Appendix A  Undergraduate education degree programs offered by Australian universities in 2002

Information as advertised in the various state university admission centre booklets for 2002 entry, or else from web-based information as of December 2001. In general, because of the focus on new undergraduates and on-campus courses, this listing does not include postgraduate entry degrees or diplomas, higher coursework degrees or distance-mode courses, or special, vocational and adult education degrees.

Information given for each university is presented for each campus of that university, since offerings vary markedly with campus.

**Australian Catholic University**
*(Mount Saint Mary, Strathfield, NSW)*
Bachelor of Education (Primary)
Bachelor of Teaching / Bachelor of Arts (Secondary - Mathematics)
Bachelor of Teaching / Bachelor of Arts (Secondary - Technology)
Bachelor of Teaching / Bachelor of Arts (Secondary - Visual Arts)
Bachelor of Teaching / Bachelor of Arts (Secondary - Humanities)
*(Signadou, Canberra, ACT)*
Bachelor of Education (Primary)
*(Ballarat, VIC)*
Bachelor of Education (Primary)
Bachelor of Teaching (Primary) / Bachelor of Arts
*(Melbourne, VIC)*
Bachelor of Education (Primary)
Bachelor of Teaching (Primary) / Bachelor of Arts
*(McAuley, Brisbane, QLD)*
Bachelor of Education (Primary)

**Australian National University**

no programs offered
Avondale College

Bachelor of Education (Primary)
Bachelor of Education (Secondary)
Bachelor of Arts / Bachelor of Teaching
Bachelor of Business / Bachelor of Teaching
Bachelor of Science / Bachelor of Teaching

Bond University

no programs offered

Central Queensland University

Bachelor of Learning Management (Early Childhood)
Bachelor of Learning Management (Primary)

Bachelor of Learning Management (Early Childhood)
Bachelor of Learning Management (Primary)

Bachelor of Learning Management (Early Childhood)
Bachelor of Learning Management (Primary)

Bachelor of Learning Management (Early Childhood)
Bachelor of Learning Management (Primary)

Bachelor of Learning Management (Early Childhood)
Bachelor of Learning Management (Primary)

Bachelor of Learning Management (Early Childhood)
Bachelor of Learning Management (Primary)

Bachelor of Learning Management (Early Childhood)
Bachelor of Learning Management (Primary)

Bachelor of Learning Management (Secondary)
Bachelor of Learning Management (Secondary)
Bachelor of Learning Management (Secondary)
Bachelor of Learning Management (Secondary)
Bachelor of Learning Management (Secondary)
Bachelor of Learning Management (Secondary)
Bachelor of Information Technology / Bachelor of Learning Management (Secondary)
Bachelor of Science / Bachelor of Learning Management (Secondary)
Bachelor of Science (Applied Physics) / Bachelor of Learning Management (Secondary)

**Charles Sturt University**
(Albury Wodonga)
Bachelor of Education (Early Childhood)
(Bathurst)
Bachelor of Education (Early Childhood)
Bachelor of Education (Primary)
Bachelor of Social Science (Psychology) / Bachelor of Teaching (Primary)
Bachelor of Social Science (Psychology) / Bachelor of Teaching (Secondary)
(Dubbo)
Bachelor of Education (Primary)
(Wagga Wagga)
Bachelor of Education (Primary)
Bachelor of Education (Technology & Applied Studies)
Bachelor of Teaching (Secondary) / Bachelor of Science
Bachelor of Teaching (Secondary) / Bachelor of Information Technology

**Curtin University of Technology**
(Bentley)
Bachelor of Arts (Asian Studies) / Bachelor of Education
Bachelor of Science (Chemistry) / Bachelor of Education (Secondary)
Bachelor of Science (Environmental Biology) / Bachelor of Education (Secondary)
Bachelor of Science (Mathematical Sciences) / Bachelor of Education (Secondary)
Bachelor of Science (Physics) / Bachelor of Education (Secondary)
Bachelor of Social Science / Bachelor of Education
Bachelor of Science (Occupational Therapy) / Bachelor of Education (Early Childhood)
Bachelor of Science (Occupational Therapy) / Bachelor of Education (Primary)
Bachelor of Education (Early Childhood)
Bachelor of Education (Primary)
Bachelor of Education (Secondary)
(Kalgoorlie)
Bachelor of Education (Early Childhood Teaching)
Bachelor of Education (Primary Teaching)
Deakin University

(Geelong)
Bachelor of Education (Primary)

(Melbourne)
Bachelor of Teaching (Secondary) / Bachelor of Applied Science (Human Movement)
Bachelor of Education (Primary)
Bachelor of Teaching (Secondary) / Bachelor of Arts
Bachelor of Teaching (Secondary) / Bachelor of Applied Science (Health Science)
Bachelor of Teaching (Secondary) / Bachelor of Science

(Warrnambool)
Bachelor of Education (Primary)

Edith Cowan University

(Joondalup)
Bachelor of Education (Kindergarten through Primary)

(Mount Lawley)
Bachelor of Education (Early Childhood Studies)
Bachelor of Education (Primary)
Bachelor of Education (Secondary)
Bachelor of Arts (Education) / Bachelor of Business
Bachelor of Arts (Education) / Bachelor of Arts (English)
Bachelor of Arts (Education) / Bachelor of Arts (Language Studies)
Bachelor of Arts (Education) / Bachelor of Arts (Social Sciences)
Bachelor of Arts (Education) / Bachelor of Science

(South West (Bunbury))
Bachelor of Education (Primary)

(WA Academy of Performing Arts)
Bachelor of Education (Secondary) – Arts
Bachelor of Education (Music)

Flinders University

(Bedford Park)
Bachelor of Education (Junior Primary / Primary)
Bachelor of Education (Upper Primary / Lower Secondary)
Bachelor of Education (Secondary Science)
Bachelor of Education (Secondary)
Bachelor of Education (Special Education)

**Griffith University**

*(Queensland Conservatorium and Mt Gravatt)*

Bachelor of Music / Bachelor of Education

*(Queensland College of Art and Mt Gravatt)*

Bachelor of Visual Arts in Fine Art / Bachelor of Education (Secondary)

*(Logan)*

Bachelor of Education – Primary

Bachelor of Human Services – Child and Family Studies / Bachelor of Education - Primary

*(Gold Coast)*

Bachelor of Education – Primary

Bachelor of Science / Bachelor of Education - Secondary

Bachelor of Exercise Science / Bachelor of Education

Bachelor of Arts in Psychology / Bachelor of Education - Primary

*(Mt Gravatt)*

Bachelor of Education - Primary

Bachelor of Education – Secondary (Drama)

Bachelor of Education – Secondary (English or Social Sciences)

Bachelor of Education – Secondary (Health and Physical Education)

Bachelor of Education – Special Education

Bachelor of Technology Education

*(Nathan and Mt Gravatt)*

Bachelor of Education – Secondary (Mathematics, Science or Computing)

Bachelor of Science / Bachelor of Education - Secondary

Bachelor of Arts / Bachelor of Education - Secondary

Bachelor of Arts in Languages and Applied Linguistics / Bachelor of Education - Secondary

**James Cook University**

*(Cairns)*

Bachelor of Education (Primary)

Bachelor of Education (Early Childhood)

Bachelor of Education / Bachelor of Psychology

Bachelor of Education - *Graduate entry* (Early Childhood or Primary)

Bachelor of Education (Professional Development)

*(Cairns and Townsville)*
Bachelor of Education / Bachelor of Arts
Bachelor of Education / Bachelor of Science
Bachelor of Education (Secondary)
(Townsville)
Bachelor of Education (Early Childhood)
Bachelor of Education (Primary)
Bachelor of Education (Secondary)
Bachelor of Education / Bachelor of Arts
Bachelor of Education / Bachelor of Arts (Honours)
Bachelor of Education / Bachelor of Languages
Bachelor of Education / Bachelor of Psychology
Bachelor of Education / Bachelor of Science
Bachelor of Education / Bachelor of Science (Honours)
Bachelor of Education (Human Movement)
Bachelor of Education - Graduate entry (Secondary, Primary or Early Childhood)
Bachelor of Education (Professional Development)
Bachelor of Educational Services (Child Care)
Bachelor of Sport and Exercise Science / Bachelor of Education

La Trobe University
(Bendigo)
Bachelor of Arts (Outdoor Education)
Bachelor of Arts (Outdoor Education) / Bachelor of Behavioural Science
Bachelor of Teaching (Primary, or Secondary)
(Mildura)
Bachelor of Teaching (Primary, or Secondary)

Macquarie University
(North Ryde)
Bachelor of Education (Early Childhood)
Bachelor of Education (Early Childhood) (by distance education)
Bachelor of Science with Diploma of Education

Monash University
(Clayton)
Bachelor of Arts / Bachelor of Education
Bachelor of Commerce / Bachelor of Education
Bachelor of Education / Bachelor of Laws
Bachelor of Information Management & Systems / Bachelor of Education (Secondary)
Bachelor of Music / Bachelor of Education (Secondary)
Bachelor of Science / Bachelor of Education (Gippsland)
Bachelor of Arts / Bachelor of Education
Bachelor of Primary Education
Bachelor of Secondary Education (Peninsula)
Bachelor of Arts / Bachelor of Education
Bachelor of Early Childhood Education
Bachelor of Information Management & Systems / Bachelor of Education (Primary)
Bachelor of Music / Bachelor of Education (Primary)
Bachelor of Primary Education

Murdoch University
(Murdoch)
Bachelor of Education (Primary)
Bachelor of Arts / Bachelor of Education (Secondary)
Bachelor of Science / Bachelor of Education (Secondary)

Northern Territory University
(Casuarina)
Bachelor of Teaching (Early Childhood)
Bachelor of Teaching (Primary)
Bachelor of Education (Preservice)
Bachelor of Arts / Bachelor of Teaching
Bachelor of Science / Bachelor of Teaching

Queensland University of Technology
(Kelvin Grove)
Bachelor of Creative Industries (Dance) / Bachelor of Education (Secondary)
Bachelor of Creative Industries (Drama) / Bachelor of Education (Secondary)
Bachelor of Creative Industries (Visual Arts) / Bachelor of Education (Secondary)
Bachelor of Music / Bachelor of Education (Secondary)
Bachelor of Education (Early Childhood)
Bachelor of Education (Primary)
Bachelor of Education - Secondary (Business Education)
Bachelor of Education - Secondary (English/Film and Media Studies)
Bachelor of Education - Secondary (Home Economics)
Bachelor of Education – Secondary (Languages Other Than English)
Bachelor of Education – Secondary (Physical Education)
Bachelor of Education – Secondary (Science/Maths/Computing)
Bachelor of Education – Secondary (Social Science)
Bachelor of Applied Science (in Human Movement Studies) / Bachelor of Education (Secondary)
(Kelvin Grove and Carseldine)
Bachelor of Arts (Humanities) / Bachelor of Education (Early Childhood)
Bachelor of Arts (Humanities) / Bachelor of Education (Primary)
Bachelor of Arts (Humanities) / Bachelor of Education (Secondary)
(Kelvin Grove and Garden Point)
Bachelor of Applied Science / Bachelor of Education (Early Childhood)
Bachelor of Applied Science / Bachelor of Education (Primary)
Bachelor of Applied Science / Bachelor of Education (Secondary)
Bachelor of Business (Accountancy and Economics) / Bachelor of Education (Secondary)
Bachelor of Information Technology / Bachelor of Education (Secondary)

Royal Melbourne Institute of Technology University
(Bundoora)
Bachelor of Education (Early Childhood)
Bachelor of Education (Primary)
Bachelor of Applied Science (Physical Education)

Southern Cross University
(Coffs Harbour)
Bachelor of Technology Education (Secondary)
(Lismore)
Bachelor of Education (Primary)
Bachelor of Applied Science / Bachelor of Education (Secondary)
Bachelor of Arts / Bachelor of Education (Secondary)
Bachelor of Contemporary Music / Bachelor of Education (Secondary)
Bachelor of Human Movement Science / Bachelor of Education (Secondary)
Bachelor of Visual Arts / Bachelor of Education (Secondary)

**Swinburne University of Technology**

no programs offered

**University of Adelaide**

*(North Terrace)*

Graduate Diplomas in Education *only*

**University of Ballarat**

*(Mount Helen)*

Bachelor of Education (Physical Education)
Bachelor of Education (Primary)
Bachelor of Education (Primary +Middle School)

**University of Canberra**

*(Bruce)*

Bachelor of Education (Early Childhood Training)
Bachelor of Education (Primary Teaching)
Bachelor of Education (Secondary Education – Human Movement/Physical Education)
Bachelor of Education (Secondary Education – Music)
Bachelor of Education (Secondary Education – Design/Technology)
Bachelor of Education (Secondary)

**University of Melbourne**

*(Parkville)*

Bachelor of Early Childhood Studies
Bachelor of Education (Primary)

**University of New England**

*(Armidale)*

Bachelor of Arts / Bachelor of Teaching
Bachelor of Commerce / Bachelor of Teaching
Bachelor of Science / Bachelor of Teaching
Bachelor of Education (Primary)
Bachelor of Music / Bachelor of Teaching
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<td>Bachelor of Teaching / Bachelor of Science</td>
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<td><em>(Central Coast)</em></td>
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<td>Bachelor of Education (Secondary)</td>
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<td>Bachelor of Health and Physical Education</td>
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<tr>
<td>Bachelor of Behavioural Studies / Bachelor of Education (Middle Years of Schooling)</td>
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<td>Bachelor of Contemporary Studies / Bachelor of Education (Middle Years of Schooling)</td>
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<tr>
<td>Bachelor of Social Science / Bachelor of Education (Middle Years of Schooling)</td>
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</table>
(Gatton)
Bachelor of Agricultural Science (Animal Science) / Bachelor of Education
Bachelor of Agricultural Science (Plant and Soil Science) / Bachelor of Education
Bachelor of Agricultural Science (Rural Technology) / Bachelor of Education
Bachelor of Applied Science (Animal Studies) / Bachelor of Education
Bachelor of Applied Science (Crops and Rangelands) / Bachelor of Education
Bachelor of Applied Science (Environmental & Production Horticulture) / Bachelor of Education

(St Lucia)
Bachelor of Agricultural Science / Bachelor of Education
Bachelor of Applied Science (Food Science and Nutrition) / Bachelor of Education
Bachelor of Arts / Bachelor of Education
Bachelor of Business Management / Bachelor of Education
Bachelor of Commerce / Bachelor of Education
Bachelor of Economics / Bachelor of Education
Bachelor of Music / Bachelor of Education
Bachelor of Natural Resource Economics (Agricultural Economics) / Bachelor of Education
Bachelor of Science / Bachelor of Education
Bachelor of Social Science / Bachelor of Education

(Tewantin)
Bachelor of Early Childhood Studies (Childcare)
Bachelor of Education (Early Childhood)
Bachelor of Education (Primary)
Bachelor of Education (Secondary)
Bachelor of Arts / Bachelor of Education (Secondary)
Bachelor of Commerce / Bachelor of Education (Secondary)
Bachelor of Science / Bachelor of Education (Secondary)

(Wide Bay)
Bachelor of Education (Early Childhood)
Bachelor of Education (Primary)
Bachelor of Education (Secondary)

University of South Australia
(Magill)
Bachelor of Early Childhood Education
Bachelor of Education (Junior Primary & Primary)
Clever Teachers, Clever Sciences

Bachelor of Education (Specialisation) – in Early Childhood; Junior Primary/Primary; or Secondary

**University of Southern Queensland**
*(Toowoomba)*
- Bachelor of Commerce / Bachelor of Education (Secondary)
- Bachelor of Early Childhood Studies (Childcare)
- Bachelor of Education (Early Childhood)
- Bachelor of Education (Primary)
- Bachelor of Education (Secondary)
- Bachelor of Arts / Bachelor of Education (Secondary)
- Bachelor of Science / Bachelor of Education (Secondary)
  *(Wide Bay)*
- Bachelor of Commerce / Bachelor of Education (Secondary)
- Bachelor of Education (Early Childhood)
- Bachelor of Education (Primary)
- Bachelor of Education (Secondary)

**University of Sydney**
*(Camperdown)*
- Bachelor of Education (Primary Education)
- Bachelor of Education (Secondary – Human Movement & Health Education)
- Bachelor of Education (Secondary – Humanities & Social Science) / Bachelor of Arts
- Bachelor of Education (Secondary – Mathematics)
- Bachelor of Education (Secondary Science) / Bachelor of Science
- Bachelor of Education (Secondary – Design & Technology)
- Bachelor of Education (Secondary) / Bachelor of Arts (Psychology)
- Bachelor of Education (Secondary) / Bachelor of Science (Psychology)

**University of Tasmania**
*(Hobart)*
- graduate entry (Bachelor of Teaching) *only*
  *(Launceston)*
- Bachelor of Education (Early Childhood)
- Bachelor of Education (Primary)
- graduate entry (Bachelor of Teaching) *also*
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<tr>
<th>Institution</th>
<th>Location</th>
<th>Bachelor of Education Programs</th>
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<td>N-W Centre</td>
<td></td>
<td>Bachelor of Education (Early Childhood) (first year only)</td>
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<td>Bachelor of Education (Primary) (first year only)</td>
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<td>University of Technology, Sydney</td>
<td>Kuring-gai</td>
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<td>Bachelor of Science / Bachelor of Education</td>
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<tr>
<td>University of Western Sydney</td>
<td>Bankstown</td>
<td>Bachelor of Education (Early Childhood)</td>
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<td>Bachelor of Education (Primary)</td>
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<td>Penrith</td>
<td>Bachelor of Education / Bachelor of Theology</td>
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University of Wollongong

(Wollongong)
Bachelor of Education (Physical & Health Education)
Bachelor of Teaching (Early Childhood)
Bachelor of Teaching / Bachelor of Education (Primary)

University of the Sunshine Coast

No programs offered

Victoria University of Technology

(Echuca)
Bachelor of Education (Nyerna Studies)
(Footscray Park)
Bachelor of Education (Prep -Year 12)
Bachelor of Education (Prep -Year 12) – (Mathematics Teaching)
Bachelor of Applied Science (Physical Education (Secondary))
(Melton)
Bachelor of Education (Outdoor Education)
Bachelor of Education (Prep - Year 12) – (Physical Education (Primary))
Appendix B  Surveys of teacher education programs

B-1  Institutions Involved in the Project

Australian Catholic University  http://www.acu.edu.au
Avondale College  avondale.edu.au
Batchelor Institute  nt.gov.au/bbtc
Central Queensland University  cqu.edu.au
Charles Sturt University  csu.edu.au
Curtin University of Technology  curtin.edu.au
Deakin University  deakin.edu.au
Edith Cowan University  cowan.edu.au
Flinders University  flinders.edu.au
Griffith University  gu.edu.au
James Cook University  jcu.edu.au
LaTrobe University  latrobe.edu.au
Macquarie University  mq.edu.au
Monash University  monash.edu.au
Murdich University  murdich.edu.au
Northern Territory University  ntu.edu.au
Queensland University of Technology  qut.edu.au
Royal Melbourne Institute of Technology University  rmit.edu.au
Southern Cross University  scu.edu.au
University of Adelaide  adelaide.edu.au
University of Ballarat  ballarat.edu.au
University of Canberra  canberra.edu.au
University of Melbourne  unimelb.edu.au
University of New England  une.edu.au
University of New South Wales  unsw.edu.au
University of Newcastle  newcastle.edu.au
University of Queensland  uq.edu.au
University of South Australia  unisa.edu.au
University of Southern Queensland  usq.edu.au
University of Sydney  usyd.edu.au
University of Tasmania  utas.edu.au
University of Technology, Sydney  uts.edu.au
University of Western Australia  uwa.edu.au
University of Western Sydney  uws.edu.au
University of Wollongong  uow.edu.au
Victoria University of Technology  vu.edu.au
Dear (Dean),

As part of the DETYA commissioned project, ‘Preparing Teachers for the Challenge of Teaching Science, Mathematics and Technology in 21st Century Australia’ we are aiming to describe the science, mathematics and technology teacher education programs (primary and secondary) currently available at all universities throughout Australia. We seek your advice, as follows.

We would like to obtain information about the science, mathematics and technology programs that you are currently offering for initial teacher education. We ask your permission to gather details about these programs from your university website and to include this information in the report.

We would like to provide an accurate and comprehensive description of each program, so we also ask your permission to contact the relevant program co-ordinators or other appropriate persons who may be able to provide clarifying details about each specialisation.

Part of the brief for this project is to identify innovative practice in teacher education programs and to carry out case studies of selected examples of innovative practice. We invite you to identify any innovative programs in science, maths or technology (primary or secondary) or innovative aspects of your programs in these specialisations, and to indicate the appropriate person who could provide details of the innovation.

We invite you to take this opportunity to showcase your teacher education programs. Before publication of the report, each contributor will be provided with a draft of their contribution in order to suggest any changes that may be necessary.

In reply, would you please email David Palmer (eddhp@cc.newcastle.edu.au). As we are operating on a very tight time schedule, we would appreciate your reply as soon as possible.

We emphasise that your participation in this project is voluntary. However, if you decide not to participate would you please inform us of your decision.

Complaints. The University requires that all participants are informed that if they have any complaint concerning the manner in which a research project is conducted it may be given to the researcher or if an independent person is preferred, to the University’s Human Research Ethics Officer, Office for Research, Chancellery, University of Newcastle, 2308, telephone (02) 49216333, or David Palmer at the numbers below.

Thank you

Dr David Palmer  
Faculty of Education  
The University of Newcastle  
NSW  2308  
Ph (02) 49215715  
Email eddhp@cc.newcastle.edu.au

AND  
Prof. Geoffrey Lawrance  
Faculty of Science & Mathematics  
The University of Newcastle  
NSW  2308  
Ph: (02) 49215474  
Email: csgl@paracelus.newcastle.edu.au
B-3  Letter to other staff

Dear colleague,

We are seeking your voluntary participation in the DETYA commissioned project: Preparing Teachers for the Challenge of Teaching Science, Mathematics and Technology in 21st Century Australia.

This project aims to describe the science, mathematics and technology initial teacher education programs (for both primary and secondary levels) currently available at all universities throughout Australia, and to identify innovative aspects of these programs.

You are asked to provide information to this project by participating in an audiotaped telephone interview of about 40 minutes. The guide questions for the interview are listed below.

We invite you to take this opportunity to showcase your teacher education program. However, we emphasise that your participation in this project is voluntary. Before publication of the report, you will be provided with a draft of the section relating directly to your contribution in order to suggest any changes that you feel are necessary.

If you are willing to be interviewed by telephone, would you please email David Palmer (eddhp@cc.newcastle.edu.au) and indicate some preferred times for interview, preferably during the next seven days. You will be contacted to confirm one of these times.

Complaints. The University requires that all participants are informed that if they have any complaint concerning the manner in which a research project is conducted it may be given to the researcher or if an independent person is preferred, to the University’s Human Research Ethics Officer, Office for Research, Chancellery, University of Newcastle, 2308, telephone (02) 49216333, or David Palmer at the numbers below.

Thank you

Dr David Palmer
Faculty of Education
The University of Newcastle
NSW 2308
Ph: (02) 49215715
Email eddhp@cc.newcastle.edu.au

AND

Prof. Geoffrey Lawrance
Faculty of Science and Mathematics
The University of Newcastle
NSW 2308
Ph: (02) 49215474
Email csgl@paracelsus.newcastle.edu.au
B-4 List of participants who provided information for the survey of programs

**Australian Catholic University**
Marg Horne       Phil Clarkson       Barbara Odgers
Martin Maguire   Peter Taylor

**Avondale College**
Cedric Greive

**Batchelor Institute**
Ron Watt          Geri Pancini

**Central Queensland University**
Ken Appleton      Pat Moran          Allan Harrison

**Charles Sturt University**
Rod Francis       Tom Lowrie         Bob Dengate
Will Letts        Colin Boylan       Peter Wilson

**Curtin University**
Len Sparrow       Rob Cavanagh       Joy Yukich

**Deakin University**
Susie Groves      Russell Tytler      Ron Smith
Geoff White

**Edith Cowan University**
Dennis Goodrum    Jack Bana          John McQueen
David McDougall

**Flinders University**
Rick Lambert

**Griffith University**
Robyn Zevenbergen Howard Middleton Jim Richmond
Jan Wilson
<table>
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<tr>
<th>University</th>
<th>Members</th>
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<tbody>
<tr>
<td>James Cook University</td>
<td>Steve Ritchie, Ian Putt, Rhonda Faragher, John King</td>
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<td>LaTrobe University</td>
<td>Bruce Waldrip, Les Lyons, Steve Tobias, Marion Sargeant, Peter Cox</td>
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<td>Macquarie University</td>
<td>Christine Preston, John Farrell, Grant Kleeman</td>
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<td>Monash University</td>
<td>Debbie Corrigan, Karen Malone, Barbara Clarke</td>
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<td>Northern Territory University</td>
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<td>University of Canberra</td>
<td>Jim Woolnough, Marilyn Fleer, Steve Thornton, Rosemary King, Mary Hewett</td>
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Clever Teachers, Clever Sciences

University of Melbourne
Kaye Stacey  Rod Fawns

University of New England
Garry Clark  David Daniels  Barry Squire
Bruce Cameron  Paul Muirhead

University of New South Wales
Michael Matthews  Rick Connor

University of Newcastle
Julie McLeod  David Palmer  Kath Grushka

University of Queensland
Donna Satterthwait  Diane Mayer

University of South Australia
Mike Chartres  Bruce White  Steve Keirl
Bruce Underwood

University of Southern Queensland
John Green  John Austin  Lesley McAuley-Jones
Mark Dawson

University of Sydney
Tony Sperring  Mike Gunnourie  Armstrong Osborne

University of Tasmania
Natalie Brown  Jane Watson  Peter Ferguson
Harvey Wynne

University of Technology Sydney
Janette Griffin

University of Western Australia
Khim Harris  Sharron Wheeler  Clive Whitehead

University of Western Sydney
Alison Elliott  Jenny Way  Wayne Sawyer
Alan White  Kevin Watson
University of Wollongong
Brian Ferry         Julie Kiggins

Victoria University of Technology
Jan Thomas          Brenda Cherednichenko
B-5 List of interview guide questions and rationale for each question

Introductory questions

Roughly how many students are currently enrolled in each year of the program?

