Auckland
NEW ZEALAND
09 426 4736

Michael Shea
California State University/University of Waikato
Private Bag 3105
Hamilton 2020
NEW ZEALAND

Noeleen Smith
Auckland College of Education
Private Bag 92-601
Symonds St, Auckland 1035
NEW ZEALAND
Ph: 09 623 8899 F: 09 623 8875

Ken Stevens
Memorial University of Newfoundland
Department of Education
St Johns NF, A1C 5S7
CANADA
Ph: 709 737 4847 F: 709 737 8582

George Stolarski
Wilson Park Secondary College
P O Box 2344
Melton South, VIC 3338
AUSTRALIA
Ph: 03 9743 4622 F: 03 9747 8408

Heather Stonyer
Auckland Institute of Technology
59-67 Wellesley St East
Auckland 1001
NEW ZEALAND
Ph: 09 307 9999

Christine Stuart
Kohia Terrace School
38 Lockwood Road, Hunua RD 3
Papakura, Auckland 1730
NEW ZEALAND
Ph: 09 292 4847

Geoff Swan
Edith Cowan University
2 Bradford St
Mt Lawley, WA 6050
AUSTRALIA
Ph: 08 9370 6425, F: 08 9370 6105

T

Lu Tan-Ni
University of Waikato
SMTER Centre
Private Bag 3105, Hamilton 2020
NEW ZEALAND
Ph: 07 856 2375

Ian Taylor
University of Waikato
SMTER Centre
Private Bag 3105, Hamilton 2020
NEW ZEALAND

Gregory Thomas
Queensland University of Technology
Victoria Park Rd, Kelvin Grove
Brisbane, QLD 4059
AUSTRALIA
Ph: 07 3864 3333 F: 07 3864 3643

Kun-Hsien Tsai
University of Waikato
SMTER Centre
Private Bag 3105, Hamilton 2020
NEW ZEALAND
Ph: 07 834 0988

Chi-Yan Tsui
University of Auckland
Department of Education
Private Bag 92-019, Auckland 1030
NEW ZEALAND
Ph: 09 627 1517, F: 09 627 3095

W

Bruce Waldrip
La Trobe University
P O Box 199
Bendigo, VIC 3552
AUSTRALIA
Ph: 03 5444 7485, F: 03 5444 7800

Mal Ward
La Trobe University
P O Box 199
Bendigo, VIC 3550
AUSTRALIA
Ph: 05 444 7800

Gillian Ward
Auckland College of Education
Private Bag 92-601
Symonds St, Auckland 1035
NEW ZEALAND
Ph: 09 623 8899 F:09 623 8875

Greg Watson
Avondale College
Victor St, Avondale
Auckland 1007
NEW ZEALAND
Ph: 09 828 7024

Jim Watters
Queensland University of Technology
Victoria Park Rd, Kelvin Grove
Brisbane, QLD 4059
AUSTRALIA
Ph: 07 4940 7577 F: 07 4940 7407

Morley West
Rotorua Lakes High School
P O Box 7002
Te Ngae, Rotorua 3230
NEW ZEALAND
Ph: 07 345 6124 F: 07 345 5964

Richard White
Monash University
Faculty of Education
Clayton, VIC 3168
AUSTRALIA
Ph: 03 9905 2800

Michèle Whitten
Epsom Girls' Grammar School
Margot St, Epsom
Auckland 1003
NEW ZEALAND

John Wilkinson
La Trobe University
P O Box 199
Bendigo, VIC 3553
AUSTRALIA

Jan Wilson
Griffith University
Faculty of Education, Mt Gravatt Campus
Nathan, QLD 4111
AUSTRALIA
Ph: 07 3875 5630

Barry Wilson
Brisbane Boys' College
Kensington Tce, Toowong
Brisbane, QLD 4066
AUSTRALIA
Ph: 07 3309 3500 F: 07 3309 3618

Jim Woolnough
Dickson College
48 Euree St, Reid
ACT 2612
AUSTRALIA
Ph: 02 6248 8349

Tony Wright
Massey University
Private Bag, Palmerston North
Manuwatu 5320
NEW ZEALAND
Ph: 06 350 4788

Z

Yvonne Zeegers
University of South Australia
St Bernards Road, Magill
SA 5072
AUSTRALIA
Ph: 08 8302 4470 F: 08 8302 4536