This question was not intended to give accurate numbers (most of the interviewees did not have easy access to the official enrolment figures) but rather the intention was to get a ‘ball park’ figure only.

Is this a new program?

This question was designed to identify programs which had been developed in recent years, and which might therefore be ‘new’ or innovative.

What is the basic structure of the program?

This question was intended to provide an overview of the balance between content studies and education studies.

Content/Discipline Studies

What content/discipline studies are in the program?

Which faculty teaches the content studies?

Are the content studies general offerings or are they tailored to Education students?

To what year level (100, 200, 300) are the content studies undertaken? (i.e. the depth of content studies)

These questions were designed to address the first term of reference in the project: ‘The Nature and Level of Content Studies Undertaken’.

Curriculum Method Studies

Which specialist method subjects do your students typically take?

How many credit points do these represent in the total program?

How many hours per week is allocated to them?

The second term of reference for the project was to investigate the ‘Articulation Between Content Studies and Pedagogical Studies’, but evidence from the pilot studies indicated that much, if not all, of this articulation actually occurred within the specialist method subjects. For example, it was in these subjects that students made the closest links between their specialist discipline content and pedagogical practice (e.g. by designing learning experiences that were appropriate for specific discipline content). The other advantage of focusing on the curriculum method studies was that, in many cases, the innovations that most specifically applied to mathematics/science/technology education were to be found within these units (because these were usually the only units in the program for which mathematics,
science or technology education students were together as a coherent group, instead of being combined with students of other specialisations). Consequently it was decided to focus on the specialist method subjects as indicators of the articulation between content studies and pedagogical studies in the program.

**Teaching Practice**

*How many practica are there?*

*How many days are each of the practica?*

*Do the practica clash with content/discipline studies?*

These questions were intended to provide base-level information about practicum, to inform the third term of reference: ‘The Integration of Teaching Theory and Practice’.

**Literacy and Numeracy**

*Where are the students taught how to teach literacy and numeracy in this program?*

This question was designed to address the fifth term of reference (‘Skillling Teacher Education Students in Practices to Develop Literacy and Numeracy in School Students in Relation to These Content Areas’). This question was not asked of primary education programs because it was assumed that literacy would be an integral part of the program, and that numeracy would be the main aspect of the mathematics curriculum subjects. Because the requirements for literacy and numeracy in secondary specialisations varied from state to state, and because of the need to keep the interviews to an acceptable time limit, it was decided to not probe the detailed substance of the literacy numeracy education, as to do this issue justice would require a separate study.

**School/Industry Links**

*Do the students have any professional experiences in schools apart from formal practica?*

This question was designed to provide some of the information for the sixth term of reference: ‘The Exposure of Teacher Education Students to School Projects and Programs Designed to Improve Student Outcomes in Their Method Area’.

*Do the students have any links to the wider (non-school) community, including business or industry?*

This question was designed to address the seventh term of reference (‘The Links Between the Teacher Education Program and Business/Industry’).

**Things We Like**

*What are the things that you particularly like about your program? What aspects of it are you particularly proud of?*

These questions were intended to allow participants to describe aspects of their program which they wanted to highlight, to assist the identification of innovative practice.
Innovations

Are there any aspects of your program that you regard as innovative?

This question was designed to assist the identification of innovative practice.

Challenges

What do you see as the main challenges, constraints or difficulties for this program?

This question was intended to identify any factors that might negatively impact on the program or the innovations in the program.

Other Programs

Does your institution offer other, related programs for initial teacher education in this specialisation?

This question was designed to address the fourth term of reference (‘Differences in Teacher Preparation Between Different Types of Programs’). Students in related programs (e.g. undergraduate and graduate secondary science programs at the same institution) often sit in the same classes for many of their education subjects. Therefore, rather than repeat the whole interview for each separate program, it was decided to just briefly mention the other related programs and their relationship to the focus program.
Appendix C  Surveys of science deans and professional bodies

C-1  e-Letter to science deans

Dear Pro Vice-Chancellor / Dean

As part of the DETYA commissioned project, ‘Preparing Teachers for the Challenge of Teaching Science, Mathematics and Technology in 21st Century Australia’, we are aiming to describe the science, mathematics and technology teacher education programs currently available at all universities throughout Australia. Moreover, we also seek to probe the level of partnership between education and science, and to expose innovative and high quality programs and partnerships.

We invite you to take this opportunity to showcase your participation in teacher education programs, and or to give your views on science, mathematics and technology teacher training more generally.

Below are a number of questions for consideration and response. In reply, would you please e-mail Professor Geoffrey Lawrance (Geoffrey.Lawrance@newcastle.edu.au). Alternatively, written or faxed [to (02) 49215472] responses may be sent. As we are operating on a fairly tight time schedule, we would appreciate your reply as soon as practicable.

We emphasise that your participation in this project is voluntary. However, if you decide not to participate, would you please inform us of your decision.

Questions

1. If you have a teaching partnership with the Education Faculty/School at your University, could you describe how the partnership operates?

To what extent would you consider this partnership to be innovative?

2. Does your Faculty provide all science/mathematics discipline courses/subjects for teacher education students in your University?

To what extent would you regard your present teaching arrangements for these courses/subjects as representing innovative practice?

3. Are you aware of any current programs for the preparation of science, mathematics and technology teachers anywhere in Australia that you consider are innovative and important?

4. If you have any views on what should definitely be included in future innovative high quality programs of science, mathematics and technology teacher training, would you care to expand?
Thank you for your co-operation.

Please return your response to the address at top.

[Complaints. The University requires that all participants are informed that if they have any complaint concerning the manner in which a research project is conducted it may be given to the researcher or is an independent person is preferred, to the University’s Human Research Ethics Officer, Office of Research, Chancellery, University of Newcastle, 2308, telephone (02) 49216333. Co-Directors of this project are Professor Geoffrey Lawrance, Faculty of Science and Mathematics, telephone (02)49215474, and Dr David Palmer, Faculty of Education, telephone (02)49215715]
C-2 Information form

Preparing Teachers to Teach Science, Mathematics and Technology

Terms of Reference
This project will explore the nature of teaching in university courses that prepare new teachers to teach science, mathematics and technology in both primary and secondary schools. It will target innovative practice in the preparation of teachers.

As part of this exploration the study will examine how the programmes deal with the following issues:

- Articulation between content studies and pedagogical studies in the preparation of these teachers;
- The nature and level of content studies undertaken;
- The integration of teaching theory and practice;
- Differences in teacher preparation between different types of courses;
- Skilling teacher education students in practices to develop literacy and numeracy in school students in relation to these content areas;
- The exposure of teacher education students to school projects and programmes designed to improve student outcomes in their method area;
- The links between the teacher education programme and business/industry.

Technology is a broad area in the secondary school curriculum. The school subject areas covered for the purposes of this study are: computer studies, home science, agriculture, and technical studies which includes subjects like design and technology, textiles and design, graphics, and materials and technology.

Methodology

Universities will need to be surveyed about the details of their teacher education programmes to prepare teachers to teach science, mathematics and technology at both primary and secondary level. This survey should provide an overview of how programmes are addressing the issues listed above. On the basis of this information case studies of a number of innovative programmes will provide more detail about the way programmes address key aspects of the preparation of teachers to teach science, mathematics and technology.

Outcomes
The main outcome of the study will be a report of current initial teacher education preparation in the areas of science, mathematics and technology to inform policy development. A secondary outcome will be the sharing of information about innovative practice to inform the continuing development of teacher education programmes.
Dear colleague,

We are presently engaged in the DETYA commissioned project: Preparing Teachers for the Challenge of Teaching Science, Mathematics and Technology in 21st Century Australia.

This project aims to describe the science, mathematics and technology initial teacher education programs (for both primary and secondary levels) currently available at all universities throughout Australia, and to identify innovative aspects of these programs.

We invite you participate in this process by submitting your ideas about innovation in maths, science and technology teacher education. In particular, we invite you to identify any existing programs that you consider to be innovative, or that you consider to contain innovative elements. We also invite your views on the quality of current programs of teacher education in these specialisations and welcome any suggestions about innovations that should be included in teacher education programs for the 21st Century.

Your responses will be used, along with those of others, to develop guidelines for the identification of innovative practice in current teacher education programs.

Please reply to David Palmer, at the email address below.

As we are operating on a tight schedule, we would appreciate your reply as soon as possible.

Complaints. The University requires that all participants are informed that if they have any complaint concerning the manner in which a research project is conducted it may be given to the researcher or if an independent person is preferred, to the University’s Human Research Ethics Officer, Office for Research, Chancellery, University of Newcastle, 2308, telephone (02) 49216333, or David Palmer at the number below.

Thank you

Dr David Palmer AND Prof. Geoffrey Lawrance
Faculty of Education AND Faculty of Science and Mathematics
The University of Newcastle AND The University of Newcastle
NSW 2308 AND NSW 2308
Ph (02) 49215715 AND Ph: (02) 49215474
Email edhdp@cc.newcastle.edu.au AND Email csgl@paracelsus.newcastle.edu.au
C-4 Submission from the Australian Academy of Technological Sciences and Engineering (ATSE)

Introduction

Through its Education Committee, ATSE has maintained a constant interest in science and technology teaching since 1998. It has published a number of reports that bear on the Terms of Reference of this inquiry, particularly in respect to primary schooling.

Although the Terms of Reference are broader, we note that in the invitation from Professor Geoffrey Lawrance and Dr David Palmer for ATSE to respond, particular emphasis is placed on ‘innovation in maths, science and technology education (in particular science)’. Neither the current request nor the broader terms, promises value. The deficiencies that underpin the quality of teacher training and the preparedness of the teaching profession to teach these disciplines in both primary or secondary schools have fundamental origins that are not addressed by either.

It is concerning that within the Terms of Reference; the final paragraph maintains the anachronism that the technology curriculum is somehow embodied in the teaching of a set of traditional technology areas. Technology is an approach to making and doing. The processes and culture are about ‘doing informed by thought and knowledge’. The outcomes are about the synthesis of ideas into new things and actions. This is innovation. The aging approach to curricula embodied in the narrow functionality of each of the identified areas is part of our failure to teach technology and to prepare teachers to teach it.

A Summary of ATSE Views on the Problems

It is ATSE’s view that the nation’s failure to achieve desired outcomes in the areas of mathematics, science and technology teaching are not particularly complex. Indeed they can be simply described. They are not about interesting new activities. These exist in the system and indeed have been identified in a number of inquiries, some of which have been funded by DETYA. The lasting problems are endemic to the training of teachers, to the employment culture within public schooling, to the low level of public support for teachers and the culture in which they are employed and to confused political accountability for these illnesses.

In respect to schooling, the Australian voter remains ignorant of the respective responsibilities of our two levels of government. The bureaucracies and the politicians within the Commonwealth and States are content with this community ignorance and indeed enjoy the absence of accountability in which each can blame the other for system failures. The recent responses to the Ramsey Report Quality Matters: Revitalising Teaching: Critical Times, Critical Choices in New South Wales suggest that at least some of the universities are prepared to obscure their own failures to invest adequately in teacher preparation by similarly blaming others. ATSE is impressed by the thoroughness of Ramsey’s work. It believes that it should be weighted heavily in the considerations of the present study.
The focuses of ATSE's continuing concerns are:

- The qualifications of those selected into teacher training courses in our universities.
- The quality of the pre-service training of teachers in the universities, particularly in respect to science and technology teaching in primary schools.
- The quality, amount and formal recognition of in-service training provided for teachers. This is a critical issue in primary schools, since the great majority of these teachers have an extremely low level of teaching readiness in science and technology.
- The facilities available in primary schools for science and technology teaching. The deficit is not only in the area of the equipment necessary to maintain valid practical experiences but also in respect to the accommodation of this practical work. In general teaching space science and technology experiences are unsafe for students and teachers and project work is not secured. It is also clear the lack of identified space and a diffusion of responsibility also lead to loss and deterioration of any equipment and materials that are provided.
- The climate of teacher employment and the culture of confrontation between the public employers of teachers and the Teachers Unions. These battles and the resulting conditions of employment, including the poor recognition of those who perform at the highest level except by ceasing to teach, are critical determinants of the low interest in the profession among school-leavers. These industrial matters also include the in-service training deficiencies highlighted above.

A recent study on technology teaching sponsored by the Department of Education, Training and Youth Affairs has so far appeared only as a draft. This draft is most disappointing in the lack of focus of the recommendations. The education bureaucracies grudgingly admit there are deficiencies but the paths to addressing the problems are not addressed. The recommendations included in the draft report are predominantly about more talks between those groups that have been spectators to the decline in national capability. There is no recognition of urgency and no plans to address funding deficiencies.

This report and its authors confirm the existence of exemplary teaching and innovative approaches to training technology teachers. This work, it seems, would be a prime source of information within the narrow interpretation of the current brief.

**ATSE'S Approach to Addressing the Problems**

The Academy has decided to attempt a cooperative study with other interested bodies that will evaluate the cost of addressing the deficiencies identified above. ATSE believes it has advantages over others who are attempting to create change in this area of schooling.

The Academy has observed that many groups active in influencing schooling policy are often dismissed in the political debate as pursuing some form of self-interest. This method of denigration of the views of ATSE is not available.
ATSE is a national body with a well-developed State Divisional structure. It believes that this structure can lead to a fair assessment of the current policy framework in which both levels of government contest responsibility.

ATSE is an independent organisation of professional Fellows selected because of their contribution to applied science and technology development in Australia. The Fellows are or have been employed at the executive level in business, research organisations and universities. All have national and international reputations. They are knowledgeable about the issues but are not potential beneficiaries from any future policy changes except through any ultimate benefit to the nation.

ATSE has the standing to influence policy. The Fellowship believes that the state of readiness of the nation’s schools is a matter on which it must use its political capital and public credibility.

The resources of the Academy are limited largely to the time given by its members. Thus ATSE must seek the cooperation of others in this exercise. Although the input of others will be acknowledged, any public statements and publication of the outcomes of this study will be those endorsed by ATSE.

ATSE’s approach to evaluating the cost of attacking the problems identified above is explained below. Approaches to organisations with relevant responsibilities are currently being planned.

(i) **The qualifications of those selected into teacher training courses in Universities**

The lack of appeal of a career in teaching to the better performing school leavers has complex origins and it would be naive to suggest that commencing salaries or even life-time earnings are the sole determinants. Anecdotal evidence suggests that teacher dissatisfaction with their conditions of employment and the low level of professional recognition within the teaching services lead to feedback to students that discourages them from contemplating a career in teaching.

No doubt salaries, promotion opportunities and a lack of rewards for exemplary performance are significant in teacher judgements of the standing of their own profession and in the decisions made by parents and school-leavers in comparing other possible careers with teaching.

Whether or not monetary rewards are the primary cause of the lack of interest of the best performing school-leavers or simply a contributing factor; there must be value in investigating the earning differences between teaching and some other professions. If significant differences are found then it should be possible to estimate of eliminating this factor as an inhibitor of the well credentialled choosing a career in teaching.

Any estimation of these costs can only be addressed using procedures that establish the conditions of appointment of teachers to their initial professional employment and the conditions applying to subsequent ‘performance unrelated’ increments and advancements. In addition, it will be necessary to look at the general employment culture considering tenure, in-service training opportunities and rewards for personal efforts in career development and for demonstrated exemplary professional practice. It will be necessary to compare these conditions with other professions, particularly for those in the public sector. As we have suggested previously, the public sector sets the scene for the payment of teachers. The
independent schools, in a material sense, need do only marginally better, because there are other features of the independent schools that are attractive for many.

Information on these matters exists. Bodies such as the Teachers’ Unions and the Science Teacher Association of Australia have collected data. We will seek the cooperation of these bodies in the study without allowing ATSE to dilute its accountability for the outcome. It may be also that salary surveys by bodies such as the Royal Australian Chemical Institute will provide information about the later career rewards for chemists in teaching compared with those in other employment sectors.

This information is also relevant to the data required in the consideration of (v), below. In this section, the differences in respect to salaries of people otherwise identical in terms of professional equivalence should be collected. In (v) there must be an attempt to address separately the neglect of differentiation in rewards based upon identifiable elements such exemplary practice and evidence of the application of skills attained through in-service training, addressed under (iii).

There are matters to be considered such as independent responsibility. In our observation, there is probably no more lonely unsupported professional challenge than that of the first year teacher carrying a full teaching load in a primary school. To eliminate these career-damaging demands a year of internship under reduced load must be considered and costed. The recent Ramsey Report on Teacher Education in New South Wales adds weight to the previously published ATSE view that increased supervised professional practice, in the form of an internship, should be established as a necessary component of the registration of professional teachers.

The public debate on rewards for teachers is often ill informed. The irrelevance of teacher holidays in the discussion on rewards is clearly demonstrated by the low demand for teacher training among the best school leavers.

While we concentrate on primary schools, there seems no need to address reward differentiation on the grounds of teaching area. The Science Teachers’ Association of Australia has recently made the case for differential salaries for science teachers. Whatever the merit of this, the arguments seem not to be material while we concentrate on the primary school.

(ii) The quality of the pre-service training of teachers in the universities, particularly in respect to science and technology teaching in primary schools.

The emphasis here is on content only in as much as the cost of good science and technology experience in teacher training inhibits its introduction. A central question is: “Does the memory of the relative funding index for teacher training, as previously used by DETYA and still reflected in funds distribution by many university administrations, preclude the inclusion of worthwhile science and technology practical experience?” Is it impossible for teacher education cost centres to resource practical learning of these disciplines and is it impossible for these centres to pay the going rate to access the facilities and staff of science and engineering faculties? Is there evidence that the relative funding index once applicable to the separate Teachers Colleges was greater than that currently operated by universities internally? These matters of relativity are more important, since the evidence is that the universities, as a whole, are doing more with less.
The matter of the cost of schoolteacher supervision in schools is a contentious issue. Its impact, along with the costs of practical science and technology, is the basis of any case for increased relative funding.

As highlighted above, the cost of a teacher supervised internship year on decreased teaching load for graduates entering the teaching force could be the most worthwhile innovation in teacher preparation. The Ramsey Report suggests this.

Evidence on these questions will be available from the Committee of Deans of Education. Naturally, again in this area, ATSE will have to do an independent check with the universities, perhaps the AVCC, and with DETYA.

(iii) The quality, amount and formal recognition of in-service training provided in schools. This is a critical issue in primary schools where the great majority of teachers have an extremely low level of teaching readiness in science and technology.

The quantifying of the necessary investment in this area will be difficult. However, it will be relatively easy to gain from employer groups and unions their recommendations on the minimum budget for the maintenance of contemporary capability for professional staff. Other bodies, such as the Institution of Engineers Australia, the Royal Australian Chemical Institute and the Australian Institute of Physics will have information. It will be more difficult to get believable figures on the current investment in the State Education Authorities. This will be especially true, if the teacher feedback on the emphasis of all in-service training on bureaucratic reporting requirements can be substantiated.

The on-going deficit in this area will be substantiated with credibility through the above. However, there is an accumulated debt that must be evaluated. Science and Technology were not curriculum areas when the current primary teaching force was trained. There is clearly a case for the funding of in-service training at a temporary extraordinary level in these areas; at least until there is real evidence that pre-service training meets the needs.

The ATSE evidence is that the very best of the existing primary school teachers are insecure when faced with the current demands of science and technology. They need off-the-job practical experience. These are the good people in the middle of a teaching career who have been let down by the system.

(iv) The facilities available in primary schools for science and technology teaching. The deficit is not only in the area of the equipment necessary to maintain valid practical experiences but also in respect to the accommodation of this practical work so that it is safe for the student and teacher and secure for the time necessary, it is also clear that a lack of identified space also leads to loss and deterioration of that equipment and materials provided.

All of the work the Academy has done to date shows, unequivocally, that primary schools need specialised space, modest equipment and materials budgets to secure the teaching of both science and technology. The current level of investment, outside the irrelevant information technology budgets, must be discovered. The reported current rate of deterioration of existing equipment must be verified. It is recognised that the reported depreciation rates are a function of the inadequate spaces available for teaching and storing. Bodies such as the Science Teachers Association of Australia and the Technology Education Federation of Australia and the State Education Departments should be sound sources of the initial information.
Safety issues and the need to maintain the integrity of many practical exercises for considerable periods, demand identified specially equipped space for science and technology work. The identification of space for individual subject areas in primary schools has been resisted. This policy is unsustainable in the terms of the determination shown by Ministers at both levels of government and their bureaucrats to introduce science and technology in primary schools.

The medium term aim must be for every primary school student to have access to specialised space, equipment and the materials to meet the objectives of the science and technology curricula.

It is recognised the significant costs of addressing these needs will create reactive and negative responses from politicians used to addressing demands cast in the short term and focused on change that is obvious in the term of a single government. Any recommendations must address priorities and a concert of investment by both levels of government over at least a decade.

(i) The climate of teacher employment and the culture of confrontation between the public employers of teachers and the Teachers Unions. These battles and the resulting conditions of employment, including the poor recognition of those who perform at the highest level except by ceasing to teach, are critical determinants of the low interest in the profession among school-leavers.

The previous reports of the ATSE have addressed these concerns in principle. The issues of separating the costs assignable to these deficiencies in the system of employment in the public sector can be separated from those associated with the general reward levels are addressed, in principle, under (i).

The path to setting a cost on improving these aspects of the rewards of teachers can be addressed by approaching employer groups and professional bodies in other professions to ascertain the organisational budgets for the recognition of superior performance.

The discussion of these matters must involve the Teachers’ Unions. There can be no rewards in this category unless there is a coincident recognition that those who are below average in respect to these features of exemplary teaching will not receive these differential payments and may fail to qualify for normal service increments and, in the worst cases, may justify dismissal. All this is predicated on the assumption that if less than satisfactory performance is found targeted in-service training as suggested in (iii,) above, will be made available.

Conclusions

ATSE expresses an interest in the current inquiry. It notes the restrictive terms of reference. It expresses concern that the outcomes of the work may be used to suggest that there is no problem. There is a real possibility that evidence of exemplary behaviour by teachers who have survived the system will be used to conclude that there is nothing to be done.

If the inquiry team wishes to meet representatives of the Education Committee of the Australian Academy of Technological Sciences and Engineering to discuss any of the issues described above, contact should be made through the Academy’s Office at Ian McLennan House, 197 Royal Parade, Parkville, Victoria, 3052 or at natashar@atse.org.au. Direct contact with the Chair of the ATSE Education Committee, Professor Bob Breakspere can be achieved at breakspe@roksnet.net.au.
C-5 Submission From the Royal Australian Chemical Institute

The Royal Australian Chemical Institute (RACI) is extremely concerned at the state of the ‘enabling sciences’ (chemistry, physics and mathematics) in Australia with the numbers of students choosing further study of these subjects dropping both in high school and university and with the university departments shrinking in size. The need for more high quality graduates in these subjects is as important as the need for the general population to see science as a relevant part of their lives and culture. The provision of high quality science teachers in sufficient numbers to staff Australian schools is imperative if this situation is to improve (see Rebuilding the Enabling Sciences at www.raci.org.au).

In gathering ideas for this response, I have contacted RACI members from industry and academia in addition to those groups within the Institute with a particular interest in education. The comments refer to science teacher education, in particular chemistry teacher education, but many of the principles could apply equally to mathematics and technology teacher education programmes.

Since we do not have access to the teacher education programmes from all university science education departments in Australia, it is difficult to comment on current innovative practices, or to know if the ideas expressed represent innovation. However, the Institute believes that these ideas are fundamental to any initial science teacher education course if such a course is to result in high quality, effective science teachers.

Propositions for Science Teacher Education programmes:

The research indicates that for students to learn science effectively, with deep understanding and interest, they need to be actively involved in their own learning. This means that the students should do most of the thinking work rather than the teacher acting mainly as a ‘talking text book’. Therefore:

1. Any initial teacher education course must be predicated upon the widely accepted contemporary theories of effective teaching and learning in science.

2. Course delivery should be modelled on such theories, embodying constructivist, student-centred approaches rather than lectures on using such approaches.

3. Additional funding is required to redress the trend to more lectures and less workshops which funding cuts have necessitated in some institutions.

It follows that science education lecturers should themselves be outstanding teachers, fully conversant not only with the relevant research but also with current developments in science syllabi and assessment procedures pertinent to their students. Being aware of actual developments and practices in schools is important. Therefore:

4. Lecturers should be actively involved in on-going research into effective science education
5. Lecturers should spend at least one term every five years teaching science in school(s) to keep 'in touch' and to hone their teaching skills, in particular with regard to student-centred strategies.

Research is indicating the importance of 'subject specific' pedagogies in the effective teaching and learning of science – e.g. in chemistry, the work on macroscopic, microscopic and symbolic representations. Therefore:

6. Such pedagogies should also be integrated into the course in such a way as to relate them to actual teaching situations.

To be effective, science teachers need a solid background in the science they are to teach and a real understanding of the concepts behind it. Lack of either can result in an over-reliance on textbooks and 'keeping one jump ahead' of the students, which leads to a preponderance of 'teacher tell' strategies being used. Therefore:

7. The preferred model for such courses for secondary school science teachers should be:
   - B.Sc. + 2 year Master of Teaching;
   - B.Sc. + 1 year Diploma of Education
   - 4 year double degree in Science and Education

The Science degree should ideally contain substantial study of biology, chemistry, earth science and physics + some computing. Teachers of senior science should have 'majored' in the science they are teaching.

There is a perception that chemistry concepts, whether encountered in junior science or senior chemistry, are often not taught by teachers who have any real knowledge and understanding of chemistry. Hence they are not well taught and are not understood by the students. Since not all teachers will be specialist chemists, there must be a mechanism for gaining knowledge of chemistry as part of the teacher training. This is true for other areas of science also. Therefore:

8. As part of the course, the trainee teachers should be given the opportunity to improve their knowledge and understanding of the branches of science with which they are not familiar, at least up to a Year 10 level. This could be by 'private study' that is monitored and must be completed satisfactorily as an assessment requirement of the course. One such subject could be studied each semester.

The RACI believes that science is best taught in primary schools by the classroom teacher rather than a 'science specialist', thus keeping science as part of the perceived 'core curriculum'. We recognise that many trainee primary teachers have not studied science beyond Year 10 – and were unimpressed by science up to that level. Therefore:

9. The preferred model for primary teachers would be:
   - a bachelor's degree followed by a 2 yr M.Teach (or a 1 year Dip Ed) with relevant science content (especially chemistry and physics) in the course
   - a 4 year B.Ed. course which contains substantial, relevant science content

10. An emphasis in the course on science as a way of questioning and finding explanations for things around us, rather than a store of facts, so that teachers are excited and motivated to teach it in this way.
Chemistry is often seen as not very relevant to everyday life and few people have any appreciation of what chemists (and other scientists) do and how they work. Therefore:

11. Each student teacher in secondary science education courses should be paired up with a research or industrial chemist (or other scientist) with whom they can discuss, visit and find out about the 'real science' they do. Sharing experiences will give all prospective teachers access to many examples of 'first hand science' and contacts could well continue when the teachers are in schools. This can only inform their science teaching.

Literacy, numeracy and communication skills seem lacking in many young chemists who seek employment with RACI members and skills in these areas must be well developed in our science teachers also. Therefore:

12. Strategies for the ongoing development of literacy, numeracy and communication skills in students should be explicit in initial secondary teacher training courses, as well as those for primary teachers.

Science teachers need to be highly competent in using a variety of teaching strategies, including those which contemporary research indicates are the most effective if real learning is to occur. The assessment of secondary science teachers, in particular, should reflect the individual’s ability to do this in a real situation. Therefore:

13. A major part of the assessment should be linked to their actual teaching, their reflection on it, their ability to analyze strengths and weaknesses and build on or overcome these. The assessment should be carried out by the course lecturers (with input from the teachers).

The practicum is a very important part of the course and must therefore be as effective as possible. There needs to be much greater co-operation between the schools and the tertiary science educators to ensure this effectiveness. In primary schools, students need to experience teaching science as well as other curriculum areas. Therefore:

14. A much greater dialogue needs to exist between the mentor teachers and the tertiary educators with respect to what is expected of the trainee teacher during the practicum.

15. Mentor teachers need to be chosen who are able to support the trainee teacher in their classroom management and as they try a wide range of teaching strategies, including more student-centred ones.

16. An increase in the practicum e.g. to include 1 day per week in addition to the block period, could allow an exploration of specific aspects of teaching. This would require the close cooperation of schools and Education Faculties to be effective.

Many of the suggestions for improvements to the initial teacher training courses for science teachers require an investment of more time if they are to be implemented effectively. Therefore:

17. The extra time required will need to be funded.

These comments refer mainly to the ‘Science Method’ part of an initial teacher training course. Other aspects of the course also need to be relevant and involve active learning strategies.

18. Problem based learning approaches would be effective for parts of the course.
The MTeach course at The University of Sydney uses this approach for some aspects of its course with some effect.

Much chemistry (science) today uses computers and other instruments. Therefore:

19. *Courses should ensure that trainee teachers have high standards of computing and data logging skills.*
Mathematics education has gone through massive change over the last 20 years. There has been a major change in emphasis from formal skills and theoretical knowledge, attractive to the stronger student, to a more experimental and exploratory way of teaching, catalysed by the existence of the calculator and graphic calculator and the wish to make mathematics appealing to a broader cross-section of the population.

Together with these changes there have been major changes in the methods of teaching for which much retraining of teachers would have been relevant, but probably only a fraction has been done. These comments go back also to the need to adjust the contemporary training of teachers.

In the first instance one should question whether the changes have been for the good. There is much evidence, much of it complex and some confusing. Certainly, universities have frequently reported declining standards of entering students in the last decade, and a lower proportion of students attempting adequate mathematics for later tertiary studies.

Universities have in general lowered mathematics requirements on entry. One of the biggest engineering schools in the country, the one at UNSW, now has no formal prerequisite knowledge (although students with stronger backgrounds presumably have a higher probability of passing).

It should seriously be questioned first of all whether the changes toward dependence on expensive calculators in the classroom, which are not used in later life, are really beneficial. If one concludes that they are, then a conscious attempt should be made to ensure that teachers are trained to use these devices to maximum output, something which I understand from experienced and respected teachers is possible.

In the Australian Mathematics competition for the Westpac awards we are also noticing declining participation and scores in the senior years, although this trend is not so obvious in the lower secondary years. One of our projects has been the Mathematics Challenge for Young Australians Enrichment Program.

This program, partially funded by DETYA, has attracted of the order of 20,000 students in Australian secondary schools annually. The Enrichment component of this contains course material which provides students to the insight of logic, structure, proof, geometry, discrete mathematics, topics which we believe talented students are finding challenging and provide incentive to pursue further study. They certainly enrich and complement the mathematics as taught in the classroom.

I do not expect that these comments will address the particular issues on which you sought. However, they do provide some general thoughts which your committee may wish to consider in their deliberations.

I certainly believe that our project, which is innovative in that it has developed over the last 10 years, is providing wide value to the student population.

In going in further directions, it still might be wise to look at ways to ensure that students who eventually might pursue quantitative studies in university, whether in
Science, Engineering or Technology, are given as much of a theoretical background as possible to give them the necessary options in the future.

Peter Taylor (Professor)

Executive Director, Australian Mathematics Trust, University of Canberra
Clever Teachers, Clever Sciences

C-7 Submission From CSIRO Education

CSIRO Education has had considerable dealings with student teachers around Australia. We offer a variety of science and technology programs that enhance school education and as such would like to put forward three suggestions regarding teacher education.

1. Many student teachers that go on to teach science have no background in scientific research themselves. A science degree followed by a Dip Ed leaves no time for the student to undertake original research. CSIRO believe it is important for teachers to involve the students in original student research. Science is not just a body of facts and most state curriculum statements have accepted that it is important to teach students about working scientifically. This area of the curriculum can be supported by involvement in state science talent fairs, the BHP Science Competition and some other competitions. We however believe that a better way to lead teachers in this area of the curriculum is to have the teachers and students involved in the CREST Program. (Creativity in Science and Technology). This focuses on the steps involved in research rather than producing a winning entry. The methodology behind CREST is applicable for science technology and mathematics teachers.

2. Student teachers should be exposed to different teaching scenarios. While there is a diversity of teaching strategies in schools, extension education resources such as the CSIRO Science Education Centres provide a different approach to science education and as such require some different teaching skills to those found in most schools.

Student teachers have done observation and teaching rounds in some of our science education centres around the country. The advantage to the student teacher is that they can use the same teaching content over a number of days to attempt different delivery mechanisms. They also get to observe a different regime of teaching strategies.

3. CSIRO Education believes it is important for student teachers to broaden their understanding of science education and to learn of some of the resources that are available to support education. These resources include the Double Helix Science Club. Not only is the magazine an ideal vehicle for learning about current research in science, the club also supports a significant number of school science clubs. Primary school teachers and students can also use Scientriffic as a resource. This magazine aimed at children between the ages of 7 and 10 also has a teacher’s guide that links the articles with the school curriculum. These resources for teachers and students are heavily discounted for student teachers.

Other resources available for teachers and students include The Student Research Scheme where senior secondary students get to work on a real project with real scientists. This is usually done outside regular class hours but the impact on students is usually enormous.

In conclusion we are suggesting that student teachers should be able to teach students about the value and methodology of scientific research. We also believe
that student teachers need to be exposed to a variety of teaching strategies and resources that can be found outside of the classroom.

David Trotter

National CSIROSEC Coordinator

July 2001
# Appendix D  Descriptions of primary teacher education programs

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PROGRAM DESCRIPTIONS

Program Description D1

AUSTRALIAN CATHOLIC UNIVERSITY

BACHELOR OF EDUCATION (PRIMARY)
BACHELOR OF ARTS/BACHELOR OF TEACHING (PRIMARY)

This is a 4-year program, which has been running in its present form for about 4 years. There are about 800 students in the whole program and similar numbers in most of the other campuses, except ACT and Ballarat, which have fewer. There are 360 credit points (or 36 units with each unit worth 10 credit points) of which roughly one third is discipline studies and the rest are education subjects. Most of first year is discipline studies and year 4 is all education.

Content/Discipline Studies

Students do a major (subjects to year 3 level) or 2 minors (subjects to year 2 level) in the Faculty of Arts and Sciences. These are general offerings of the Faculty of Arts and Sciences. Neither a mathematics nor science major is offered, although minors in both subjects are.

There is a mathematics foundation subject ('Exploring Mathematics' is 10cp, 3 h/wk face to face for 12 weeks). This subject covers themes on number, probability, measurement etc and is taught from a problem solving perspective.

The Science and Technology foundation subject looks at science as part of our culture and studies science in other cultures, and globalisation. It focuses on what science is and its links to culture.

Curriculum Method Studies

There are 2 mathematics curriculum subjects. The first deals with some of the syllabus content areas and the students are involved in a semester-long project where they interview children and analyse their mathematics understandings. There are a lot of hands-on activities in workshops. In the second mathematics method subject, students cover other syllabus content and do a major assignment (which focuses on various methods of exploring groups of children’s understandings) while they are on practicum.

There is one science and technology education subject, which focuses on syllabus documents and related issues in the context of particular syllabus topics.

Students can choose extra mathematics education or science education subjects as electives (which present extra teaching strategies etc). About 15 students do this for science, and fewer for mathematics.

Teaching Practice

In year 2 there is a 3-week introductory round and a 4-week block at the end of the year. There are two 4-week blocks in third year and 2-week and 6-week blocks in
year 4. Blocks are held at the end of semester (in years 2 and 3) to avoid clashes (the semester is 12 weeks long in all faculties). However, in year 4, the block starts at the beginning of the semester for 2 weeks; students then return to the same school and class for 6 weeks, and finally complete the semester with another 6 weeks on campus.

School/Industry Links

Students are required to interview children as part of one of the mathematics curriculum subjects. In the past they have also done this in science.

Things We Like

There has been a good improvement in the students’ understanding of mathematics and science, and they are confident to teach in these areas even though they were initially fearful.

Innovations

There is a close link between science and mathematics education research (carried out by the staff) and this research is linked to the teaching. There is a mathematics education research unit, which is doing a longitudinal study of early numeracy development, and the techniques developed in this program have been introduced to the undergraduates. The doctoral studies of the science education staff are linked to the science education program.

Challenges

Lack of time and how to use the limited time in a creative way that will form a solid beginning for teacher education are the main challenges.

Other Programs

This program varies slightly from state to state.

There is a 2-year, end-on Bachelor of Education (primary)(postgraduate) which has about 40 students in each year at the Victorian campuses. These students do basically the same education content as the students above and the students are mixed together in most classes. There are two 4-week blocks and an extended practicum. The mature age students are a delight to teach.

Phil Clarkson

Program Description D2

UNIVERSITY OF CANBERRA

BACHELOR OF EDUCATION: PRIMARY TEACHING

This is a 4-year program, which has been running since 1998. There are 140-180 students in each year. There are 96 credit points, of which 22 are an approved major from another school, and the rest are Education offerings (each subject is 3-4cp).

Content/Discipline Studies
Students can choose an approved major in science or mathematics (the subjects are general offerings of the School of Information, Sciences and Engineering). A suitable sequence of subjects has been approved in consultation between both schools (staff from the School of ISE also provide course advice and support services).

There is a mathematics content subject which is offered by the School of Education but some of the tutors are from the School of ISE (there are strong links to the mathematics discipline staff via the mathematics resource centre). This subject is designed to cover mathematics to upper secondary standard and uses a non-rote learning approach. Students must achieve 80 per cent mastery.

**Curriculum Method Studies**

There are two mathematics method subjects which are pedagogy based, but the content is explored at the same time.

There is one science education subject (3h/wk) which begins with interactive teaching (based on children's understandings and questions) in which students investigate toasters to study electricity and related topics, then the process approach, discovery approach and transmission are covered. Tutors model these approaches at the students' level. Students critically reflect on what these approaches say about the nature of science, learners, content knowledge, pedagogy and gender. Students develop a program which they teach during professional experience, then share and evaluate it. Students use Web CT to discuss questions about science concepts (e.g. creationism). Student evaluations are extremely positive about this subject and students typically develop positive attitudes towards science.

There is a technology subject, which covers designing, making and appraising with information systems and materials. It uses a process approach to technology and also covers cultural perspectives. It has links to the School of Design (e.g. staff from the School of Design are involved in activities, such as examining artefacts, and also do presentations). It covers design and pedagogy of a broad range of technologies (from computers to didgeridoos).

**Teaching Practice**

In each semester of years 1, 2, and 3, there is a 2-week block practicum and about 3 observation and lead-in days. In the final year there is a 40-day internship during semester 1 (in semester 2 the students are qualified as relief teachers). Clashes with discipline subjects are avoided by arranging with content providers to catch up at a later time or by arranging with schools for students to come back to campus on certain days.

**School/Community Links**

In the science education subject, students are required to interview 3 boys and 3 girls about 'living and non-living'. Students also critique science articles from the web and analyse the implications about the nature of science. Students in the technology education subject interview the general public about their views of technology. The Minerals Council, Botanical Gardens, and the National Science and Technology Centre are involved in the program.

**Things We Like/Innovations**
The science and technology is innovative because the lecturers model interactive teaching (and the program is gender-sensitive and culture-sensitive). This allows the students to reflect at a very high level because they are experiencing what they are learning about.

There are strong links to other sectors in the university (e.g. the mathematics tutors work together) and the community (e.g. students are involved in science sessions in the community).

Students go into rich environments for practicum because the university staff have inserviced a lot of the teachers involved.

Challenges

Time and funds are limited, but Web CT and other creative techniques have been used.

Other Programs

The Bachelor of Education: Primary Teaching (Graduate Entry) is a 2-year program, which has about 40 students. They do the same mathematics and science method subjects as the undergraduates, but students have choice in assignments to cater for their own needs.

The Graduate Diploma in Education: Primary Teaching is a one-year program. The students do the same mathematics and science method subjects as the undergraduates.

Program Description D3

AVONDALE COLLEGE

BACHELOR OF EDUCATION (PRIMARY)

This is a 4-year program, which has been running for many years. There are about 110 students in total. The course involves 120 credit points comprising education studies, content subjects, electives, institutional requirements and practicum.

Content/Discipline Studies

There is a mathematics content subject (3cp) which is set at roughly HSC level and covers a broad range of mathematics topics (4 h/wk face to face).

There are two 1.5 credit point science content subjects. Each involves 2 h/wk of classwork, practicals and workshops. The first subject includes chemistry and biology, and the second includes astronomy, earth science and physics. The science subjects are practical and revolve around ‘everyday’ processes and materials.

Curriculum Method Studies

There is one mathematics curriculum method subject and one science curriculum subject (each is 3cp and 4 h/wk face to face). Both are geared to the New South
Wales syllabi. In addition, one third of a 300 level subject deals with ‘special needs’ mathematics.

Teaching Practice

Primary preservice teachers undertake 2 weeks of practicum in first year, 5 weeks in second year, 5 weeks in third year, and 7 weeks in fourth year.

School/Industry Links

Students go to schools for observations as part of their education subjects, including mathematics and science subjects. In their final year they tutor a child in either reading or mathematics remediation and prepare a report.

Things We Like

The graduates are high quality and flexible with a sound background in science and mathematics.

Innovations

Content of the primary science and mathematics are kept as practical as possible and uses an array of ‘everyday’ materials (such as bottles, balloons, toys, string etc) in addition to the more conventional science materials.

Challenges

Again the major problem relates to funding constraints.

Cedric Greive

Program Description D4

CHARLES STURT UNIVERSITY

BACHELOR OF EDUCATION (PRIMARY)

This is a 4-year program, which has been running for 3 years in its revised form. There are about 70-100 students in each year. There are 32 subjects in the program, comprising compulsory education studies (which comprise one third of the program), curriculum studies (which cover the key learning areas), two electives (which can be in other faculties) and practicum. Each KLA has 2 subjects except Mathematics and English which have 3.

Content/Discipline Studies

There is a numeracy subject which focuses on mathematics content, and the use of social constructivist methods. It is also designed to change their attitudes to mathematics by making it relevant to real life. This subject has a community assignment in which they develop skills with data software, then collect data in the community and present it as a research report (e.g. comparing costs in different supermarkets). There is also an open-ended investigation which is recorded in a journal. The subject is intended to be confronting - students look at their whole conception of mathematics from a fresh perspective. In the workshops there are...
sessions on both mathematical software and mathematics in society. There is very positive feedback from students.

Curriculum Method Studies
Most of the mathematics and science subjects are a combination of content and methods. There are 3 mathematics curriculum subjects, which cover K-2, Primary, and Problem Solving/Assessment respectively. There are two science and technology curriculum subjects. Each is presented as 4 h/wk of face to face (e.g. a workshop and lectures). Lecturers model appropriate pedagogy for primary science and technology.

Teaching Practice
There are 105 days of practicum, comprising 3 weeks in year 1 (10 half-day visits in semester 2 to get an overview of the school, followed by a 2-week block at the end of the year), 3 weeks in year 2, 5 weeks in year 3, and a 10-week internship in term 2 of year 4. The classroom teacher is only present during the first two weeks of the internship.

In the Year 3 mathematics method subject the students work with children in schools (1:1 or small groups). The science and technology program sometimes includes science days in schools.

Things We Like
It has a good internship – students are very competent by the time they finish. There is promotion of integration across the KLAs. There is a Teacher as Researcher project in which they carry out a research project.

There are two subjects for science and technology rather than just one. Information technology is integrated across the whole program, so it leaves room for wider aspects of technology to be covered in the methods subjects (e.g. the built environment etc).

Innovations
There are two designated technology subjects - there is a computer based subject in first year which is skill based and another in year 4 which relates information technology to each KLA. These help prepare students for teaching in rural areas (e.g. Electronic Classroom is an on-line program for isolated children, plus several subjects have on-line forums).

The Teacher as Researcher project is innovative.

Some of the students go to work in Victoria, so the Victorian requirements are considered in the program.

The numeracy discipline subject (above) is innovative.

Challenges
Practicum is expensive (ie. paying teachers, plus travelling long distances for supervision in places such as Broken Hill and Cobar).

Students have weak content knowledge in science and technology when they come into the program, so the subjects need content plus methods, which reduces time for the methods component.
Other Programs

The Bachelor of Social Science (Psychology)/Bachelor of Teaching (Primary) is a 4-year program in its third year of operation and has about 30 students per year. The majority of the students are intending to be school counsellors. They do the same science and technology subjects as the students above.

Tom Lowrie, Will Letts, Bob Dengate

Program Description D5

CHARLES STURT UNIVERSITY

BACHELOR OF PRIMARY EDUCATION STUDIES

This is a one-year, end-on program, which has been running since about 1995. There are about 150 students each year. There is an internal program (10 students) and an external program (140 students). The course can be completed externally over one or two years. There are 64 credit points, comprising education subjects (most of which are key learning area studies) and practica. Students normally do four subjects each semester. All subjects are Education offerings.

Content/Discipline Studies

Admission requires a prior bachelor’s degree (or equivalent) in approved subject areas.

Curriculum Method Studies

The students must complete 5 out of the 6 curriculum subject areas. English, Mathematics and Science/Technology are compulsory. The remaining two choices are between Creative and Practical Arts, Human Society and Its Environment and Movement and Health in the Primary school.

The curriculum subjects are a combination of content and methods. There is one subject for science (optional) and one for mathematics (compulsory). The science and technology subject is equivalent to 3 hours per week face to face. Students must complete the English and mathematics subjects before they go out on practicum.

Teaching Practice

There is one practicum in semester 1 and one in semester 2. Each is 4 weeks in length. Students are encouraged to take their second practicum in alternative locations such as rural areas or inner city areas. Students who wish to teach in Victoria may do 9 weeks of practicum.

School/Industry Links

In practicum 2 the internal students visit local special education schools. The internal students have run a Streamwatch program with a local school.
Clever Teachers, Clever Sciences

Things We Like

It gives people with a degree a chance to change their career path. Some students have been lawyers and even merchant bankers and have a lot to offer as teachers.

Innovations

All the subjects are listed on-line and there are chat sessions and forums for each subject. There is on-line feedback that everyone has access to. There is a continuum of on-line usage from fully on-line to just on-line support, which supports the distance reading materials that every student gets.

Challenges

The equity of access with computers is a challenge. Some students are less computer literate than others, and a problem with distance learning is the lack of other people to talk to about it. That’s why the forum is so popular.

Peter Wilson

Program Description D6

MACQUARIE UNIVERSITY

BACHELOR OF ARTS DIPLOMA OF EDUCATION

This is a 4-year program, which has been running for many years. There are 100-150 students in each year. There are 92 credit points of which 24 are in the School Of Education and comprise the DipEd (the DipEd subjects include general education subjects and Teacher Education Program subjects). The other 68 credit points are either inside or outside the School of Education (about 90 per cent of students do a major in education, but some do sociology or psychology; few of them would choose science discipline subjects). The BA part of the program predominates during the first two years.

Content/Discipline Studies

Students must choose 2 science discipline subjects (a total of 5 credit points), which are chosen from the introductory courses for people who may not have done science at HSC level (these are in biology, earth science, geography, chemistry and physics). Students also have to do a mathematics discipline subject (most of them choose the introductory mathematics course ‘A View of Mathematics’). These are general offerings of the science faculty.

Curriculum Method Studies

There is a compulsory mathematics curriculum subject (‘Mathematics in Schools’) which is taught by Education staff (3cp, presented as 3 h/wk face to face for a semester).

There are 4 large ‘Curriculum and Teaching in the Primary School’ subjects which contain strands for each of the key learning areas. There are 5 sessions in each unit for mathematics and 3 sessions in each for science and technology (ie. 12 science workshops, which roughly equates to one whole subject). These strands focus
mainly on pedagogy. For example, the science and technology component begins
by focussing on the syllabus, then specific topics areas and teaching strategies are
covered, followed by more general aspects of programming and assessment.
Examples of activities include a scavenger hunt through the syllabus, discovery
learning strategies on the theme ‘animals’ (students have a lecture then they look at
a selection of examples of real living things and make up a worksheet for guided
discovery learning about one animal), misconceptions and activities on the themes
of magnetism and electricity, earth and space activities using the interactive teaching
approach, and planning lessons from published activities. Other topics include fair
testing, investigating, stages in science learning, and evaluating the scientific
integrity of resources. Interactive discussion is used to help students examine their
own understandings of concepts to identify areas they need to research (this
process includes study of children’s work samples, research findings, problems and
research strategies, and background information on concepts). The students are
often initially tentative about teaching S&T so confidence boosting is required, and
motivational activities are used to increase their interest in science.

There is an environmental education subject, which is a mixture of content and
pedagogy.

Teaching Practice

There is a total of 50 days in schools: 5 days in semester 1 of year 3, 5 days in
semester 2 of year 3, 20 days in semester 1 of year 4 and 20 days in semester 2 of
year 4. Practica comprise block times that are held during university vacations to
avoid clashes with other studies and in Year 4 students must attend schools on one
day every week during the university semester. Students must teach a minimum of 4
lessons from each KLA during practicum.

School/Industry Links

The students have been working with a Japanese company on the use of calculators
in schools.

Things We Like/Innovations

It is a flexible program. The students can use their BA in other fields and do not
necessarily have to go into teaching (e.g. if they have a major in psychology they can
go into school counselling).

The program has a practical, hands-on approach to teaching through the Teacher
Education Program subjects. For example, the science and technology workshop
activities are relevant to the classroom, and the lecturer models good practice (and
has developed resources of ideas for hands-on activities which are directly related to
the syllabus, relevant to children of different stages of development and based on
accessible everyday resources as well as modern technology). Many of the students
say their attitudes have changed in science and they are keen to teach it.

Challenges

Science and technology need a higher profile in primary schools – they are
overshadowed by English and Mathematics, and HSIE is often given greater
priority on the basis that it is perceived as content based, whereas science is
perceived as skills based. Science is often taught by RFF staff and the quality varies
greatly (we are working with schools to enhance their primary science and
technology). We are in the process of looking to incorporate more practicum into the program.

Other Programs

There is a 2-year, graduate Bachelor of Education (Primary) which has about 35 students in each year. This program is virtually identical to the DipEd component of the program above (the mathematics and science units are exactly the same and students are in the same classes with the undergraduates).

John Farrell, Chris Preston

Program Description D7

SOUTHERN CROSS UNIVERSITY

BACHELOR OF EDUCATION (PRIMARY)

This is a 4-year program which has been running for 5-6 years (and is being revised for next year). There are about 100 students in each year. Students do 32 units of general education subjects, curriculum subjects, practicum, and electives.

Content/Discipline Studies

Students are able to do 4 elective units from either education or other disciplines, but students have not chosen mathematics or science discipline subjects.

Curriculum Method Studies

There are 2 core units in science and technology (each is 4 h/wk for 13 weeks, and is one quarter of a semester load). The first subject covers the process and some of the content strands in the NSW syllabus, and focuses on common alternative conceptions in the main content areas and suitable pedagogies to address these conceptions (e.g. students write a journal which contains references to their own growth in understanding of science content). The second subject covers the other strands and focuses on topics such as teaching strategies, assessment and information technology.

There are 2 mathematics units which integrate content and pedagogy. The first focuses mainly on number, while the second focuses on fractions and decimals, geometry, assessment and working mathematically. There are set texts and books of readings taken from recent articles in mathematics teaching journals. Students’ professional journals and tutorial presentations draw substantially from these sources (including the designing of learning activities). Short mathematics quizzes are widely used. Student evaluations have been quite positive.

Teaching Practice

In years 1-3 there are a 3-week block practica and one day per week for several weeks. In year 4 students spend one day in schools most weeks in both semesters leading up to a 4-week block in semester 2.
School/Industry Links

In year 4 the students must teach a series of 3 linked constructivist-oriented lessons in science and technology (S&T) in their practicum school. This is to ensure that all students have taught S&T lessons before they graduate. Students study the use of informal learning centres such as interactive science centres, museums and zoos, and are required to make presentations about specific destinations which they have researched.

The mathematics units use resources from new DET initiatives (e.g. students work with children to learn to use assessment schedules from the ‘Count-me-in-too’ program). There is a lot of community involvement in the elective Environmental Education unit.

Things We Like

The program has a very strong emphasis on the curriculum studies units (12 units out of 32 are curriculum units) and each KLA has at least two compulsory units. There is a strong emphasis on practicum, and practicum/professional studies has unit status (8 units, rather than being added on).

Innovations

The new program to be introduced next year contains innovative units (e.g. issues in literacy and numeracy, professional identity and values, a final year double internship unit including an action research project, and a unit on local geographical and historical content and processes but set within a global context, called ‘Think Globally Teach Locally’). Some students also form buddy relationships with visiting students from Hong Kong to give them a wider perspective on educational experiences.

Students are encouraged to write articles for the National Primary S&T journal ‘Investigating’ and 7 students have recently had articles published or accepted for publication.

Challenges

There are a lot of content areas that primary teachers must teach and a number of other issues they must be aware of, so the program is becoming very crowded. Some units have been included to satisfy departmental requirements or policies, but students should also be educated for other education systems. There is a need to give students a broader perspective than just for one state in Australia.

More and more part-time staff are teaching in the program and this sometimes impacts on the quality of the program (it may be difficult to get quality part time staff in a range of units in the program and full time staff are spread thinly) and this is exacerbated by the highest student:staff ratios in the university. The mathematics abilities of the students vary widely and the challenge is to address this in the two mathematics units available.

Other Programs

Graduates can gain entry to the Bachelor of Education (Primary) degree and obtain two years advanced standing in the program. It attracts about 10 students each year. There are two mathematics subjects and one S&T subject. The students are mixed together with the students in the four-year program in the same subjects.

Keith Skamp, Bob Wright
UNIVERSITY OF NEW ENGLAND

BACHELOR OF EDUCATION (PRIMARY)

This is a 4-year program that began in 1998. There are between 100 and 200 students in each year. There are 192 credit points, comprising curriculum units, professional units and electives. All subjects are Education offerings.

Content/Discipline Studies

Students do 7 elective units, which are general offerings of any faculty, but not many choose mathematics or science.

The ‘Foundation Studies’ subject in year 1 has a basic mathematics component, which is presented on-line as a hurdle requirement.

Curriculum Method Studies

In first year there is a curriculum studies subject that integrates science and mathematics (it makes up one quarter of the first year). It contains some content, but the emphasis is on pedagogy.

There is a second year ‘Environmental Science’ subject (which makes up 1/8 of year 2). In year 3 there is an integrated English and mathematics subject that concentrates on programming (one quarter of year 3) and students develop an integrated unit which they teach in their semester 2 practicum.

Students are also able to choose elective subjects - there is an ‘Environmental Education’ elective and a ‘Mathematical Investigations’ elective (see below).

Teaching Practice

In year 1 there are 5 dispersed days in schools followed by a 2-week block in semester 2. In second year there is a 3-week block in July. In third year there is a 2-week block followed by a 4-week block. In year 4 there is a 10-week internship in semester 2, which is linked to an action research project.

School/Industry Links

Some elective subjects involve students tutoring reading in schools, and some students do voluntary work in schools. There used to be links to the wine industry.

Things We Like

There is a close link between the theory subjects and the practicum. During year 3 students plan a program using the 2-week block practicum then teach it during the 4-week block. This is an advantage of having full year subjects.

Innovations

The integrated nature of the program involves consultation with staff in different subjects to ensure that content is covered but not repeated.

The 'Environmental Science' subject is unusual. It serves as a vehicle for a practical example of integration. Other learning areas are linked to the Environmental
Education Policy (e.g. on an excursion, students do sketching, creative writing and science). It is popular with students.

The ‘Mathematical Investigations for Teachers’ elective emphasises problem solving activities and the role that computers can play in mathematics (getting away from using a mathematics textbook).

The ‘Environmental Education’ elective takes students on an extended coach trip to northern and central Australia. About 15-20 students go and they pay extra for it. Students from US universities also go. It creates an awareness of aspects of Australia that may be incorporated into teaching (e.g. historical, indigenous, scientific aspects).

Challenges
It is difficult to develop integrated units as staff are traditionally most comfortable in their discipline areas. We would like to see more mathematics in the program.

Bruce Cameron, Garry Clark

Program Description D9

UNIVERSITY OF NEW ENGLAND

BACHELOR OF TEACHING (PRIMARY)

This is a 2-year program, which has been running for about 2 years. There are about 12 internal students and about 85 external students in each of the stages (years). There are 96 credit points, comprising introductory education units, foundations studies units, curriculum and practicum units, and education electives.

Content/Discipline Studies
Admission requires a relevant degree or 3-year diploma or equivalent.

Curriculum Method Studies
There is one mathematics subject (‘Curriculum Studies Mathematics K-6’) and one science subject (‘Primary Science and Technology Education’). Each subject is 6 credit points, presented as 2 h/wk of workshops for the whole year. Both units are Education offerings and are a combination of content and methods.

Teaching Practice
In Year 1 students have 5 dispersed days in schools (these are linked to their mathematics workshops, for example, by interviewing children about mathematics) and a 3-week block. In Year 2 there are two 20-day blocks.

Things We Like/Innovations
The hands-on practical workshops get a lot of good feedback from students (these are supported by appropriate videos about manipulatives, calculators etc).

Students are able to overcome their fear and dislike of mathematics. They learn what it is to think mathematically.
Challenges

Coping with the increasing numbers of external students is an issue and more staff are needed across all the BT specialisations.

Distance Education

This program is also offered externally over 4 years. External students have a compulsory residential school including 3-5 days of intensive workshops (these includes mathematics in year 1 and science and technology in year 2) plus study guides and resource booklets. The students are typically mature age people who want to retrain.

Other Programs

The Bachelor of General Studies/Bachelor of Teaching (Primary Teaching) is a 4-year program but is mainly offered externally. Currently there are over 450 enrolment in this program. There are 192 credit points, of which half are discipline studies and half are education studies. The discipline studies include a major (units to year 3 level) and a minor (units to year 2 level) in other faculties (including the Faculty of the Sciences). They also must do some subjects in some of the other KLA areas (but mathematics and English are compulsory). The mathematics method subject in year 3 is 6cp. Along with the primary science and technology subject (6cp), they are shared with students in other programs. This program offers students the opportunity to become primary science and technology specialists if they so choose their majors, minors and electives.

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**Program Description D10**

**UNIVERSITY OF NEWCASTLE**

**BACHELOR OF TEACHING/BACHELOR OF ARTS (PRIMARY)**

This is a 4-year program, which has been running for 2 years in its revised form. There are 200-250 students in each year.

**Content/Discipline Studies**

There is a compulsory mathematics content subject ‘Elementary Mathematics’ which is an offering of the Faculty of Science and Mathematics. It is specifically designed for primary education students, and is presented as 4 h/wk for one semester (2 hours of lectures and 2 hours of tutorial).

There is a compulsory ‘Foundations in science and Technology’ subject which is a science faculty offering, and is specifically designed for these students. It is presented as 5 h/wk face to face. It focuses on the main strands in the NSW Science and Technology K-6 syllabus and provides content knowledge for this syllabus. It contains a diverse range of learning activities which provide a good balance between theoretical and practical components. Computing is also included.

Students have the opportunity to do 2 mathematics subjects or 6 science subjects as an extended study. These build on the compulsory core subjects. There is a specific menu of subjects for science and another for mathematics. All are science faculty
offerings. The mathematics subjects have been specifically designed for these students and employ problems solving approaches with a primary focus. There are 20-30 students in each mathematics subject. One of the science subjects has about 30 students, but numbers in the others are not available yet.

Curriculum Method Studies

There is a mathematics method subject which builds on the content knowledge and looks at applications and syllabus directions (one semester). There is a half subject in science and technology, which emphasises hands-on activities using everyday materials. Many primary students initially have negative attitudes towards science and technology, so one of the main aims of this subject is attitude change.

In each of the curriculum methods subjects there is a fieldwork component. For example, there is a program called ‘Mathematics Buddies’ in which students go to local primary schools and work with students (6 visits).

There is a year 4 subject called ‘Literacies Across the Curriculum’, which looks at the multi-literacies of the primary context. Students link subjects such as mathematics and science and bring the curriculum together in a holistic way.

Teaching Practice

There are 18 weeks of formal practicum. There are blocks at the end of first and second semester in second year, at the end of first semester of third year, and there is a 10-week internship at the end of fourth year.

All of the core education subjects have in-built fieldwork components, so students are in a range of schools every year of their degree. Clashes with discipline subjects are avoided by having blocks during exam periods (students do their exams during the first week by negotiation, then do practicum in the second and third weeks). The practicum blocks in second year are structured so that students can develop their own skills, but they also have the opportunity to observe children’s development across the year. There are no non-education subjects during the third year and fourth year practicum semesters.

School/Industry Links

There are in-school experiences included in the first year core education subjects. Students visit the demonstration school and study how children learn, lesson preparation, and what teachers do in the classroom. There are also in-built fieldwork components in each of the curriculum subjects. For example, during first semester of second year, students do a ‘Reading Buddies’ program in which they are in schools for 10 weeks and are attached to an individual learner to support their reading development. In the second semester of second year students are in schools in the Mathematics Buddy program for six weekly visits working with a small group of students, identifying, planning, teaching and assessing needs in mathematics. In fourth year students will work with children in non-school sites (this is coordinated with the social work faculty).

As part of their science and technology component, students visit a hands-on science centre to study its use as an excursion destination, work with children developing websites and implement recycling programs in schools.
Things We Like

The program provides students with core knowledge and skills, but at the same time it offers them scope for specialisation and further development of their interests. There is a solid amount of fieldwork throughout the four years, and we make sure that students have experiences in a wide range of educational contexts (and wider contexts in society in fourth year).

Innovations

The buddy programs are innovative. The learning area extended study menus are structured so they are based around the mandatory learning areas, but also offer opportunities for students to specialise. The internship is also relatively innovative in its duration, its expectations, and the status which the students have. The fourth year subject 'School Community and Family Contexts' will have links between education and social work, so students can focus on teachers’ broader roles in schools. There are good partnerships with schools, and students have experiences in a broad range of schools. The cross faculty links involve collaboration and shared planning with several other faculties (the program is linked to virtually every other faculty at the university).

Challenges

The large number of students makes it difficult to get to know all of them (but the compulsory year in first year helps students to form support structures, which counteracts this by allowing them to form peer networks). Semesterisation of subjects puts some constraints on students who wish to fast track or slow track through the program.

Other Programs

There is a one-year, end on Diploma in Education (Primary) which has 30-60 students. This is an intensive program, which does not contain separate discipline content subjects or electives.

Julie McLeod

Program Description D11

UNIVERSITY OF SYDNEY

BACHELOR OF EDUCATION (PRIMARY EDUCATION)

This is a 4-year program, which has been running for many years. There are 100-150 students in each year. In each year, students do some education subjects and some elective subjects in other faculties. Fourth year is normally all education subjects.

Content/Discipline Studies

There is a ‘Science Foundations’ subject in year 1, which was introduced in 1995 to improve the science content knowledge of the students. The subject is offered by the Faculty of Science, and lectures and laboratory sessions are done in physics,
chemistry, biology and geology (presented as 2 h/wk of lectures, 2 h/wk of tutorial and 2 h/wk of laboratory). In response to student feedback the subject is being changed and from next year the science lectures will be maintained but the workshops will be presented by the Faculty of Education and will focus on children’s understandings of science and hands-on activities appropriate for primary.

Students also choose a sequence of subjects from another faculty (e.g. arts, science or economics) up to year 3 level. Those who choose science subjects almost always do psychology subjects, but some do biology. Most students choose humanities.

HSC mathematics is a prerequisite for entry to this program.

Curriculum Method Studies
There are mathematics method subjects in years 2, 3 and 4 (each is 2 h/wk face to face for 10 weeks).

There are 3 science and technology method subjects - one in each of years 2, 3 and 4. Each of these 3 subjects takes 2 of the content strands from the syllabus (there are 6 strands) and also has a broader focus (e.g. constructivist models of learning, integration, and science/technology perspectives on cross-curriculum policies and issues).

Teaching Practice
In year 2 there are 8 days in schools, one day per week, just before and after Easter (students try to have one day per week free from university classes to allow this). In year 3 there is a 12-day practicum near the end of semester 1 and another 12 days in October near the end of semester 2 (to minimise clashes with discipline studies). In year 4 there are 15 days in schools in late May and 13 days in late October.

School/Industry Links
In mathematics, students are required to do 1:1 teaching in schools. Education staff from the NSW Minerals Council take a hands-on workshop in one of the science method subjects (students enjoy these).

Things We Like
The science foundations unit aims to change attitudes towards science. There is a focus on workshop activities in science and technology method subjects (there are no lectures).

Innovations
The cross-faculty ‘Science Foundations’ subject is innovative because it is a specially developed science unit, which is common to a range of other programs (e.g. PE, D&T).

Challenges
The students initially have an aversion to science, so attitude change is necessary.

Other Programs
There are about 70 students in each of the 2 years of the Master of Teaching (Primary), which is an end-on program for graduate students. There is more emphasis on problem solving and cooperative learning. They do method subjects in each of the
learning areas but there is less time than in the undergraduate program (a 6-week period in year 1 and a 6-week period in year 2 presented as 2 h/wk face to face). In year 1 there is an excursions week just before Easter, in which students can attend excursions in different specialisations (e.g. science at the Royal Botanic Gardens).

Mike Gunnourie, Armstrong Osborne

Program Description D12

UNIVERSITY OF TECHNOLOGY SYDNEY

BACHELOR OF EDUCATION IN PRIMARY EDUCATION

This is a 4-year program, which has been running for about 5 years in its present form. There are about 150 students in each year. There are learning area subjects, general education subjects and practica in each year. Students can select one learning area in which they want to major and they do 4 extra subjects in that area.

Content/Discipline Studies

Students can choose a major study in mathematics or science and technology (these subjects are Education offerings). The science and technology subjects focus on multidisciplinary themes (e.g. the human body subject incorporates biophysics aspects) to emphasise the relationship between different science disciplines (20-30 students choose the science strand and less choose mathematics).

Curriculum Method Studies

There are 2 compulsory science and technology subjects which combine content and methods (both are Education offerings of 3 h/wk face to face). They each cover some of the content strands from the syllabus. They focus on constructivist, student-centred approaches to learning, and lecturers model this approach in their own teaching.

There are 3 compulsory mathematics subjects, and each focuses on different topics from the syllabus.

Teaching Practice

There are 8 practica, one in each semester, for a total of 22 weeks. Practicum 1 comprises days in schools interspersed with days on campus. Practicum 2 is a 3-week block. Practicum 3 is 3 weeks in a non-school setting. Practica 4, 5 and 6 are 3-week blocks in schools. At the end of practicum 7 students receive provisional accreditation as a teacher, and practicum 8 is an internship of 5 weeks. During each practicum there are days when the students come back to university to discuss their experiences. Each practicum also has tutorials on campus.

School/Industry Links

Several of the subjects involve students in in-school experiences (e.g. in one of the science and technology subjects they are in a school or other educational setting for 2 h/wk for the whole semester). Students go to informal learning centres (e.g.
museums, sports centres) as part of practicum 3. Students go to schools to mentor children who are having difficulties in mathematics.

Things We Like/Innovations

The amount of practicum and the strong relationship between practicum and university are strengths. There is increasing amount of immersion in schools apart from practicum. There are good partnerships with schools - teachers come in to give lectures, or they give demonstration lessons in schools, and university staff provide professional development in schools.

The major sequence allows students to graduate with a strength in one of the learning areas, which would prepare them to coordinate that subject in their school. There are at least two subjects in each learning area, so they get a good grasp of each.

Challenges

It is difficult to support this much practicum, and the amount of in-school practicum has been reduced.

DET requirements for compulsory inclusions in the curriculum (e.g. special education, aboriginal education) have the effect of squeezing the other content in the program (but these things should be included).

Janette Griffin

Program Description D13

UNIVERSITY OF WESTERN SYDNEY

BACHELOR OF EDUCATION – PRIMARY EDUCATION

This is a 4-year program, which has been running for about 3 years. Students can exit after 3 years with a BTeach, and most students do this, then finish the 4th year part time. There are on average 200 students per year at the Penrith campus, but this number will decrease to about 150 students from this year onwards. There are 320 credit points comprising general education subjects, learning area choices and electives in each year. Students do at least one semester in each of the 6 learning areas. Some of the electives are further work in the learning areas and others are general education electives (all are Education offerings).

Content/Discipline Studies, Curriculum Method Studies

The science and technology subject (10 credit points presented as 3 h/wk face to face) integrates content, methods and the syllabus. The science and technology elective subject can extend into other content strands in the syllabus.

There are 2½ compulsory mathematics subjects. In first year there is an 'Introduction to Literacy and Numeracy' in which the mathematics component focuses on content and develops students' awareness of their own numeracy development. The second subject focuses on early mathematical thinking (the 0-8
age range) and focuses on pedagogy. The third subject focuses on the 8-12 years age range with an emphasis on pedagogy.

There are 4 mathematics electives (student numbers in these subjects fluctuate greatly from year to year). These cover mathematics and technology, cultural contexts for teaching mathematics, mathematics investigations, and further mathematics content for students who need it.

Teaching Practice

In year 1 students go to schools one day per week for 3 weeks plus a 2-week block (orientation, then teaching). In year 2 there is a 4-week block with 4-5 lead up days and the same in year 3. In year 4 students may choose an internship (which puts them in schools for 10 weeks of semester 2) but as most of the students are part-time and already teaching in schools, there is no compulsory practicum (the year 4 students also do an action research project which may focus on science or mathematics).

School/Industry Links

In past years students have taught a gifted and talented program at a local school.

Innovations

The program demystifies science and creates positive attitudes towards science and technology. Students like science and technology by the time they finish the course (through the modelling of interesting, motivating approaches to science). For example, the students construct a model house in groups (it has to contain 3 electrical components with appropriate safety considered). This project integrates science and technology, and is hands-on and the students love it. Student comments are very positive – increasing the chance that they will teach it in schools after they graduate.

We build their confidence and attitudes towards mathematics and towards teaching mathematics. We achieve this through very hands-on workshops.

Challenges

Lack of time is an issue because there is a lot of material to get through for science and technology. The original intention was to have a school-based component in the mathematics subjects, but because of large enrolments, this is not possible. The integration of more computing into tutorials is also an issue.

Other Programs

The Graduate Diploma of Education – Primary Education is a one-year, end on program, which has about 100 students. The mathematics method subjects are more compressed than in the 4-year program. There is a compulsory science and technology subject, which is very similar to the one above. There are about 45 days of practicum.

The Bachelor of Education – Early Childhood has about 100 students in each year, many of whom will become teachers in primary schools. Each year, the students run mathematics and science fairs in local infants schools. They select activities, prepare a newsletter, liaise with teachers and parents, videotape the event and report it in a portfolio. The program integrates ICT heavily into the mathematics program (e.g. students are required to set up mathematics and science computer activities for
children in schools and home environments). The mathematics and science subjects are school-based and all practical work is completed in school settings, involving teachers, children and portfolio assessment. The students also run a mathematics carnival in a big primary school in western Sydney. It is a huge fair involving 300 children in mathematics activities, which are videotaped and reported via portfolios. It is very popular with the school.

Kevin Watson, Jenny Way, Alison Elliott

Program Description D14

UNIVERSITY OF WOLLONGONG

BACHELOR OF TEACHING/BACHELOR OF EDUCATION IN PRIMARY EDUCATION

This is a 4-year program, which has been running for 4 years in its present form. There are about 170 students in each year. In each year students do some general education subjects and some electives. Two of the electives (year 1) are from other faculties, but the rest are KLA method subjects offered by Education. It is possible for students to choose 2 science faculty general offerings and a series of 4 science and technology method subjects, but this is not common. Students do the BT over 3 years then the B.Ed. for the 4th year.

Content/Discipline Studies

There is a science and technology subject in year 1 which covers some discipline content as well as the syllabus (presented as 2 h/wk of lectures and 1 h/wk of tutorial) and is presented by the Education staff. There is a similar mathematics subject in year 2. The rest of the mathematics and science offerings are electives (below).

Curriculum Method Studies

More than half the students would choose at least one of the following science and technology subjects. Most contain some content and methods. The first KLA method focuses on school links. Students work in pairs with teachers to develop a 4-week program and teach it in school (so there is content and method involved). This subject is an elective and is popular because of the school link. Elective 2 is about programming and planning. Elective 3 is an investigations subject on an area of content that the students feel they need more work on (e.g. electricity, motion etc). Elective 4 is a design and make subject in which they develop a project and keep an electronic journal. The mathematics KLA electives are based around problem solving related to the syllabus.

Teaching Practice

In first year there is a 2-week block in May. In second year there is a 2-week block in June. In third year there is a 6-week block in September/October. Clashes with the other subjects in first year are avoided by restricting their choices and taking subjects at night. There is no field experience in year 4 because many of the students are already working as teachers.
School/Industry Links

All the students work as explainers at the science centre (located on campus) in year 1 as part of their compulsory science subject. Each student develops an explanation for one of the exhibits. They all also do a field study experience at the field study centre nearby.

Things We Like/Innovations

In the science centre the students learn to work with hands-on exhibits and learn content knowledge. The students have the opportunity to become science and technology specialists in this program. This does happen with some students (6-8 students per year). There are good links to the science centre, the environmental education centre, schools and the science faculty.

Challenges

We would like to increase the compulsory mathematics and science and technology experience in the program, especially the working in schools component. Changing students’ attitudes to science is a challenge.

Other Programs

The Graduate Diploma in Education (Primary) is a one-year, end-on program, which has about 90 students. The mathematics and science preparation is similar to the undergraduate program, but they don’t have the experience in the science centre. There are 9 weeks of practicum. A revised version is being introduced soon. The mathematics and science method lecturers are exemplary teachers and provide a lot of support for the students.

Program Description D15

UNIVERSITY OF WOLLONGONG

KNOWLEDGE BUILDING COMMUNITY (KBC) MENTORING PROGRAM

This is an alternative pathway for students in the BT/B.Ed.(primary), which began in 1999 and has about 75 students in total. It is based on the notion that teachers should be collaborative learners and professional problem solvers. It’s a mentoring program because it uses school teachers as mentors. The program was created at UOW and is a hybrid version of problem based learning. Students enrol in the same compulsory education subjects as the mainstream BT students, but the subjects are presented in a school-based, problem-based mode. They also do the subject ‘Introduction to Problem Based Learning’ instead of the first elective in the BT program. Due to funding restraints, they revert back to mainstream mode in second semester of each year (the opportunity to compare teaching approaches is a valuable learning experience for them).

After 4 weeks on campus, the students start 2 days per week in schools and one day per week on campus (there is some formal instruction) and one day of self-directed learning each week for semester 1. The students interview and observe in schools in
the first year as they work together in groups on their set tasks (students use Web CT to communicate with each other about their in-school experiences). The assessment tasks are devised by the students and are school-based (e.g. How is reading taught in your school?). The marking guidelines are negotiated with the classroom teacher and university staff. There are 4 schools involved in the program. Students observe and assist with a variety of teachers rather than just copying one teacher. The amount of in-school time is about the same as the mainstream students.

The students who have been in the program for 3 years are very supportive of KBC and often offer to help other students and plan the program.

The mathematics education subject runs in semester 1 in year 2 so it is presented in KBC mode (involving practical problem-solving activities, lots of hands-on activities with classroom application and case studies of mathematics in the classroom).

**Things We Like**

The students are empowered by the kind of experiences they have. They have a clear understanding of what teachers do. The subjects are not pigeon holed, but the students see the overlaps between different curriculum areas.

**Innovations**

We’ve been able to replace lectures and tutorials. We’ve shown that you can contextualise the learning/theory/practice. The students have incredible enthusiasm. The school partnerships strengthen the links to the university because each school is visited by university staff each week to keep up the working partnership. The teachers relish the increased responsibility for teacher education as mentors of the students.

**Challenges**

Funding is a problem, because the program runs on a shoestring. Getting a home-room on campus was a coup, but getting other university staff to become involved is difficult. Coordinating the program is a huge job.

*Julie Kiggins*

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**Program Description D16**

**BATCHelor INSTITUTE**

**ADVANCED DIPLOMA OF TEACHING (PRIMARY)**

This is a 3-year program, which was re-accredited 5 years ago. It is a nationally accredited award. There are just over 200 students in total. All the students are indigenous, and the majority are from remote communities in the NT. Most of the students are assistant teachers, who already are working in remote community schools.
Content Studies/Curriculum Method Studies

Students do a one-semester science unit which focuses on teaching methods and includes the idea that science is a social and cultural construct. The unit includes observations of science being taught in classrooms. Students do a science investigation which includes defining a problem, surveying the literature and conducting experiments. They also plan and microteach science lessons which focus on working scientifically. Many of the students have very limited knowledge of western science. They study what science is, both from a western perspective and also from their own perspective in terms of indigenous knowledge, through talk and discussion.

There are two mathematics units. The ‘Teaching Mathematics’ unit involves planning and microteaching mathematics lessons, study of the curriculum documents and frameworks, and looking at mathematics from a cross-cultural perspective. There is a final year unit called ‘Working with Mathematics’ which is part of the internship. There is also another unit called ‘Mathetics’ which looks at world views and how mathematics for example is just one way of looking at the world. They explore the idea that different cultures have different knowledge systems, and mathematical ideas are expressed in those systems in different ways.

These units are taught in two intensive blocks of one week each (e.g. for a mathematics unit there are two one-week workshops). In between the workshops students go back to their communities and work as assistant teachers and do their assignments for their units (this often requires observations of children in the classroom or microteaching or action research). The entire course is taught like this. The teaching is done by people who have a background in teaching in aboriginal schools in remote communities.

Teaching Practice

There are two 15-day blocks in first year, and the same in second year. In the final year there is a 10-week block, which is the internship. The teaching is done in their own communities. Most students do all their practica in their own school but a significant number do practica in various schools.

Students visit other schools as part of their mathematics, science and other units. These experiences in schools beyond their community are very important. Batchelor Institute is located adjacent to a primary school, and the students often go there to microteach etc.

School/Industry Links

The Mathetics unit was co-delivered with UNISA. Teleconferencing was used to link the students to non-indigenous students enrolled in an indigenous studies program at UNISA.

Things We Like

The teacher education program has a history of responding to community needs. It was designed to train teachers for remote communities, without removing students from their communities for long periods. In the early days the staff travelled to the communities to deliver the program.
The Institute has a ‘both ways’ philosophy, which brings together western knowledge and indigenous knowledge (i.e. western science does not have a monopoly on the truth) through all its teaching programs.

Innovations

The mixed mode delivery is responsive to communities. The delivery is a mix of students travelling to intensive workshops (on campus or a regional annex or a community) and then going back to their community and doing assignments and practica in that community. The tasks that are given to students to do as their assignments include time to reflect and think about the implications of knowledge as it applies to their own community context and cultural perspective.

Challenges

Students have little or no secondary education.

Students need to halt their studies from time to time for cultural and family reasons.

The movement of students to and from remote locations (often when there are floods) creates huge logistical problems. Lecturers travel to remote communities between workshops and for practicum supervision, and this often involves many hours of flying or driving time (lecturers are often away for a week at a time).

Other Programs

The early childhood and primary programs are currently being re-accredited as a Bachelor of Teaching and a Bachelor of Education.

Ron Watt, Geri Pancini

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**Program Description D17**

**NORTHERN TERRITORY UNIVERSITY**

**BACHELOR OF TEACHING (PRIMARY)**

This is a 3-year program, which has about 90 students in each year and has produced 3 years of graduates so far. Students must complete 240 credit points. Each subject is worth 10cp (usually presented as 3 h/wk face to face) and all are Education offerings.

Content/Discipline Studies

There is a mathematics content subject in year 1 and a technology content subject (which is half computing and half ‘design, make and appraise’) in year 2.

Curriculum Method Studies

There is a science education subject in year 2, which is a combination of content and method. There is a second mathematics education subject in year 3 which is partly method and partly content. These subjects emphasise the use of hands-on activities.
Teaching Practice

There is a field experience subject in Year 1, which involves one week observing in schools. There is a 4-week practicum in year 2 (many of the students do a design-make-appraise program, which they developed in their technology subject). In year 3, there is a 5-week block followed by a 8-week block (which contains an action research project).

Things We Like

In several of the subjects, students practise peer assessment (ie. assessing each other using a constructed format) to hone their assessment skills. All students do an aboriginal studies unit, a social justice and cultural diversity unit and the unit ‘Language and Culture in Educational Settings’ so they get good input on how to work with students from diverse backgrounds.

Innovations

During practicum, the university staff are facilitators, rather than assessors. There is a collegiate arrangement with the schools in which assessment is carried out by the classroom teachers in consultation with the student and support lecturer. The practicum model has an integrated constructivist approach in which students frame their own learning. The practica take the beginning teacher competencies framework as a base. Students choose competencies to focus on during practicum and drive the learning process themselves. They negotiate their learning with the cooperating teacher. Practicum 2 has an action learning project and Practicum 3 has a group research project which is negotiated with the schools.

Challenges

Professional development support is necessary for classroom teachers to move to the collegiate system of practicum assessment. We would like to include other content in the program (e.g. ESL). We would like more students to take up the option of taking a practicum in Aboriginal community schools. There are 2 compulsory university studies in the program (e.g. ‘Northern Australian Studies’) that are not directly related to teaching.

Other Programs

The Graduate Diploma in Primary Education is an 18-month or 2-year, end-on program which has been operating since 1996. It has 60 students enrolled (75 per cent are external). Although the NT requirement is only one year of teacher education as a minimum, this extended program was set up because students need longer to begin the think in terms of the role of a teacher and the needs of children. Students must pass the mathematics unit in the university bridging program, as a prerequisite for the mathematics component. They do the same methods subjects as the undergraduates. There are three practica (4 weeks in year 1, 5 weeks in semester 1 of year 2 and 4 weeks in semester 2 of year 2) totalling 65 days in schools. As the third practicum is a mini-internship, they come out as fairly polished teachers. This program articulates with a masters program to give a full two years of teacher education, to accommodate students who wish to teach in Queensland (a significant number of students do this). It also provides an opportunity for students to study in special education or ESL.
The Bachelor of Education (Preservice) is a 4-year program which has about 50-80 students in each year and was set up about 3 years ago as an option for students who were in the 3-year (BT) program to go straight through and complete a 4th year. The first 3 years are the BT, and year 4 is mainly electives and an internship of 11 weeks. The electives can be any subjects from the university, but because they often clash with practicum, the students usually choose subjects from Australian Open Learning and other education electives in Special Education and ESL. This program is offered externally as well (which is becoming more popular, even with people in other states).

Mohan Ram, Suzanne Parry, Margo Ford

Program Description D18

NORTHERN TERRITORY UNIVERSITY

BACHELOR OF SCIENCE/BACHELOR OF TEACHING

This is a 4-year program, which has been running for 3 years. There are about 10 students enrolled. This program is designed for both secondary and primary education. Students do 320 credit points of which 150 are education, 80-100 are science faculty offerings, 20 are NTU compulsory units (e.g. ‘Northern Australian Studies’) and the rest are electives from any faculty. The difference between the primary and secondary streams occurs in the education subjects – the primary teaching students do learning areas subjects while the secondary students do secondary method subjects. Students are required to complete their science discipline studies in the first three semesters. From semester 4 onwards, the students do their electives, education and compulsory subjects.

Content/Discipline Studies

Students do a major in science (e.g. biology, chemistry, mathematics) with at least 40cp at level 3, and they must also complete a minor in a second teaching specialisation. These are general B.Sc. offerings from a selected list.

Curriculum Method Studies

Primary teaching students do primary methods subjects in mathematics, science, technology and the other learning areas (the same subjects as in the other primary programs).

Secondary teaching students typically study two methods subjects in their major and one method subject in their minor (each is 10 credit points presented as 3 h/wk face to face).

Teaching Practice

The primary students have a 20-day block, then a 25-day block, then a 36-day block. These may be done at any time but not before semester 4.

The secondary teaching students have a 25-day block, a 30-day block and a 25-day block. These may be done at any time but not before semester 4. Students often
Clever Teachers, Clever Sciences

choose to do ATET (Adult Teacher Education and Training) distance subjects as electives, so they don’t interfere with practicum.

Literacy and Numeracy

The science method courses include elements of literacy and numeracy. Given the fairly extensive literacy problems in early secondary schools. These people who have primary literacy training could be teaching science (and using science to teach literacy), which is a strength of this program.

School/Industry Links

On occasion, a representative from the Minerals Council comes to talk to the students.

Things We Like/Innovations

Primary education students can do a major in science. It gives students flexibility and students can follow their interest in science. It gives them skills that are not normally available in primary schools (in a wide range of science-related subjects). It is hoped that graduates from this program can change the science situation in primary schools.

The teaching practice subjects contain a good balance of theory and practice. The science method subjects contain an information technology component. Students are able to use ‘Blackboard’ to access lecture notes. They are also required to use it to find other sites on the web to find information and to allow comments on each others’ work.

Challenges

Students transferring in from other courses create a challenge. There is pressure on resources, making it more difficult to set up specialised classrooms. Financial pressure makes it more difficult to maintain a comprehensive journal collection in the library, and to employ more than a minimum of one science education specialist.

Other Programs

The one-year, end-on Graduate Diploma in Secondary Education has been operating for about 17 years. It is designed to train teachers for secondary science and mathematics teaching (most graduates will be qualified in both areas). There are currently 13 students enrolled (about half are majoring in science and half in mathematics). They do the same method subjects as the undergraduates. There are 58 days in schools, including a pre-semester subject consisting of a 2-day introduction followed by 3 days in schools (this is designed to help students to make up their minds about whether teaching is for them).

Nola Oliver, Bill Palmer
Program Description D19

CENTRAL QUEENSLAND UNIVERSITY

BACHELOR OF EDUCATION (PRIMARY)

This is a 4-year program although students have a fast track option of 3½ years. There are about 500 students in each year of the program and these are spread across 4 campuses (Rockhampton, Mackay, Gladstone and Bundaberg). It has produced about 4 cohorts of graduates but is now being phased out. Students are required to complete 32 units (each unit is 6 credit points).

Content/Discipline Studies

There is a mathematics content subject and a science content subject which are offered outside of Education and are only for education students.

The program allows students to choose 6 electives in discipline studies. There are electives in mathematics, biological sciences, physical sciences and environmental sciences. These contain a mix of discipline and pedagogy and are taught by Education staff. They are popular with students because they have a good constructivist teaching approach and they are intended to give students more confidence to teach science and mathematics.

Curriculum Method Studies

There are 2 mathematics method subjects (in year 1 and year 3). There is a subject, ‘Science Curriculum and Pedagogy’ in Year 2 and ‘Technology Curriculum and Pedagogy’ in year 4 (which is fully external). Each subject is equivalent to 2 hours/week of face to face for 12 weeks.

Teaching Practice

There are four practica (one in each year) which add up to 80 days in schools. Students complete a further 20 days working with children in an educational setting (e.g. coaching) as a hurdle requirement in their own time.

School/Industry Links

As part of their science method subject, students take a class in teams of two and teach a science unit that fits in with the teacher's program. This is intended to offer students an opportunity to teach science units that they plan (instead of just planning them, as often happens). It was previously done on a larger scale but presently only one group is doing it.

As part of the technology method subject, students plan, teach and evaluate a minimum of 2 lessons. Because this is a distance subject, they have to organise this themselves.

Things We Like

The best graduates are outstanding and have an excellent reputation in schools. CQU has the highest proportion of S1 rated graduates (these are the top-rated graduates after the departmental selection process). Students are well equipped to teach mathematics and science, there is a transformation in their confidence to teach these subjects because of the way it is taught to them.
Innovations

The content and methods are combined/integrated. This has a huge impact. All teaching is constructivist based and classroom oriented.

Challenges

Increasing class sizes interfere with effective teaching. Some campuses have limited facilities for teaching mathematics and science and have to rely extensively on part-time staff.

Other Programs

The Bachelor of Education (Primary) Graduate Program is a three-semester (intensive) or four-semester program, which has produced about 3 or 4 cohorts of graduates. There are about 20 students currently enrolled. Mathematics and science method subjects are shared with students in the undergraduate program. The graduate students are more mature and focused, and work at a better conceptual level compared to the students in the 4-year program. From 2001, the B.Ed. programs are being phased out and replaced with a new suite of Bachelor of Learning Management programs.

Ken Appleton

Program Description D20

CENTRAL QUEENSLAND UNIVERSITY

BACHELOR OF LEARNING MANAGEMENT (PRIMARY & SECONDARY)

The Bachelor of Learning Management is in its first year of operation. It is a 4-year program, but it can be fast tracked to 3 years by undertaking extra courses intensively in the Spring Term - a 6-week term in November/December. There are about 550 primary/early childhood students across all campuses and 90 students enrolled in the secondary program (of which 3 students are mathematics/science).

The BLM was developed to complement the Queensland New Basics program. Students do a total of 32 courses (subjects) of which 12 are discipline studies (for the secondary students). These are done during the first 2 years. In the education component, there are 12 core compulsory courses, which all students do. These cover 4 major domains: pedagogy (KLAs), futures (looking at the trends of today to plan strategies for dealing with issues and needs in schools of the future), networks and partnerships (which covers support networks for teachers, students and parents) and professional knowledge (general teaching strategies).

Content/Discipline Studies

The primary students can elect an optional mathematics/science discipline strand comprising 2 mathematics and 2 science subjects which present content knowledge for schools. These are Education offerings.

The secondary students do 6 courses in each of two teaching areas (e.g. chemistry and physics). These are faculty of science general offerings.
Curriculum Method Studies

Secondary students do 2 curriculum subjects for each of their teaching areas. The first focuses on years 8-10, and the second focuses on 11-12 (each is 3 h/wk face to face, presented as a lecture and a tutorial).

Teaching Practice

The primary students have 130 days in schools. During Term 1 they teach 2 h/wk each week with primary students. In Term 2 they are in schools one day per week doing tasks related to their professional knowledge strand, and another 15-25 hours which each student spends with a Learning Manager (experienced teacher) discussing issues related to each individual student’s needs. In year 2 there is a 3-week block in Term 1 and a 3-week block in Term 2, plus 30 hours with a Learning Manager. In third year there is a 4-week block and a 10-week internship.

The secondary students have 100 days in schools. There are 10 one-day visits in Term 2 of first year. In year 2 there are 10 days per Term (there is no block practicum because of their commitments with other faculties – the actual days are negotiated with the teachers). In year 3 there are 3 weeks in February, 10 days during first term, and 10 weeks in Term 2.

Literacy and Numeracy

The secondary students do the subject 'Teaching Curriculum Literacies' which covers literacy and numeracy.

School/Industry Links

The secondary students are involved in the Mathematics Challenge for primary and secondary schools (judging and helping to run it). There is an on-line mathematics club which students participate in and assist with.

Things We Like

It will get students into schools to a greater extent than other programs, so students will have more continuity in their in-school experiences. Co-operating teachers are designated as Learning Managers to help students to work through particular difficulties, and they have input into the structure of the program.

Innovations

There are strong partnerships with the teachers and educational bodies who put the program together. The program has a modular approach in which a lot of the educational psychology (for example) occurs across about 5 subjects now instead of just one. Subjects such as Learning Management are presented as a series of tutorials and each lecturer takes all the tutorials for one week of their particular topic (so students have a different tutor each week). All the university lecturers will be required to attend schools every week.

Challenges

The workload for the lecturers is continuous because it is an intensive program. There is very little time off from teaching. Trying to create a new program of high quality and to get it running is a challenge.

*Pat Moran*
Clever Teachers, Clever Sciences

Program Description D21

GRIFFITH UNIVERSITY

BACHELOR OF EDUCATION - PRIMARY

This is a 4-year program, which has been running for about 5 years in its present form. There are over 400 students in each year spread across three campuses (Mt Gravatt, Logan and Gold Coast). There are 320 credit points, which are all Education offerings.

Content/Discipline Studies, Curriculum Method Studies

The curriculum subjects integrate content and pedagogy. There are two science subjects (each is 10cp, presented as 2 h/w of lecture, 1 h/wk of lab and 1 h/wk of unsupervised workshop activities) and three mathematics subjects. The first science education subject focuses on the syllabus topics, matter and energy; the nature of science, and environmental issues. In the second subject the focus is on life, earth science and astronomy; plus the new syllabus and other curriculum materials. The mathematics education subjects focus on number, other content strands of the curriculum, and issues in mathematics education, respectively.

Teaching Practice

Students do 100 days of teaching experience at Mt Gravatt. During the first 2 years there are 3 practica of 2 weeks each. During years 3 and 4 there are 3 practica of 4 weeks each.

At the Gold Coast campus, students do 133 days of practicum. In semester 2 of first year, there are 5 days of observation, and this is repeated in first semester of year 2. In second semester of year 2 there is a 2-week block. In the first semester of third year there is a 2-week block, and a 4-week block plus 5 school studies days in semester 2. In year 4 there is a 4-week block plus 5 school studies days in first semester, followed by a 33-day internship in the first half of semester 2 (which is timed to coincide with their departmental interviews). Each practicum focuses on the KLA areas that were covered in subjects that semester.

School/Industry Links

Students have excursions to the museum, science centre and the planetarium. The Nathan campus is developing an environmental centre, which will involve the students when it opens. There is a Greenhouse Lab (developed by Jim and a colleague), which is a mobile caravan with displays and activities on solar energy, which goes around to schools. Students work on these activities.

Students at the Gold Coast campus do their technology tutorials in schools, and they teach mathematics lessons in schools as part of their mathematics education subjects (this is to give them an opportunity to try innovative teaching strategies for mathematics, which they might not get to try on practicum). This creates a link between theory and practice.
Things We Like/ Innovations

Students develop positive attitudes towards science (most students come in with negative attitudes) through the program (e.g. by using simple explanations of science concepts).

The internship is a strength. The students know they will get an intensive teaching experience at the end of the program, then they are able to pick up teaching positions in 4th term.

The Greenhouse lab and the emphasis on environmental issues are strengths. There is a theme of educating for a caring environment to help students become aware and proactive in environmental issues. There are 3 web-based modules (e.g. constructing electrical circuits in a virtual setting, plus Greenhouse issues).

The Gold Coast has a teacher education advisory group (which has influenced the program in the past, but not so much at present because the program has to conform to several different campuses). This group provides input into the program as to what should be included. There is also a practicum advisory group and an internship advisory group. These contain people from outside the university, including administrators, exemplary teachers and departmental officers representing state, independent and Catholic schools.

The B.Ed. (primary, graduate entry) program (see below) has school-based components.

Challenges

There are limitations of time when there are only two core subjects in each learning area. Staffing is very tight due to limited funding.

Schools today need to change to adapt to new social conditions, and so do the teacher education programs. The divide between schools and universities makes this more difficult. There are entrenched practices in schools which do not cater for social change.

Other Programs

There is a Bachelor of Education – Primary Graduate Entry program, which can be completed in 18 months and which was introduced this year. It has about 20-25 students at the Gold Coast. It is largely school-based (to address the issue of adequately preparing students for schools). Students do much of their tutorial work and lecture work in schools (which is costly, as it requires extra staff). The science and mathematics subjects contain similar content to those in the 4-year program.

The Bachelor of Arts (Psychology) / Bachelor of Education (Primary) is a program intended to provide students with the both strong teacher and psychology knowledge basis for school councillors and has about 10 students enrolled. The mathematics and science subjects are the same as in the B.Ed.  

Jim Richmond, Robyn Zevenbergen
Program Description D22

JAMES COOK UNIVERSITY

BACHELOR OF EDUCATION - PRIMARY

This is a 4-year program, which has been operating for many years. There are typically 200-400 students in each year. There are 75 units of education studies and 22 units of other discipline studies. During each year of the first three years of the program, the students take 6 subjects of education and 2-3 subjects of discipline studies. The fourth year consists entirely of education subjects.

Content/Discipline Studies

Students who have completed a year 12 science are not required to do any further science discipline. If they have not done year 12 science they are advised to enrol in ‘Basic Science for Primary Teachers’ which is offered by the science faculty and is specifically designed for primary education students. Topic areas in this subject are loosely tied to the primary syllabus.

Mathematics content is covered within the Education subject ‘Numeracy in Education’. Many of these students are quite weak in mathematics and have negative attitudes to mathematics, so the main emphasis is attitude change. They learn that they can do mathematics, by emphasising the fun and challenge in mathematics, using discussion, group work, making models and designs. Each subject is presented as 2 one-hour lectures and a one-hour tutorial per week.

Technology content is covered in the Education subjects ‘Information Technologies in Education’ (year 1) and ‘Technology across the Curriculum’ (year 4).

Curriculum Method Studies

Science teaching method is studied in ‘Primary Science Education’ (year 3). This subject is presented as 2 one-hour lectures and a one-hour workshop each week for one semester, and counts as 3 units.

There are two mathematics method subjects (‘Mathematics Education in Primary School’ and ‘Advanced Language Arts and Mathematics Education’ – this is an extension of the first mathematics subject and is taught as separate strands of mathematics, language and arts). Each subject is 3 units and is presented as 2 h/wk of lectures and 1h/w of tutorial.

Teaching Practice

There are 100 days of field experience. In first year, students visit schools as part requirement for the subjects ‘Introduction to Education’ and ‘Childhood and Adolescence’. There are professional experiences in second, third and fourth years which add up to 80 days of supervised practicum.

Things We Like/Innovations

There is now a separate subject for science education, whereas in previous years science method was combined with PE method and social studies method into one subject.
The ‘Managing Teaching and Learning’ subject focuses on planning and it takes a problem based learning approach which goes from practice to theory rather than theory to practice. They look at practical situations and try to draw out the theory. Students go into schools to collect data that's used as part of the subject. They use all the curriculum areas to illustrate the types of lessons that might be taught.

**Challenges**

High student numbers and limited staffing create a challenge.

Some of the students in the graduate program (below) don’t have strong mathematics backgrounds and they do less mathematics in this program than students in the undergraduate program (who have a numeracy subject as well). Lack of content studies could be a difficulty for some students.

The biggest challenge in the graduate program is to cover all the curriculum areas in two years.

**Other Programs**

There is a 2-year, end-on *Graduate Bachelor of Education – Primary* program, which currently has 36 students enrolled at Townsville and 43 enrolled at Cairns. They do the same curriculum method subjects as the undergraduates. They have 100 days of field experience – in year 1 they do a week of observations in April, then a 3-week block in July. In year 2 there is a 4-week block in January/February, a 3-week block in April/May and another 6 weeks in July/August. The subject ‘Managing Teaching and Learning’ in year 1 requires them to go into schools and provides extra days.

There is a 4-year *Bachelor of Education/Bachelor of Psychology* program, which has about 15-20 students in each year. Students do a major in psychology and the education subjects are the same as the B.Ed. (primary) but in a different order.

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Program Description D23

QUEENSLAND UNIVERSITY OF TECHNOLOGY

**BACHELOR OF EDUCATION (PRESERVICE) PRIMARY**

This is a 4-year program, which has been running since about 1995. There are about 250-300 students in each year. Each year has some general education and some learning area studies. Students can also select identified discipline electives (e.g. in mathematics or science or other areas).

**Content/Discipline Studies**

There is a mathematics foundation subject taught by Education staff, which covers number theory at about year 10 level. There is also a science foundations subject taught by Education staff, which covers the key ideas in science that relate to topics commonly taught in primary school. The level of content is about junior high school level. Most undergraduate students in primary science have limited background in scientific topics other than perhaps biology.
Students can do 3 discipline electives. About 20 students have chosen science units (e.g. on materials, biology, earth science, anatomy). Some are taught by Education staff and some by Science staff. The mathematics electives are taught by Education staff.

Curriculum Method Studies

There is a strong mathematics method component (students do at least 3 units). There is a science method subject in year 3 (over a 9-week semester, students have 38 hours of contact, comprising lecture and workshops and a one-hour problem based learning session). The unit is practical and theoretical with students developing teaching materials and exploring major theories underpinning the teaching of science.

Teaching Practice

There are 80 supervised days in schools and 20 extra days. Practicum is contained within education units. These units contain teaching experience and weekly tutorials. Each practicum has a theme (e.g. integrated curriculum planning). In year 1 students spend one day per week in school for the whole semester. In year 3 there is a 4-week block. In year 4 there is a 4-week block and a 6-week block.

School/Industry Links

Students can work in non-traditional areas for one of their practica (e.g. science museums), but most prefer to work in schools. Few would select to work in science related areas.

Things We Like

There is good infrastructure for the program, including good technological and library resources.

Innovations

The problem based learning sessions in the science method subject are innovative. We use constructivist principles to change students' attitudes in the science education method subject. Teaching strategies have been developed through action research (including a lot of cooperative work and counselling processes). Problem based learning is used to develop unit programs and to role play scenarios and work on case studies. School teachers are seconded to work in the program to provide authentic experiences (students have reacted positively to this). On-line discussion forums, selected links and computer-based resources are integral to the unit.

Challenges

It is necessary to maintain the quality of teaching with large numbers of students. Students must be switched on to science.

Other Programs

There are about 130 students in each year of the Bachelor of Education (Primary) Graduate Course. This is a 2-year, end-on program. The mathematics and science education subjects are the same as in the B.Ed. and the students are mixed together. There are no foundation subjects. The graduates have more maturity and experience than the undergraduates, but their science knowledge varies widely.
The Bachelor of Applied Science/Bachelor of Education (Primary) is a 4-year program, which has about 12 students. These students do the core subjects of the B.Ed. (192cp) but their discipline subjects are in the science faculty (192cp). They do the same science education units and the foundation units (and the mathematics equivalents) as the students above.

Jim Watters, Gordon Tait

Program Description D24

QUEENSLAND UNIVERSITY OF TECHNOLOGY

MASTER OF TEACHING

This is a 2-year, end-on program, which has been running for 3 years. There are about 40 students in each year, of which about 5 are secondary science/mathematics (there are other secondaries as well) and about 15 primary. The mix is about 50/50 primary/secondary. In the first year of offering we had a very small early childhood group as well. This is a preservice program which has a strong research focus and provides its graduates with a masters level qualification. It takes a critically reflective and research-based approach to the professional practice of teaching. The program is quite integrated – in the first and the fourth semesters, all students do the same 3 units, which are taught with an integrated approach. In the first semester, students are introduced to the ethos of the program and the notion of the teacher as researcher, then the students do a case study of a teaching/learning situation (e.g. a child, a group in a class). This provides an introduction to research. In the second and third semesters students develop a research focus which they report on in the final semester. The program takes the constructivist view that students are developers of their own professional knowledge through the teacher-as-researcher approach. The program is intended to address some of the long-standing issues in other teacher education programs, which can be impersonal, fragmented and unconnected in terms of a developmental sequence. This often relates to the large size of cohorts.

Content/Discipline Studies

Admission requires an undergraduate degree in a discipline other than education. This program has a higher GPA requirement than the Bachelor of Education – Graduate Entry program. Students also are required to submit an application support statement, which describes their ideas about education and where they fit as a teacher. For secondary students, the entry requirements are more specific – a third of an undergraduate degree in discipline studies relating to their first curriculum area and a sixth for the second curriculum area.

Curriculum Method Studies

These are done in the second and third semesters. The primary students do specific units that have been written for the MT program. They do two masters level units – one in literacy and one in numeracy in the first year. They also do a combined literacy/numeracy/technology unit, which is done at undergraduate level but with an additional component. They also do a masters-level unit called "Interdisciplinary
Primary Curriculum’ which contains the science content. Science and mathematics educators co-teach these units.

The secondary students do the same units as the Bachelor of Education – Graduate Entry students. They do 2 curriculum studies for each teaching area (each subject is 12cp, 3 h/wk, in workshops mainly). The first subject focuses mainly on the junior syllabus and the second mainly on senior level. The MT students do additional work to take these units from a B.Ed. level to a masters level.

Teaching Practice

Students go to their school sites for 5 Thursdays, every Thursday leading up to their blocks (which helps to integrate theory and practice on a weekly basis) in the first and second semesters. In semester 1 there are 5 single days and a 2-week block (focussing on the teaching setting and the role of the teacher). In semester 2 there are 5 single days leading up to a block of 4 weeks (focussing on planning, management and communication). In semester 3 there is a 4-week block focussing on inclusive curriculum and the diversity of needs. In semester 4 there is a 4-week block (focussing on being a classroom practitioner as well as a contributor to curriculum decision-making across the school). All students finish the program with a 6-week internship in their final semester (whereas the internship is optional in the B.Ed. Graduate Entry program).

Things We Like

There is a small group of students, which allows a more cohesive and integrated approach to the program (in comparison the programs with large groups of students who pick and choose units). The MT is a more cohesive offering, in which threads develop from the first semester to the fourth semester. The connections are highlighted. For example, there is an issues-based education studies unit in which students will develop a particular professional interest in an issue. Then in another unit they develop a research proposal for this issue (e.g. gender balance, bullying etc). Then in another unit, students implement the research proposal and present a report in a mini conference.

All students do an information technology component (2 h/wk of workshop) in their first semester, which is tied to their first practicum (and IT is integrated into their other studies).

Innovations

The program has a research ethos.

The first and fourth semesters are taught in an integrated fashion. We’ve broken down barriers between schools and departments, and it’s had implications for staffing (staff work in teams rather than individually). While boundaries between specified units have to be kept in terms of final assessment, the way in which the units are taught during the semester is much more integrated. We highlight the links between what they do on campus and what they do in the field.

Challenges

The link to the schools must be maintained, especially communication with supervising and mentor teachers. Also, in the metropolitan area there are four
universities competing for practicum placements, and they have a range of programs offered, so it is difficult for teachers to keep track of the requirements/backgrounds/year levels for all the students.

Ian Macpherson

Program Description D25

UNIVERSITY OF SOUTHERN QUEENSLAND

BACHELOR OF EDUCATION (PRIMARY)

This is a 4-year program, which is in its first year of operation in its current form (the old program is being phased out). There are about 150 students in each year. There are 32 credit points plus professional experiences (each unit is 1cp, and 4cp per semester is a full load).

Content/Discipline Studies

There are 9 units of electives, which may be in one or two areas (to make majors and minors) or many different areas. There are about 8 students in each year choosing a mathematics/science major. These units are general offerings of the Faculty of Sciences. The Faculty of Sciences has been involved in putting together a suitable sequences of mathematics/science units for the electives. The old program contained two compulsory units ('Mathematics for Teachers' and 'Science for Teachers') which were content units taught by the Faculty of Sciences, and these have now become optional elective units.

Curriculum Method Studies

There is a compulsory science education subject (presented as 3 h/wk of workshop) which covers the syllabus, teaching strategies, and constructivist notions of knowledge. There is a science education elective, which will focus on extension work for primary science specialists.

There are two compulsory mathematics subjects (3 h/wk of lecture/workshop). They each focus on different topics in the syllabus.

There is an environmental education unit, which is offered as a non-science elective. There is also a new technology unit in the new program, but it has not yet been fully developed.

Teaching Practice

There are 100 days of field experience, comprising PCE (Professional Context Experience) and supervised practicum. There are formal practica in second semester of year 2, in first and second semesters of year 3 and in first semester of year 4 (each is a block of 15 days). In year 4 there is also a 6-week practicum in first semester.

School/Industry Links

The professional context experience allows students to work in (for example) museums or the university astronomical observatory.
Things We Like

Students can select areas of specialisation, so rather than being a generic teacher education program, students can tailor their program through their choice of electives.

Innovations

There will be multiple offerings of units in different trimesters. Trimesters will allow students to finish their program earlier via intensive mode. There are alternative entry and exit points in the program. For example, students who are struggling in practicum can graduate after 3 years with a 3-year qualification, which will allow these students to work in non-school contexts. It is also possible for people with prior teaching experience (e.g. in indigenous education) to enter the program and become registered as teachers.

A series of video vignettes has been developed for one of the mathematics education subjects. These focus on three-way interactions between novice teachers, teacher educators and children as they work on small group tasks. This provides high quality classroom examples for both external and internal students, and allows the subject to be delivered flexibly.

Challenges

How to make best use of distance education technology in teacher education is an issue. Creating effective units for on-campus and off-campus modes is another issue.

Other Programs

The Bachelor of Education (Primary) Graduate Entry is a 2-year, end-on program which has 40-50 students in each year. As of this year, the students will do the same mathematics and science units as the undergraduates. There are no electives and no discipline content studies.

John Austin, John Green

Program Description D26

FLINDERS UNIVERSITY

BACHELOR OF EDUCATION (JUNIOR PRIMARY/PRIMARY)

This is a 4-year program, which has been running since the 1980s. There are just over 300 students in total. There are 144 units in the program. Students do discipline subjects in other faculties during the first two years, and education subjects during years 3 and 4.

Content/Discipline Studies

Students do 57 units of general studies offered by any of the faculties in the university. They do a sequence of 21 units in one curriculum area to second year level, and most do a further 21 points in a second area. Some do science but not many.
Two subjects from ‘Mathematics for Primary School Teachers’, ‘Professional English for Teachers’ and ‘Rediscovering Science’ are compulsory content subjects (the same as in the middle school program). These subjects are Education offerings and the science one covers the communication of science ideas (e.g. in matter, energy, magnetism, light, astronomy etc) and is very hands-on. The mathematics subject is offered on-line and takes an independent learning approach. It incorporates history and social impacts of mathematics. Students do an independent investigation in mathematics.

Students do a technology subject in the first semester of their final year.

Curriculum Method Studies

There are 2 mathematics curriculum subjects and one science curriculum subject (each is 3 h/wk face to face). The science subject focuses on models of constructivist teaching, and problem solving approaches (e.g. using Lego Technics, tinkering etc). One of the mathematics subjects is taught by the Primary Mathematics Association, so there are direct links to schools. The people who teach it also do the inservice workshops for teachers who are implementing the new curriculum.

These are the same subjects as in the middle school program.

Teaching Practice

There are 18 weeks of practicum – a 4-week block and a 6-week block in year 3, and an 8-week block in year 4. There is also the option of a further 4 weeks in Semester 2 of the final year.

Things We Like

Students in the science and technology curriculum studies subjects are highly engaged in active and vibrant classes.

Innovations

Students do discipline studies in other faculties so they have a rigorous content background.

Challenges

IT is a big and expensive innovation, which has been brought into the program.

Other Programs

The 2-year, end-on Bachelor of Education (junior primary/primary) Graduate Entry program has 82 students in total. They are in the same curriculum studies mathematics and science classes as the undergraduates. They have the same practicum as the undergraduates.

Rick Lambert
UNIVERSITY OF SOUTH AUSTRALIA

BACHELOR OF EDUCATION (JUNIOR PRIMARY AND PRIMARY)

This is a 4-year program that has been running for 6 years. There are 100-150 students in each year at the Underdale campus and greater numbers at the Magill campus. The program has a general studies component in which students can elect to study a major in a discipline area (27 points) and a professional studies component consisting of general education subjects, practicum and curriculum method subjects. Students do 4 subjects per semester (each subject is 4.5 points).

Content/Discipline Studies

Students choose a major in a discipline area (e.g. languages, computer science). There is a six course (six 4.5cp) Global and Local Environment general study sequence that integrates science, mathematics and environmental issues.

Curriculum Method Studies

The mathematics and science method subjects are combined into 4 subjects that integrate mathematics and science. Each of the four courses is sequenced around three ‘themes’: Children’s Learning of Mathematics and Science, Teaching Mathematics and Science, and Mathematics and Science Vehicles. The first, third and fourth course have links with students’ practicum where there is a strategic, integrated link with constructivist teaching strategies and planning, programming and assessment practices with the students planning, teaching, assessment and evaluation of mathematics and science in their practica. The first course focuses on students’ prior knowledge, exploratory activities and the interactive teaching sequence. The second subject includes focus on a short sequence of lessons which students plan, teach during practicum, then evaluate. The third year subject focuses on whole unit programming, assessment, issues and evaluation of resources. Each subject has themes on learning and teaching, as well as content themes (students learn some content as well as teaching strategies). The workshops (3 h/wk) are used to model appropriate hands-on activities in science and mathematics, and teaching approaches within selected topic vehicles.

There is a compulsory design and technology education subject, which covers a range of hands-on materials and activities, learning styles and curriculum.

Teaching Practice

In year 1 there are 10 days of observation in schools (with a focus on numeracy). The second year practicum is a 4-week block (which is linked to mathematics and science). The year 3 practicum is 7 weeks plus a series of single day visits with one key focus being planning, teaching, assessing and evaluating mathematics and science ‘units’. In year 4 there are 6 weeks in schools in which students can specialise (e.g. in mathematics and science or other areas).

School/Industry Links

Students who specialise in mathematics/science curriculum studies make contact with the state mathematics/science teachers associations. Some students are also
involved in the Oliphant Science Awards program. The teaching teams in D&T and science and mathematics have been involved in curriculum development in SA. Speakers from the astronomical association, botanical gardens or other community groups are invited to speak in both courses (D&T and Science/Mathematics).

D&T students work with special schools, making teaching aids for students with disabilities. This is a collaborative project with children at the schools. The D&T component also has extensive links to the Chamber of Energy and Mines (including a trip to Roxby mine), the recycling industry ('That's Not Garbage' and Statewide Recycling), the aboriginal education unit and the museum.

Things We Like/Innovations

There is a suite of 6 general studies electives in D&T (all are Education offerings and are a mixture of content and pedagogy) which was established 5 years ago (30-50 students each year take this option, meaning that 23 per cent of their studies have been in technology education). The subjects cover a broad range of technologies, and the students work with schools, community projects, industries, curriculum materials preparation, on-line work, IT-based learning etc. It is popular with the students. This is innovative nationally, and gets this learning area established in the schools.

The program models how to integrate mathematics and science. The lecturers work in a team of 3 to plan the integrated units and modify it from year to year. The mathematics and science education staff also work in the practicum so they see the students regularly in schools and on campus and develop professional relationships with them. There is a variety of assessment strategies (including self assessment, structured negotiated peer assessment, group project work and individual presentations).

Challenges

Extensive time and communication are needed to maintain the integrated subjects. Meetings and negotiations with staff and students are time-consuming but are highly valued by those who work in our team. We are under pressure to not continue with this style of program no matter its success and how many teaching awards we win. Getting resources for interactive, hands-on activities is time-consuming.

The place of ICT throughout the D&T courses is an issue.

Other Programs

The Bachelor of Education (Specialisation) is an end-on program for primary education. Most students do it as an 18 months intensive and there are up to 60 students in each year. They have previous degrees in a range of disciplines. The mathematics and science units are modified versions of what the undergraduate students do (mainly the key elements). They have 14 weeks of practicum.

Mike Chartres, Steve Keirl
UNIVERSITY OF SOUTH AUSTRALIA

BACHELOR OF TEACHING (ANANGU EDUCATION)

This is a 3-year program, which has been running since 1984. The program is designed to provide primary teacher education for Anangu, qualifying them to teach in their community schools. There are about 70 students spread over about 9 communities, mostly in the northwest corner of SA. In each stage (or year) there are Teaching Studies, Curriculum Studies and Community and Environment Studies.

Content/Discipline Studies, Curriculum Method Studies

The mathematics component covers what mathematics is, the history of western academic mathematics (which includes practical activities and mathematics content), and mathematics in Pitjantjatjara communities. Two out of the 12 subjects in each stage are related to mathematics (numeracy is an important component because many of the students have low numeracy levels).

The Community and Environment Studies strand includes science and health, and the relationship of these subjects to contemporary issues, such as housing and health. It is concerned with the connections between western academic science and traditional science in terms of Pitjantjatjara culture. The science takes a holistic view, which encompasses traditional views of land care and traditional views of life. It builds upon peoples’ knowledge about the past and present and adds on knowledge from other cultures (ie. from the western academic view of the sciences) and moves towards the students being able to teach these elements.

These subjects are run as modules, which are one-week workshops held in communities (students may travel to another community for the workshop) or in Adelaide or Alice Springs. The students also have ongoing activities in their own communities (including assignments).

Teaching Practice

These include classroom observations and teaching in their own community schools, as well as teaching practice in mainstream schools in Alice Springs or Adelaide. There are 3 weeks of teaching and one week of observations in the first stage (ie. first year), 5 weeks in stage 2 and 6 weeks in stage 3.

School/Industry Links

Most of the modules also include classroom activities, which are done in the community schools.

There is a close relationship with the Department of Education and the communities themselves.

Things We Like

One of the important things in remote aboriginal communities has been lack of continuity (governments change and programs stop and start). However, this program and its basic philosophies have continued since 1984. It has provided the
opportunity for people to remain in their own communities and gain a tertiary qualification (previous programs in which students had to go away to study were unsuccessful - students did not complete when they were living away from their own communities).

Innovations

The inclusion of local knowledge into the curriculum has been done successfully. For example, the incorporation of traditional knowledge about wellbeing as well as western views of medicine has been successful. Local people teach their traditional knowledge and people who work in the medical profession bring their knowledge into the program.

There is a videoconferencing facility between Ernabella and Adelaide, which is used for teaching.

Challenges

The national curriculum and its relationship to local knowledge is an issue. The knowledge of the communities and students is not always easily reconciled with the demands of a national curriculum.

Bruce Underwood

Program Description D29

UNIVERSITY OF TASMANIA

BACHELOR OF TEACHING (K-6)

This is a 2-year, end-on program, which has been operating for about 5 years. There are about 45 students in first year and about 30 in second year. There are general education subjects (25 per cent of the program), practicum (25 per cent of the program), and curriculum method subjects (50 per cent).

Content/Discipline Studies

Admission requires a previous degree.

Curriculum Method Studies

The science and mathematics subjects are curriculum and method offerings. Science and SOSE are combined into one subject which is presented as 2 h/wk face to face for the whole program (22 weeks in first year and 16 weeks in second year). It is a combination of content and pedagogy.

Mathematics has 2 h/wk face to face for the whole program. Mathematics is taught by a combination of lecturing staff and classroom teachers, who bring direct classroom experience to the primary groups.

Teaching Practice

There are 105 days of practicum.
School/Industry Links

We are working with the museum to prepare an experience for primary students. Several organisations (including Parks and Wildlife, The Environment Centre, and representatives from the hydro-electric, forestry and minerals resource industries) give guest lectures to explain the classroom support they offer. The resource industries take the students on an excursion to explain science in industry. The students use a website which is linked to the local newspaper (developed with the education editor of the Hobart Mercury).

Things We Like/Innovations

We model an integrated approach in the science and SOSE subject. Many of the students have had little science background. The science subject looks at everyday experiences and how they can be explored with children. This gives the students confidence in science. Many of the students now enjoy science and teach it on practicum. In part of the course literacy and numeracy are covered in an integrated fashion. The method is a hands-on seminar style covering content and pedagogy.

Challenges

Doing practical activities for large classes and with limited time is an issue. Finding enough time for mathematics and science given the inadequate backgrounds of many students. Being certain that mathematics and science are covered during practicum so students get hands-on experience.

Natalie Brown, Jane Watson

Program Description D30

UNIVERSITY OF TASMANIA

BACHELOR OF EDUCATION

This is a 4-year program, which has been running for many years but modified on several occasions. There are about 800 students in total. During the first 2 years students do non-education discipline studies in other faculties (half of first year and a quarter of second year). The education studies comprise general education subjects, curriculum studies and school experience.

Content/Discipline Studies

In year 1, 50 per cent of the load is non-Education in any area (general offerings of other faculties). One of the discipline areas must be continued to second year to make a minor. Few students choose science or mathematics as their non-education discipline (less than 5 per cent, of which most are biology and geography, and almost none do physics or chemistry). Only 3-4 students per year choose mathematics. Information technology is built into their core education strand and requires a mastery test in first year.
Curriculum Method Studies

There is a generic curriculum unit in first year, which gives an overview of curriculum issues (presented as 2 h/wk face to face for 1 semester). In year 2 there is a compulsory half semester each of mathematics, science and technology.

In years 3 and 4 there are further electives in all the learning areas, or students can choose general education electives. There is a year 3 science elective, which focuses on concept development. The year 4 science elective is popular (it attracts about half the year group) and emphasises science links to the community – students cover Streamwatch, Coastalwatch, National Parks, museum, forest and mineral industries, and how to develop curriculum to use these places as excursion destinations. It focuses on understanding science and its impacts in the local community.

There are compulsory mathematics units in years 2, 3, and 4. There are further mathematics electives and these are reasonably popular.

Teaching Practice

There are 2 weeks of practicum in year 1, 3 weeks in year 2, 7 weeks in year 3, and 7 weeks in year 4. There is negotiation with the other faculties to avoid clashes with practicum – if subjects wish to be on the recommended list they have to be willing to negotiate to avoid clashes.

School/Industry Links

The year 4 method subject described above has extensive science-related links.

During the final semester of year 4 students plan and present an education conference attended by teachers. The students also run a children’s expo (to look after the kids while the teachers are at the conference).

Things We Like

The students have significant choice in electives and disciplines so they can set themselves up as teachers with special strengths (but they have a basic introduction in everything).

Innovations

The general structure of the program is innovative. The links with the education community are very strong (e.g. guest lectures by local teachers and visits to local schools).

A unique feature is the structure of the program. Students follow the core compulsory program, but beyond that can ’profile’ themselves by elective choices. For example, by careful planning and elective selection primary students may do curriculum units in middle schooling, middle years mathematics, middle years English and negotiate to do school experience in a middle school program setting. The current year 4 cohort includes several who have chosen the middle schooling pathway and are completing their Internship in that setting. There are similar pathways for other curriculum areas such as LOTE, which is in fact linked to an out-of-country teaching experience.

The program also has an alternative year 4 honours pathway.
Challenges
Student numbers are very large and this restricts the innovations that can be introduced. Timetabling and administration of large numbers of students, and timetabling of cross faculty studies are challenges. How to increase staffing and other resources is an issue.

Peter Ferguson

Program Description D31

DEAKIN UNIVERSITY

BACHELOR OF TEACHING (PRIMARY) / BACHELOR OF SCIENCE

This is a 4-year program, which has been running since about 1993 but is now being phased out. There are about 20 students. Students do 16 credit points in the Faculty of Education and 16cp in the Faculty of Science. Students do 8 credit points per year (=4 subjects). Most of the discipline subjects are in the first 3 years and most of year 4 is education subjects.

Content/Discipline Studies
These units are general offerings of the science faculty. Students graduate with a B.Sc. They do an 8cp major (to year 3 level) and a minor (to year 2 level).

Curriculum Method Studies
There are 2 curriculum studies units in primary mathematics, one in primary science and one in technology (design and make) education. These are delivered by Education personnel and are 3-4 h/wk face to face for one semester. In both the first mathematics education subject, and the science education subject, students are given an option whether to do the subject on campus or school-based (about 50 per cent choose school-based). All students attend an on-campus lecture (in which discipline content is combined with pedagogy). The workshops may be on campus (2 h/wk) or at schools (3h/wk). The in-school sessions start with input from the lecturer then students work with small groups of 3-4 children for 1 hour and implement the techniques covered in the workshop. Then the students have morning tea together and share their experiences. Student assignments require them to plan, justify and evaluate the lessons with children.

The science curriculum subject is arranged in science content topics and covers science content knowledge, knowledge of children's learning in science and of curriculum issues, and general education issues. For those students not taking the school based option, most of the workshops are on-campus, but there is a 3-week block when students have a workshop on campus then work with small groups of children at a school for one hour, followed by a review. The students teach a sequence of lessons over the 3 weeks.

Teaching Practice
There 20 days of field experience in year 2 - in each semester, students are in schools for 10 days over 3 weeks (so they can attend classes in their other faculty
on heavy days). There is a similar approach in year 3. In year 4 there is a 10-day negotiated block in semester 1 and two 3-week blocks in semester 2.

Things We Like

Students can graduate with 2 strong degrees.

The mathematics and science curriculum subjects are valued by the students (many of them say it’s the best thing they do) and it changes their views of teaching and learning.

Innovations

The school-based mathematics and science primary education units are innovative (see above).

There is a strong on-line component in the general education subjects.

Personal research on teaching and learning is embedded in the mathematics and science curriculum subjects.

Challenges

Very few, if any, of the students are choosing mathematics in this program.

Other Programs

There are also primary double degree programs for human movement and arts. These double degree programs are being phased out and replaced by a new program which is being accredited at the moment. The new program will contain the same general education subjects and a discipline study sequence done in another faculty, but the main difference is that there will be two compulsory mathematics content units designed specially for students in this program, and 2 compulsory science content subjects (‘Ecology and the Environment’ and ‘The Physical Environment’) which will be delivered by the science faculty. These units will provide compulsory discipline content in mathematics and science. There will also be 3 units of mathematics education instead of 2 (plus the science method subjects and the technology method subject). There have been extensive meetings with the science faculty to develop these new units.

Susie Groves, Ron Smith, Russell Tytler

Program Description D32

LATROBE UNIVERSITY

BACHELOR OF TEACHING / BACHELOR OF EDUCATION

This is a 4-year program, which has been running for many years. There are about 100-150 students in each year. The first 3 years of the program are the Bachelor of Teaching and the fourth year is the B.Ed.. There are 4 units in each semester.

Content/Discipline Studies

There is a science subject in each year. There is a first year science content subject, which covers topics such as light, energy and astronomy. It is half offered by the
science faculty and half by Education (lectures are shared and workshops and tutorials are worked out together). This subject is presented as 4 h/wk for 12 weeks and is specially designed for these students.

In year 1 there is a ‘History of Mathematics’ subject (presented as 4 h/wk for one semester) which is an Education offering. This looks at mathematics content from a historical perspective.

Curriculum Method Studies

The second year science subject has two themes (earth science and kitchen chemistry) and focuses on constructivism, assessment activities and conceptual change. The third year subject is an integrated unit in mathematics and science, which has the theme ‘Sport’. The fourth year subject covers astronomy and teaching strategies. Each of these subjects has a different topic as a vehicle for their science method studies (e.g. earth science, kitchen chemistry) so students are learning some content as well as pedagogy. Technology is included in the science method subjects in each year.

In year 1 the subject ‘Mathematics Education A’ is a curriculum unit (presented as 2 h/wk for one year). This subject is aimed at attitude change in mathematics (students have poor skills and low self esteem in mathematics). The subject encourages students to think about how mathematics is taught and how it could be better taught. It also involves problem solving activities, reflection activities, communication about ideas, and open-ended investigative mathematics. Students develop short innovative mini lessons for peer teaching.

In year 4 there is an elective unit ‘Contemporary Mathematics’ which covers the teaching of mathematics in a reform-oriented environment, and the findings of research. It includes a ‘what works for me’ series of presentations (ie. good teaching ideas) – students trial these ideas in the classroom during the week and also do implementation of lecture content in the classroom.

Teaching Practice

First year practicum is one day per week in school for 8 weeks then a one-week block. In first semester of second year they have a school-based science/technology program in schools for the first 7 weeks of the term, followed by a 3-week general teaching block, and then another 3-week block in second semester. In third year there is a 3-week block followed by a 4-week block. In fourth year there is no practicum, but in some of the 4th year subjects they have to work with students as part of their assignments (but they organise this themselves).

School/Industry Links

In the second year science method subject the students are required to go into classrooms in teams of 3 or 4 and teach the science program for 7 weeks. It serves as an introduction to teaching science in the schools. Students can work together as a group to build their teaching skills and they can try out innovative ways of teaching.

Things We Like/Innovations

We change their perceptions of science and build up their confidence. The science program which students plan and teach in year 2 allows them to apply the theory to a continuous program rather than isolated lessons. The third year unit which
integrates mathematics and science is popular with the students because they can see integration in practice.

The practicum gives them classroom experience over an extended period. The electronic dialogue journal is innovative and a powerful way of reflecting on what is happening in the classroom. There is a high level of communication in tutorials and students accumulate a lot of resources. The research readings provide information about particular areas of interest.

Challenges

Changing the students’ attitudes to teaching science is a challenge, as is defending the amount of science in this program (there is marginally more science than other subject areas).

Large group sizes make it more difficult for the lecturer to work with individual students.

Other Programs

There is also a one-year, end-on Graduate Diploma in Education in which some of the subjects are shared with the undergraduates. Eighty students are currently enrolled.

Bruce Waldrip, Steve Tobias

Program Description D33

MONASH UNIVERSITY

BACHELOR OF PRIMARY EDUCATION

This is a 4-year program, which has been running in its present form for 3 years. There are about 60 students in each year. In each year there are learning area studies, general education and discipline subjects. Students are required to do a broad range of discipline subjects with some specialisation through electives in years 3 and 4. All subjects are Education offerings.

Content/Discipline Studies

The ‘Exploring Science’ subject in year 1 is a compulsory discipline subject, which presents general science content (presented as 2 h/wk for a semester). The science content is presented through ‘Hollywood Meets the Labcoat’ which looks at science in movies (‘Frankenstein’, ‘Jurassic Park’ DNA, ‘Outbreak’ infectious diseases, ‘Gattica’ genetic engineering, ‘The Matrix’ artificial intelligence). Students enjoy it. They watch the movie in their own time then do readings and assessment tasks about the science content and social awareness of the issues in the movie. The tutorials contain hypothetical scenarios and hands-on activities. The aims are to make students scientifically literate, generate an interest in science and build their confidence. The science discipline electives include ‘Australian Ecology’, ‘Conservation and Environmental Issues’, ‘Marine Science’ and ‘Science, Technology and Society’. These focus mainly on content and are popular with students.
There is a compulsory mathematics discipline subject in year 2 – ‘Exploring Mathematics’ which is intended to build their confidence in mathematics (taught by Education staff). It looks at mathematics from a cultural perspective (e.g. historical and cultural aspects of counting and measuring).

Curriculum Method Studies

There is a science methods subject in year 2 (presented as 3 h/wk face to face) which covers the syllabus issues and hands-on activities for primary science. Students build their confidence by doing lots of hands-on and preparing activities themselves. It is strongly connected to early childhood views of science (instead of secondary). The lecturer role-plays a primary classroom with the students.

The technology method subject (year 3) has not been taught yet.

The first mathematics method subject is in year 1, and focuses on young children’s mathematical thinking and some of the content areas at this level. Students interview children 1:1 and reflect on their observations. The second mathematics education subject will extend to upper primary mathematics content (e.g. fractions) and has more emphasis on teaching and assessment strategies. There is a mathematics education elective subject for students who have an interest in mathematics (it contains some statistics and a particular focus on issues and planning in primary mathematics).

Teaching Practice

In year 1 students do one day per week of observations for Semester 1 and a one-week block in Semester 2. In years 2-4 there are two 3-week blocks in each year.

School/Industry Links

In the elective ‘Conservation and Environmental Issues’ students study the urban environment by working with the city council on community-based development projects related to children’s issues. They work with the council for 4 weeks and report their findings and make recommendations to the city council (e.g. about transport, shopping malls etc). These are presented to the mayor and the council at the end of semester (the media is present plus industry people) some recommendations are implemented.

All the other science electives are off-campus community programs. For example, students adopt a piece of remnant vegetation and do an environmental needs-assessment of the whole area including soil testing, and develop recommendations as input to current community programs. This develops skills in using fieldwork as classrooms. It gives them an opportunity to develop new scientific knowledge rather than being told science content.

Things We Like

The series of mathematics subjects are sequenced to lead students from children’s ideas about mathematics, then challenging their own mathematical ideas, then leading them to experiences in schools and the opportunity for reflection.

Innovations

Using popular culture to study science in the ‘Exploring Science’ unit (see above). The science method subjects emphasise children’s curiosity and natural learning styles - rather than the scientific method.
The mathematics education program uses a practicing teacher to present some material, which brings real examples from school into the class and makes it relevant.

Challenges
More time for mathematics/science would allow more depth – there are only 2 compulsory science subjects in the 4-year program. Contact hours have reduced over the last few years because of financial pressure.

Other Programs
The Graduate Diploma in Education (Primary) is a one-year, end-on program, which has 60-70 students. They do a science method subject which is similar to the subject in the 4-year program but has more hands-on activities and is presented separately. The mathematics subjects are run as seminar groups, which allows good discussion and reflection. They are easy to engage, but some students are very lacking in mathematics knowledge and confidence.

Karen Malone, Barbara Clarke

Program Description D34

ROYAL MELBOURNE INSTITUTE OF TECHNOLOGY UNIVERSITY

BACHELOR OF EDUCATION

This is a 4-year program, which has been running for 2 years in its present form. There are about 140 students in each year. Students can graduate with two specialisations, to be chosen from primary, early childhood and adult education (most students choose early childhood/primary or primary/adult). All students do the same subjects in year 1. There are education subjects, discipline subjects, curriculum method subjects and electives. All subjects are Faculty of Education offerings. Students do 4 subjects in each semester (generally 3 hours/week for 12 weeks with an additional non-teaching week for assessment/semester).

Content/Discipline Studies
There are 2 compulsory numeracy subjects (presented as 2 h/wk face to face) and one mathematics discipline elective which integrates mathematics, science and technology (3 h/wk face to face). The integrated approach was developed partly because of the small numbers of students choosing this elective but also because it is more educationally appropriate. The subject focuses on topics such as current ethical issues in science, environmental issues and other problems of current concern (students integrate the mathematics through problem solving and by mapping, data analysis, and spreadsheets etc).

Curriculum Method Studies
There is a compulsory primary mathematics method subject (3h/wk face to face) and an elective method subject that focuses on strategies for teaching mathematics. There is one compulsory science method subject and one compulsory technology method subject.
Teaching Practice

There are 40 days of practicum each year, except year 4 in which there are 70 days. Students go to the ‘professional practice sites’ one day per week and have a 2-week block in each semester of the first three years of the program. In year 1 they go to the same primary school for the whole year (to provide continuity with a particular site and a particular mentor). In year 2 they go to their other stream (early childhood or adult). In year 3 they have one semester in each stream. In semester 1 of year 4 they have 20 days of their own choice of sites. In second semester of year 4 they have 10 weeks of practicum, which can be split between sites, or done all in one stream. Students work in pairs with one mentor teacher, to establish a buddy relationship which lasts for 12 months (this is a strength of the program because students support each other as well as having support from the mentor). University coordinators work with communities of 26 or so pre-service teachers to support the learning in education subjects and professional practice. Community coordinators (practitioners or recently retired teachers or principals) are employed one day/fortnight to liaise with mentors and site leadership teams.

School/Industry Links

The University has entered into formal partnerships with schools, regional educational authorities and industry to support the professional practice program and other joint ventures. Funding for supervision is used to release site-based mentors to participate in mentor development programs and professional practice meetings at the University.

Things We Like

The numeracy subjects have a hands-on, problem-based approach in which students are accountable for their own levels of understanding.

There is an integrated approach in the mathematics/science/technology electives. Students are required to carry out site-based tasks as part of their requirements for some curriculum methods subjects.

Innovations

The practicum is innovative (see above).

The numeracy subjects involve technology (mathematics software and simulation resources) and hands-on, problem-based learning and peer assessment. Students prepare a primary mathematics portfolio of games and activities which is peer assessed according to performance-based scoring criteria (which helps students to master performance-based assessment).

Challenges

We would like to introduce more curriculum method mathematics into the program. Students like what is being done in mathematics but, because of the short time available, it is very intensive and puts the students under pressure.

Getting sufficient teachers and/or University coordinators to participate in the professional practice program is a challenge.
Other Programs

The Graduate Diploma in Education (Primary) is a one-year program, which has about 40 students. They do the same method subjects as the undergraduates, but no discipline subjects or electives. There are 45 days of practicum.

Di Siemon, Chris Walta
(in consultation with Peter Meaney, Iris Blyth and Bill Eckersly, October, 2001)

Program Description D35

UNIVERSITY OF BALLARAT

BACHELOR OF EDUCATION

This is a 4-year program, which began this year. There are 140 students in year 1 (there are about 120 second year students who have transferred in from a previous program). There is a primary pathway and a primary/middle school pathway. There are 480 credit points comprising education studies, a discipline sequence and practicum.

Content/Discipline Studies

All students do a discipline sequence of 6 non-education units (15 cp each). At present, 4 students are doing a science strand and 5 are doing mathematics (most students do their discipline sequence in physical education or psychology).

Curriculum Method Studies

All students do a science subject in year 2, which contains both content and pedagogy (it is 4 h/wk for 1 semester, presented as a 1 hr lecture, 2 hr tutorial, and a forum, which is an enlarged tutorial group for discussions). The mathematics subject also has forums. Both are Education offerings.

The School of Science is developing discipline units which will be tailored for these students.

Teaching Practice

Field experience begins in week 3 of year 1 (teams of students spend one day per week for 10 weeks in small rural schools, to provide a link between school and university). In second semester students spend one day per week in non-school community education settings. There is a 3-week block practicum in year 2, two 3-week blocks in year 3, and a 6-week block in year 4.

School/Industry Links

Students do Waterwatch activities at a local land care centre, and this aspect of the course is being built up.

Things We Like

There is a theme across each year, which creates connectedness between subjects. First year focuses on communities of learners. Second year is about connections in
Clever Teachers, Clever Sciences

learning. The third year theme is diversity of learning and the fourth year theme is developing a professional identity. The honours year is unique.

Students experience attitude change in science. Many of the students have negative attitudes initially. The lecturer models a constructivist/interactive teaching style, as well as enthusiasm and enjoyment, so students develop positive attitudes.

Innovations

It allows students to have a choice of primary or middle school teaching destinations. The practicum has been remodelled.

The whole course is innovative because each year, the units are linked by a theme.

Challenges

It is important to overcome the students’ initial attitudes towards science. They initially don’t like science and their view of science teaching is to give kids copious notes and get them to memorise a lot of facts. Getting them to change this view is the biggest challenge and getting them to realise that science can be relevant and enjoyable.

Other Programs

The Bachelor of Teaching is a 2-year, end-on program for primary education. There are less than 5 students in each year.

Gary Henderson, Robyn Brandenburg

Program Description D36

UNIVERSITY OF MELBOURNE

BACHELOR OF EDUCATION (PRIMARY)

This is a 4-year program, which has been running since 1995. There are 100-120 students in each year. There are 400 points, comprising general education subjects, learning area subjects and practica.

Content/Discipline Studies, Curriculum Method Studies

There are 4 mathematics subjects and 3 science and technology subjects (each is 12.5 points). The earlier year subjects are mainly discipline content (which relates to the primary curriculum) and some pedagogy, while the fourth year subjects are mostly pedagogy with some discipline content. All subjects are taught by Faculty of Education staff.

In years 2-4, all the mathematics and science subjects are offered at either standard or advanced level. Students who have a good background in mathematics or science are able to choose the advanced stream in that learning area. The advanced subjects provide a deeper understanding of the discipline at primary level (e.g. making links between topics, problem solving activities and strategies, deeper research on children’s learning). About 15-20 students each year do the advanced mathematics and science subjects. The treatment of the first year science subject emphasises constructivist theory, the third year subject takes a problem-solving design.
approach to science and technology, and the year 4 subject is school based emphasising science curriculum design, presentation and learning assessment in a particular topic area (they take over classes teaching children in small groups through a whole semester and report to each other and school teaching staff in discussions in the school). The advanced students do presentations to the school staff.

Teaching Practice

There are 100 days of practicum and an in-school program in year 4.

School/Industry Links

Some assignments require students to interview children in schools. Occasionally, children from local schools come to campus for a session. Students are involved in judging primary sections of the Science Talent Search for STAV and in-service programs (working with people in sessions, editing papers). They participate in STAVCON (as guides etc). They have helped to develop exemplary science programs for summer school inservices.

Things We Like

The course is strong in the learning areas, particularly mathematics and science. Students have 4 years of mathematics and science education, so they have a good chance of becoming knowledgeable and skilled teachers of mathematics and science.

The program emphasises pedagogical content knowledge in the KLA subjects. The program covers the mathematical knowledge that teachers need to teach mathematics and well at primary level - all subjects cover primary mathematics and from an advanced viewpoint rather than leaving this to high school mathematics. They incorporate current research in mathematics education and have created a proper academic discipline of primary mathematics education.

The program aims to develop positive attitudes toward science and mathematics, based on seeing evidence of children’s enjoyment of the subject (the students have close encounters with children who are enjoying science).

Innovations

The program is innovative because of its emphasis on pedagogical content knowledge and learning area strengths (see above). Also, some web-based materials and CD-ROMs have been produced for the program because there is very little available commercially of sufficient depth in mathematics pedagogical content knowledge for primary level.

The program engages three well placed schools in pedagogical partnerships to help student teachers to realise that science can be a positive and exciting learning experience.

Challenges

The students have a moderately high TER score but their understanding of mathematics is often weak. There is pressure to reduce teaching hours in the university but these students need teaching time in mathematics and science.

There are funding issues for subjects which run in tutorials rather than mass lectures.
Working with schools requires a lot of consultation and responsibility – this takes staff commitment to maintain the operation.

Other Programs

The Bachelor of Teaching (Primary) is a 2-year, end-on program, which has 80-100 primary education students. Students spend 18 months on campus, then have a 6-month internship. There are 2 mathematics subjects and one science subject (which are year long).

Kaye Stacey, Rod Fawns

Program Description D37

CURTIN UNIVERSITY

BACHELOR OF EDUCATION (PRIMARY EDUCATION)

This is a 4-year program, which is currently in its second year of operation after being revised. There are about 80 students in each year of the new program. There are 800 credit points, comprising educational studies and electives. In each semester there typically are two compulsory general education subjects and two electives. Some of the specialist ‘electives’ are compulsory.

Content/Discipline Studies

There is a science and technology content subject (25cp) in year 1, which is an Education offering. Students in this program need to have year 12 mathematics as a prerequisite (another mathematics content subject is planned).

Curriculum Method Studies

In year 1 there is a curriculum unit which contains mathematics method (2 hours per week for one semester) There will be another mathematics method subject in year 3 and another in year 4.

In year 2 there is a curriculum unit which concentrates on the science curriculum framework (25cp, presented as 3 h/wk face to face).

Teaching Practice

In semester 1 of year 1 there is a one-week practicum. Year 1 also has a 3-week block, as do each of years 2 and 3. In year 4 there will be an internship of about 10 weeks. In semester one of year 4 the students will also do an action research project which will be school-based.

School/Industry Links

The year 3 and year 4 mathematics subjects will probably take students into the classroom.

The Department of Minerals and Energy provide scholarships for students to do their practica in remote areas (the students often stay out there after they graduate).
Innovations
This program is based on an outcomes approach to teacher education. The faculty has developed outcomes based on desirable attributes (e.g. attributes of the beginning teacher).

Also, a student-centred style of learning is incorporated into the units (e.g. by giving them choice in assignment details). Some aspects of assignments are negotiable (according to student interests) and some are non-negotiable.

Challenges
There is a lack of full-time staff. A lot of sessional staff are employed and it is difficult to train them in student focussed teaching because they don’t get paid to come to meetings.

Also some graduates still appear to be using transmission approaches in the classroom after they graduate (word of mouth information) so long term attitude change is a challenge.

Other Programs
The old Bachelor of Education (Primary Education) program did not have an outcomes focus. It had less mathematics and less literacy and a different emphasis in practicum schools (e.g. the internship).

Len Sparrow

Program Description D38

EDITH COWAN UNIVERSITY

BACHELOR OF EDUCATION – PRIMARY

This is a 4-year program, which has been operating for about 5 years. There are about 400 students in each year (across 3 campuses). Students do 31 units consisting of education studies, practicum and electives.

Content/Discipline Studies
Students do 3 discipline electives in other faculties. About 10-15 students choose mathematics electives (to become mathematics specialists). There are 3 mathematics discipline units which have been specifically designed for education students (‘Principles of Mathematics: Number’, ‘Principles of Mathematics: Geometry’ and ‘Topics in Mathematics’). These units are only taught by staff with a strong interest in teacher education. The emphasis is on how to make mathematics interesting (e.g. by using mathematical tricks and puzzles). The students who take these subjects are predisposed towards mathematics, but have very traditional ideas about what mathematics is, and they need to be alerted to resources which will enliven their mathematics teaching. Students give presentations on topics which they find interesting and which give other students ideas to use in the classroom (e.g. number tricks, mathematics in magic).
Curriculum Method Studies

There are 3 mathematics curriculum subjects. Each covers different topics from the mathematics syllabus (e.g. the year 2 subject concentrates on number) and is a mixture of content and pedagogy (the content is a vehicle for helping them understand how to teach it). There are a lot of hands-on activities with materials and modelling of techniques (each subject has 3 h/wk face to face in workshops).

There are 2 science education subjects which emphasise hands-on activities where the lecturer models teaching techniques (each is 3 h/wk in one mass lecture and a 2-hour workshop). The mass lectures incorporate videos, which were developed to demonstrate teaching strategies. Full time staff present the mass lectures and casual staff do the workshops. There is a Technology and Enterprise Education subject which has just started this year.

Teaching Practice

There is one week (of orientation) in semester 1, and another week in semester 2 of year 1. In year 2 there is a 2-week block. In year 3 there is a 2-week block and a 4-week block. In year 4 there is a 10-11 week assistant teacher program in term 2 of semester 1.

School/Industry Links

Students in the mathematics subjects spend 1-2 sessions in schools working with small groups of children on problem solving activities (as do science).

Things We Like

It is a good all round program and school experience is built into it all the way through, including first year. In mathematics we emphasise a hands-on approach and we get them doing mathematics with real kids. There is a good proportion of mathematics and science in the program.

Innovations

There is an in-house published text for each of the 3 mathematics education units and 2 science education units. The units ‘Information Technology and Learning’ and ‘Language Across the Curriculum’ (which covers the importance of language in teaching and learning across all subject areas) are innovative units which are compulsory for primary.

The program produces very large numbers of graduates but it runs on a very small amount of funding. Maintaining the quality in the program in the light of the lack of resources is an innovation (using the video clips, workshops, peer teaching and in-house texts).

The tailored mathematics discipline subjects are innovative (see above).

Challenges

Maintaining links with local schools when sessional staff are doing most of the teaching, is a challenge.

Other Programs

There will be a Bachelor of Education (K-7) program starting next year at Joondalup campus. There will be a compulsory content unit which has both mathematics and science, and a reduced number of method subjects.
There is a one-year, end-on Graduate Diploma in Education (Primary) which has about 130 students. They do less mathematics and science subjects (about half of what is in the 4-year program, so the content is compressed to the essentials). They have 1 day per week in school for the whole program, as well as 9 weeks of practicum, in 3 blocks.

Jack Bana, Dennis Goodrum, David McDougall

Program Description D39

MURDOCH UNIVERSITY

BACHELOR OF EDUCATION (PRIMARY)

This is a 4-year program, which has been running for many years. There are about 150 students in each year. There are 96 points of which 71 are education studies, and the remainder can be education electives or subjects in a specialty teaching area (from other faculties). Students have the opportunity to choose mathematics/science as a specialty area but very few do.

Content/Discipline Studies

There is a mathematics content subject (‘Cultural Mathematics’ of 3 credit points presented as 4 h/wk face to face for internal students) which covers the nature and purpose of mathematics and ways of thinking about it (rather than a typical content unit). It is intended to change the way students think about mathematics, from closed, procedural, answer-oriented views, to getting them thinking about its significance to them personally and to the world at large. It includes the non-European origins of mathematics, the mathematics involved in Aboriginal communities, the impact of information technology and other aspects. It also draws attention to the importance of specific mathematical concepts (e.g. fractions, decimals). It is taught by Education staff.

The science content subject ‘Introduction to Physical Science’ (3 credit points, presented as 4 h/wk) is designed to encourage attitude change in science. It has a social-community context (e.g. the history of the discipline and current social issues which relate to it). It covers mainly physics and chemistry and is taught jointly with Physics staff.

Curriculum Method Studies

There is a mathematics method subject (4 h/wk) and a science method subject (which is half Society and Environment, presented as 3 h/wk face to face).

Teaching Practice

In year 1 students do a unit called ‘Introduction to Teaching’ which has a campus component, plus 5 days in a primary school and 5 days in a secondary school (mainly doing observations). In years 2, 3 and 4 there are 10-day blocks linked to each of the 4 primary method units (so when students do their primary mathematics unit they will have 10 days in schools concentrating on mathematics teaching). This allows students to put into practice the things they have learnt on campus and helps them to make the links. In year 4 students do an additional block.
of 10 weeks (in semester 2) in which students teach up to a full teaching load. Teaching practice is usually held in university vacation times, to avoid clashes.

School/Industry Links

The elective unit ‘Science Communication and Education’ focuses on science education in the community (museums and science centres etc) and informal science education. The staff have extensive links to museums etc. Students do a group project in the ‘Cultural Mathematics’ unit where they take an aspect of everyday life and look at the mathematical elements of it (e.g. plan the viability of a home laundry business, using real data about the costs of advertising, leasing and buying, and looking at how mathematics is related to the decisions made). It emphasises that mathematics has a part to play in making real world decisions.

Things We Like/Innovations

The school experience is the outstanding feature (each practicum is linked to a specific method subject, as described above). Students are placed in schools and have a staff member present at the school for a whole day with them. This builds a strong relationship between the teacher, student and university tutor.

The mathematics discipline subject is innovative and has significant on-line supplementation. It has changed many students' views of mathematics.

Challenges

There are community/political pressures to include more additional issues/topics in teacher education programs (e.g. Aboriginal education, IT etc). These are worthwhile, but create an overcrowded program because other content cannot be omitted.

Many students have unhelpful views of what mathematics is (e.g. predominantly procedural views) and how people get to be good at it (e.g. you are either born good at it or you're not, and probably 'I'm not'). These are dangerous views to take into a career in education.

Other Programs

There is a one-year, end-on Graduate Diploma in Education (Primary) which has about 100 students. They do the same curriculum method units, but not the mathematics and science discipline units. It is a 30-point program whereas a normal one-year load is 24 points. They do the ‘Introduction to Teaching’ subject in January and have their first field experiences before semester starts. It is also offered externally.

Renato Schibeci, Barry Kissane
Appendix E  Descriptions of secondary mathematics/science teacher education programs

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Program Description E1

AUSTRALIAN CATHOLIC UNIVERSITY

GRADUATE DIPLOMA IN EDUCATION (secondary)

This is a one-year, end-on program, which has been running for many years (although it has been frequently modified). There are usually 5-12 mathematics students in the Victorian campuses. There are usually 16-22 science students and 10 mathematics students in the NSW campus. The NSW campus has about 15 TAS students in a sponsored (by CEO and DET) cohort. Students do some general education subjects, field experience and curriculum subjects to total 120 credit points (each subject is 10cp).

Content/Discipline Studies

Previous requirements are a degree with a major in one curriculum area and a minor in another (i.e. students need at least a minor in mathematics to enter mathematics teaching). Academic or industry credentials may be accepted for TAS.

Curriculum Method Studies

Victorian students do 2 method subjects in each of their two teaching areas (e.g. science plus another subject such as mathematics or PE). The first semester science method subject focuses on general science techniques, especially for junior high school. The second semester science subject breaks into specialty areas for the senior science specialisation. The first mathematics method subject covers mainly junior mathematics and the second has more senior mathematics content (each subject is 3 h/wk face to face, as a tutorial or workshop).

NSW students do two senior science methods and one junior secondary method.

The first TAS method subject focuses on the Computing Studies and Design and Technology 7-10 syllabi, and students focus on individual lessons and short lesson sequences. In the second TAS subject students do either computing or industrial technology at senior high school level.

Teaching Practice

The Victorian students have two field experiences in semester 1 and one in semester 2, totalling 9 weeks (45 days in schools). The NSW students have 6 weeks
of practicum. They also have 9 days of lead-up visits to their practicum school in which they do a range of tasks (this is a strong, school-uni link).

School/Industry Links
As part of the mathematics method subjects, Victorian students assist with the judging of the mathematics talent quest, with teachers from schools. Students sometimes work in a local school which has a special mathematics program. They are encouraged to tutor children in mathematics. Students visit the offices of the professional associations and meet the staff and look at their resources and discuss the issues facing the wider community. There are some common classes and workshops with VUT.

Literacy and Numeracy
This is covered in the general education subjects, and mathematics literacy is covered in the mathematics method subjects (e.g. reading a mathematics textbook, reading a train timetable).

NSW TAS students cover the literacy of technology in their method subjects.

Things We Like
Students find the work practical because it focuses on student learning - how to get students involved in their learning and taking control of their learning (this is particularly important in mathematics, where there is a lot of negativity amongst school students) and strategies for coping with mixed abilities and challenging brighter students.

The TAS students show great improvement in their skills and have reached a good standard in information technology. We are developing software-based teaching resources.

The NSW program has strong links to schools.

Innovations
The school/industry links (above) and the graduate certificate program (below) are noteworthy. Student learning is supported by a website and the program emphasises authentic tasks.

Challenges
Getting enough students who have studied mathematics in their previous degree is a challenge.

Some technology students come in wishing to teach woodwork or textiles and do not realise that TAS teaching now has a much wider scope. Many TAS students don’t have a very academic background.

Building more teaching practice into the program is a challenge.

Other Programs
There is a Graduate Certificate in Middle School Mathematics, which has about 60-70 students and is funded by the Catholic Education Office, so students don’t have to pay fees. This program is for practising teachers who are currently being asked to teach mathematics in schools, but who don’t feel they have the mathematics background to do so (some schools also pay for programs like this because it is hard to find qualified mathematics teachers). There are 4 units, which are mostly
mathematics content, with some pedagogy. The mathematics is taught by modelling good secondary pedagogy. It doesn’t include senior level mathematics.

Marg Horne, Martin Maguire, Peter Taylor

Program Description E2

AUSTRALIAN CATHOLIC UNIVERSITY

BACHELOR OF EDUCATION (SECONDARY) (POSTGRADUATE)

This is a 2-year, end-on program, which has had one cohort of graduates in its present form. There are about 6-10 science students. Students do 18 units, comprising 3 units of general education subjects, 13 units of professional studies units (which include the 4 curriculum methods units) and 2 units of religious studies. Students graduate with 3 teaching areas, one of which is religious studies.

Content/Discipline Studies
Admission requires a degree with 2 curriculum areas (e.g. biology and chemistry).

Curriculum Method Studies
There are two ‘Teaching and Curriculum’ subjects in each teaching area (each subject is 2 h/wk face to face as lecture/workshop). Students with two science teaching areas study four ‘Teaching and Curriculum’ subjects. The first science teaching and curriculum subject covers the nature of science, syllabuses, work programs, teaching methods, language in science, controversial content issues, equity and social justice issues in science. The students are given a firm foundation in outcomes-based education (Years 8-10 science) and objectives (Years 11-12 syllabuses).

The second semester teaching and curriculum subjects are each allocated 3 h/wk. These subjects cover assessment strategies, methodologies as well as content in Years 8-10 science and the Years 11-12 science discipline areas (Biological Science, Chemistry, Multi-strand Science, Physics). These subjects emphasise innovative strategies for teaching each of the curriculum areas.

Teaching Practice
Students have 100 days of field experience. In each of semesters 1, 2 and 3 there is one day per week for 10 weeks and a 2-week block. In semester 4 there are 2 days per week for 3 weeks and a 6-week block. The one/two day per week component is designed to give students a consistent presence in the school and exposure to classrooms and teaching (they teach, form relationships etc).

Literacy and Numeracy
The science method subjects cover language issues.

Things We Like
They are going out to schools every week and are in continuous contact with the school culture and subjects they will be teaching.
Innovations

The nature of science is a strong theme. Constructivism and the idea that scientific knowledge is created by the scientists themselves are also foci. They get a good grounding in outcomes-based education (Years 8-10 Science) and method in their Years 11-12 discipline areas (one third of the semester is used for student presentations based on innovation in science teaching).

Challenges

Ideally there should be more time for the curriculum areas. The variety of backgrounds that students come in with means that some do not have a good grounding in the range of science teaching areas.

Other Programs

The Bachelor of Teaching/Bachelor of Arts is a 4-year program offered in NSW. There are about 20 students in mathematics teaching. It has a mathematics curriculum strand and a science curriculum strand. Students may also do a major or double major in TAS. The mathematics/science/TAS discipline units are general offerings of the School of Arts and Sciences. Students do the same education subjects as the graduate DipEd students. The first two years are mostly discipline studies, the third year is a mixture of discipline and education, and the final year is all education. There is a 4-week block practicum in year 3 (after they’ve done their first curriculum method unit) and a 10-week internship in semester 2 of year 4.

Barbara Odgers (Qld), Peter Taylor (NSW)

Program Description E3

UNIVERSITY OF CANBERRA

GRADUATE DIPLOMA IN EDUCATION: SECONDARY TEACHING

This is a one-year, end-on program, which has been running for many years. There are about 10 mathematics students and about 20 science students enrolled. There are 32 credit points, comprising 24cp of a common core in education and 8cp of curriculum studies.

Content/Discipline Studies

Students have at least second year level mathematics or science in their previous degrees.

Curriculum Method Studies

Students do 2 curriculum method subjects, which may both be in science, or both in mathematics or one of each. Each subject is 4cp (presented as 4 h/wk in two workshops). The first subject is an introduction to lesson planning and teaching strategies focusing on years 7-10. The second subject focuses on senior secondary, and planning units of work. A representative from the School of Information, Sciences and Engineering was present at focus group meetings to design the curriculum method subjects.
Teaching Practice

There are 25 days of professional experience in semester 1 and 25 days in semester 2. During the first 5 weeks students visit schools for 2 days per week (to ease them into the school environment and get them thinking about the whole nature of teachers’ work and the broader school structure, rather than getting them straight into teaching) then they have a 3-week block.

In 2002, the school visits will be one day per week. Also, in semester 2, the school holidays and mid-semester break do not coincide, making it more difficult to arrange a convenient 5-week block for professional experience.

Things We Like/Innovations

There are links between the compulsory information technology subject and the curriculum method subjects, so students are aware of the impact of technology in their particular learning area.

Teachers from local schools regularly come to the workshops to talk to the students.

Students develop a wider view of mathematical literacy – they are challenged to understand what it means to learn mathematics well (i.e. it is more than just rules etc).

In the science method subjects, the lecturer models laboratory strategies and the students do the activities, then the students design their own lessons around the activities. Theoretical ideas about constructivism and misconceptions are built around classroom scenarios, to make the link between theory and practice.

The 2 days per week in schools leading in to their first practicum is innovative.

The mathematics student resource centre is provided by the School of Information, Sciences and Engineering and is available for education students. This was one of the first such centres to provide tutoring and peer support for students in mathematics. The sharing of tutors produces a strong link between the 2 schools.

Challenges

We are creating closer links between the core education subjects and the curriculum method subjects to create a coherent integrated program, without losing the specialty knowledge and expertise which goes with the individual subjects. This includes rationalising the assessment tasks so they are not all due at the same time, including possible integration of assessment tasks.

Other Programs

The Bachelor of Education: Secondary Teaching is a 4-year program, but the intake in mathematics and science is very low (there was no intake last year, and this year there are one or two students). Similarly, the 2-year Bachelor of Education: Secondary Teaching (Graduate Entry) program has one or two students. These students do the same curriculum method subjects as the DipEd students. The B.Ed. (secondary) program has a mathematics major sequence offered by the School of Information, Sciences and Engineering. It contains a mastery program which helps students consolidate their basic skills in mathematics (students are very positive about this experience). There is a self-paced bridging program for students who need it. There is a mathematics resource centre, which is a learning support centre where students can drop in and study the texts, or be tutored. The tutors are shared between
education and engineering and are available in the centre for 35 h/wk. Tutors are also available on Sunday afternoons before exams.

The present programs are being reviewed to create a double degree program with closer links between the schools and the university, so professional experience plays a core role in the program.

Steve Thornton, Jim Woodnough, Mary Hewett

Program Description E4

AVONDALE COLLEGE

BACHELOR OF SCIENCE /BACHELOR OF TEACHING

The Bachelor of Science/Bachelor of Teaching is a 4-year program, which has been running for 2 years in its present form. There are currently 16 students enrolled. The program contains science discipline studies, education studies and compulsory institutional studies. There are 5 subjects in each semester (most are 3 credit points – the maximum weighting for any one semester subject).

Content/Discipline Studies

Students may do a double major (60 credit points up to and including an array of 300 level subjects), or a single major and a minor (48 credit points up to and including 300 level subjects) or a major and two minors (66 credit points up to and including 300 level subjects). Subjects offered at the 300 level include Chemistry, Physics, Mathematics, Biology, Geography and Information Technology. Most students do a major and a single minor. Minor fields can additionally include Food and Nutrition.

Curriculum Method Studies

Students preparing to teach science are required to take a total of 9 credit points of curriculum method subjects. These are usually broken down into six 1.5 credit point units (each requiring 2 h/wk face to face contact). Each student must take 3 credit points of Junior Secondary Methods and students can take up to 3 credit points of Mathematics Methods. Typical Curriculum Method Studies include detailed study of the NSW syllabi involving its content and specific teaching methods related to content. Method studies also include laboratory organisation, safety issues, practical work (including open projects), assessment procedures, use of resources and independent information research.

Teaching Practice

There are two weeks of practicum in semester 1, 3 weeks in semester 3, 3 weeks in semester 5, and 9 weeks in semester 7. Practica are held during university vacation time to avoid clashes with the discipline subjects.

Literacy and Numeracy

Topics involved in literacy are included in a number of subjects such as ‘Introduction to Teaching’, ‘Learning Theories’ (which has two sessions on reading
literacy and teaching reading in secondary content subjects) and in the Curriculum Methods classes.

School/Industry Links

Ten hours of each curriculum method subject must be done with practising teachers. Students are actually bussed to participating secondary schools, where participating school teachers can discuss a range of topics including school or laboratory organisation, marking and assessment. In addition, students visit and observe teachers as part of their first year general education subjects.

Things We Like

Graduates tend to be flexible teachers who exhibit 'hands-on' skills.

Innovations

The curriculum method subjects have a high involvement with teachers in both private and government schools (these visits are funded). The College also runs a supervised coaching program for high school students within its own buildings but employing undergraduate preservice science teachers.

Challenges

Funding the program is always a major challenge. For example, laboratory equipment in the Avondale College Science Department is of tertiary standard, however, students need hands-on experience with equipment used in schools (for example, less intricate data loggers).

Other Programs

Avondale has a 2-year, end-on Bachelor of Teaching in which the education component runs in conjunction with the double degree program. There are currently some 5 students enrolled.

Cedric Greive

Program Description E5

CHARLES STURT UNIVERSITY

GRADUATE DIPLOMA OF EDUCATION (SECONDARY)

This is a one-year, end-on program, which has been running for many years. There are about 20 mathematics teaching students and about 80 science teaching students (nearly all are by distance education). Students do 8 subjects of which 5 are core education subjects, 2 are curriculum method subjects and one is an elective (or a second method).

Content/Discipline Studies

Admission requires an undergraduate degree in an appropriate discipline area. Many of the mathematics education students have engineering or mathematics degrees.

Curriculum Method Studies
There are two method subjects in each specialisation (e.g. science or mathematics). The second subject has more senior syllabus content than the first. These subjects are only done by distance mode. There are six hours of residential school for each subject.

Teaching Practice
There are 8 weeks of practicum - 4 weeks in semester 1 and 4 weeks in semester 2.

Literacy and Numeracy
In the second curriculum method subject they do reading and assignments and in-school workshops on literacy (in both mathematics and science). Students are given quite a strong base in mathematics literacy.

School/Industry Links
There are informal school visits which individual students can organise. Future assignments will be more school-based.

The second curriculum subject articulates closely with NSW HSC On-Line (mathematics).

Things We Like
The residential school works well – students mix with students in other subject areas. CSU has a strong on-line profile - in the 2 method subjects there is a strong communication and teaching and learning on-line model. These 2 subjects are a way of demonstrating teaching and learning on-line (there are weekly links etc)

Innovations
The articulation with HSC On-Line and the whole on-line enhancement of the subject is innovative.

Challenges
The problem of lack of face to face communication in distance education is being treated by on-line enhancements and residential schools.

Bob Dengate

Program Description E6

CHARLES STURT UNIVERSITY

BACHELOR OF TEACHING (SECONDARY)/BACHELOR OF SCIENCE

This is a 4-year program, which is in its first year of operation. There are 11 students currently enrolled, of whom 4 are mathematics specialists. Students do 16 discipline subjects and 16 education subjects. There are some education subjects in each year but education subjects increase towards the end of the program.

Content/Discipline Studies
Students do a major (to year 3 level) in biology, chemistry, earth science or mathematics, and a minor (to year 2 level) in biology, chemistry, earth science or
physics (mathematics students must do an information studies minor). All are Faculty of Science and Agriculture general offerings.

Curriculum Method Studies

There will be 3 science method subjects (mathematics majors will do 2 mathematics method subjects and a computer studies method subject). Each will be 4 h/wk of face to face. Methods one and two will be the same as the ones currently operating in the Graduate Diploma of Education (Secondary) and the students will be in the same classes (the third method will be new).

Teaching Practice

There is a one-week orientation during the July break in year 1 (comprising 2 days in a primary school and 2 days in a high school, to look at transition aspects) and a week in a high school science class in June (during the university vacation to avoid clashes with discipline subjects). In year 2 there will be 3 weeks, in year 3 there will be 9 weeks, and year 4 will have a 10-week internship in which the students take a full teacher's load. It is hoped to use the university exam period for practicum to avoid clashes.

Literacy and Numeracy

The subject ‘Literacy Across the Curriculum’ presents strategies for developing literacy and numeracy across the curriculum. Some literacy and numeracy is also covered in the methods subjects.

School/Industry Links

Students who major in chemistry will have a chemistry industry experience (as part of their discipline study).

Things We Like

There is a good balance of discipline and education. There is a strong emphasis on field experiences.

Innovations

There is a strong focus on rural schools. Students are expected to do practica at rural schools. Several subjects have content that deals with teaching in small rural secondary schools. There is a special subject about teaching in rural secondary schools (which looks at living and teaching in small communities). Students develop competencies in audiographics telecommunications packages that are used in regional areas.

Challenges

The timetabling of subjects across 3–4 different schools at the university is a challenge.

Colin Boylan
MACQUARIE UNIVERSITY

BACHELOR OF SCIENCE DIPLOMA OF EDUCATION

This is a 4-year program, which has been running for many years. There are about 25 science students and 12 mathematics students in the final year (these include numbers in the graduate program as well). Students do 92 credit points, of which 24 are in education and the rest are in the science faculty. The B.Sc. part of the program predominates during the first two years.

Content/Discipline Studies

Students do a B.Sc. with a major up to year 3 level in one of the teaching areas and a minor in another. All subjects are general offerings of the science faculty.

Curriculum Method Studies

Students do 3 methodology units in year 4. There is a core unit, which focuses on lesson planning, learning outcomes and teaching strategies with a focus on junior high school (3 credit points, presented as 3 h/wk of workshops for one semester). Students then choose 2 units (a major and a minor) from biology, chemistry, physics, earth and environmental science (presented as two lots of 2-hour workshops each week for one semester). The specialist subjects are usually taught by casual staff who are practising teachers.

There are corresponding mathematics method subjects.

The science method lecturer teaches in a laboratory in the science building and has very close links with the science faculty.

Teaching Practice

In year 3 the students have 9 days in schools, over two semesters. In year 4 there are 37 days at one school (1 day per week with a master teacher for a period, then 2 blocks).

Literacy and Numeracy

This is integrated across the general education subjects and the method subjects.

School/Industry Links

In year 3 the secondary student teachers visit a primary school for 2 days. They also visit a non-school, education provider for 2 days and work with the education staff (e.g. at the museum). Students visit field studies centres as part of their method subjects.

Things We Like/innovations

The practicum model is a developmental model (rather than just blocks) so students have the opportunity to put into practice the pedagogical skills they have developed over time. They also develop a rapport with a particular Master Teacher and an ongoing presence in schools (instead of having practica in different schools they are attached to only one school in year 4). Teacher education has a whole university focus because the content studies are based in other faculties.
There is a strong relationship between the curriculum lecturers, the master teachers in the schools, and the students. The curriculum lecturers observe students in schools, provide feedback and liaise with the master teachers. There is a strong network of teachers involved in the program and they are also provided with professional development.

The senior science syllabus studies include intensive study of the syllabus and many of the practicals which are specific to each content area. Students are required to develop a unit of work related to one of the content areas (which they can then use after they begin teaching). The teachers involved in the program have a lot of credibility with the students because they are currently teaching the content in classrooms, and they can present current materials that have been introduced for the new syllabi. The assignments in the first semester course are research based. This means that students conduct research in their practicum school on pupils understandings of concepts and the skills of their master teacher. This is a valuable assignment because students not only review the research literature, but they also become directly involved in action research.

Challenges

Loss of staff has made it more difficult to maintain the links with schools (by reducing the number of school visits). Keeping schools involved in the program is a challenge as schools are overburdened.

It is difficult to get good methods lecturers from schools (ideally they should be seconded for more than 12 months).

The new HSC has involved many changes, and method lecturers need to come to grips with these changes in several different syllabi.

Other Programs

The Graduate Diploma in Education is a one-year, end-on program. It is a more intensive program, and includes a one-month course run during February. After the February program, Grad Dip Ed students combine with the continuing students for the methodology-based units.

Grant Kleeman, Christine Preston

Program Description E8

SOUTHERN CROSS UNIVERSITY

GRADUATE DIPLOMA (EDUCATION)

This is a one-year, end-on program, which has been running for about 10-15 years. It was expanded to include science about 5 years ago. There are 15-20 students in science (there is no mathematics delivered locally). There are 8 education offerings and no electives.
Content/Discipline Studies

Students must have a previous degree which enables them to teach at least two of the sciences at secondary school. Most of the students have biology or geography.

Curriculum Method Studies

Students do 2 curriculum units in their specialisation area (ie. one quarter of the program is curriculum). The first has a focus on years 7-10 and the second focuses on senior level. These subjects are taught by casual staff who are practising teachers and the teaching is done in their schools (5 h/wk face to face for 13 weeks, presented as 4-7pm two evenings per week in the school laboratory).

Teaching Practice

There is a 3-week block and a 4-week block, and 10 single-day visits to schools (which are timed to precede the blocks).

Literacy and Numeracy

This is covered in the curriculum subjects usually taught by practising teachers.

Things We Like/Innovations

The use of casual staff who are practicing secondary teachers makes the program directly relevant to the classroom. They model teaching approaches, and the students feel this input is very relevant.

The double degree program (below) offers science discipline subjects with an educational focus.

Challenges

The use of casual staff who are practicing secondary teachers also may have the drawback of there perhaps being less focus on broader pedagogical and research issues such as constructivist learning. Also, these classes always have to be after hours because of the availability of these teacher-lecturers.

Other Programs

Along with 4 other combined degrees there is a 4-year Bachelor of Applied Science, Bachelor of Education (Secondary) degree with 15-20 science students (there is no mathematics intake) which has started running this year. They do 20 units in the Bachelor of Applied Science component, and 8 of the 12 education units are common to the DipEd. Most of the applied science component occurs during the first two years. Students choose a major (6 units) from biology or geography, and can complete up to 3 units in chemistry. In four of the Applied Science units there must be an educational focus in their assignments (e.g. their assignments could relate to schools or education in the community, and this is coordinated with the science lecturers). There is an ‘Integrated Project’ in the applied science component, in which the education students will be required to do an education/school-based project. Of the 100 practicum days in the program, 20 are completed in education oriented settings within the first degree units.

Keith Skamp
UNIVERSITY OF NEW ENGLAND

BACHELOR OF SCIENCE/BACHELOR OF TEACHING (SECONDARY TEACHING)

This is a 4-year program, which is in its fourth year of operation. There are about 5 students in each year. During the first 3½ years students complete their discipline studies. The education units start in the second semester of year 3. There are 192 credit points of which half are in Science and half are in Education. The education component comprises general education subjects, curriculum subjects and electives.

Content/Discipline Studies

Students do a major in one science or mathematics and a minor in another science or mathematics. The major comprises subjects to year 3 level and the minor comprises subjects to year 2 level (all are general offerings of the Faculty of Science). The Faculty of Science has also suggested some proposals for programs.

Curriculum Method Studies

Students do two method subjects for science. The third year unit (12cp) focuses on junior secondary, and the fourth year unit (12cp) focuses on senior science. Each subjects represents 3 h/wk face to face on average. Mathematics students have parallel subjects.

Teaching Practice

Students have a total of 60 days in schools. There are two block practica of 20 days each (in year 3 and year 4) and two lots of 10 dispersed days (one day per week) in schools in year 3 and year 4. Each student is attached to the same school for all the dispersed days, but attends on different days of the week.

Things We Like/innovations

The combined degree provides an alternate pathway to the profession. There is a commitment to teaching right from the start, in comparison to end-on programs (during the first orientation week of their science component they meet the Education coordinator and are welcomed to the profession.

There is an extensive program involving school and community activities that is operated as part of the science method subjects, but is a ‘compulsory optional extra’ which receives no allocation of credit points. Friday of every week is kept free of lectures. Every week, students have an activity such as visiting an independent school to study laboratory safety, teaching a lesson in a state school, participating in an integrated field trip, visiting a primary year 6 class, visiting a high school to experience science-related vocational education, a two-day mines tour in the Hunter valley, visiting a local mine, visiting an urban environment to identify links to science, and visiting an environmental education centre to study the environmental education policy. Students are very positive about these experiences.
Challenges

The program is offered across faculties, which creates communication challenges.

Other Programs

The Bachelor of Teaching (secondary) is a 2-year, end-on program, which is in its second year of operation. Students are combined in method subjects with students in the other programs, but the combined number is 21 internal and 82 external students for science teaching (this university has one of the biggest cohorts for science). There are 5 days of observation in schools dispersed over term 1. There is a block practicum of 3 weeks and a second block of 4 weeks. There is an internship in year 2.

The Graduate Diploma in Education (secondary) is a one-year program, which has been operating for many years. It does not contain the internship or the research project. The other subjects are basically the same as the BT program, and students are combined in the method classes.

Paul Muirhead, David Daniels

Program Description E10

UNIVERSITY OF NEW SOUTH WALES

BACHELOR OF SCIENCE/BACHELOR OF EDUCATION

This is a 4-year program, which has been running for about 8 years. There are about 8-10 students in each year (roughly half mathematics and half science). There are 96 units of science subjects and 72 units of education. During the first three years, students do mostly science subjects and a small number of education subjects, then the 4th year is all education.

Content/Discipline Studies

Students do a B.Sc. with a major (subjects to year 3) in mathematics or one of teaching sciences. The science students do a minor (subjects to year 2) in another teaching science and first year subjects in 2 other teaching sciences. The mathematics students do a minor in any other area. All discipline subjects are general offerings of the Faculty of Science.

Curriculum Method Studies

Students do 2 curriculum method subjects (each is 6 units) in each of their two teaching areas. In science, the 2 method subjects are combined and presented as 8 h/wk face to face, presented as 2 hours per night for 4 nights, for 14 weeks in semester 1 and 7 weeks in semester 2. The science subjects are taught by casual staff who are also classroom teachers. Teaching strategies are modelled, particularly by using physics examples, then the students submit assignments based on their own discipline area. They cover theories of learning, teaching strategies appropriate to these theories, peer teaching and micro teaching (which is located in a school laboratory, so they have to order their equipment with the science assistant, and
checking the equipment and packing up are their responsibilities). In semester 2 the focus is on the senior syllabus. The mathematics students also do a double mathematics method, which is taught by subject head teachers.

Teaching Practice

There are 40 days of practicum, which is all in the second semester of year 4. Starting next year there will also be a teaching block in 3rd year. At the beginning of 4th year there is a schools visit week in which students observe in schools for 5 days.

Literacy and Numeracy

This is covered in the method subjects. The lecturers have a strong background in literacy, and science literacy and general language skills (e.g. worksheets, listening skills and presentation skills) are covered in depth.

School/Industry Links

Students go to the zoo and the museum and go into classes that are held there to see how the education departments operate there and what they have to offer the junior and senior syllabi.

Things We Like/Innovations

The use of part-time method staff has been popular with the students. These are current teachers, and the students value their input.

In future years they would like to include members of the Science Teachers Association in the practicum experience. These teachers would be targeted as mentor/supervisors for practicum. Students would go to schools one day per week. This would help to address the problem of the great variability of students’ experiences in practicum schools.

The method lecturers are able to concentrate on presenting effective and innovative teaching strategies (e.g. constructivist teaching strategies, discrepant events, social discourse) rather than having to teach content as well.

Challenges

The difficulties of science teaching in general are that school students don’t want to do science, and not many people want to teach science.

It is difficult to incorporate extra time into the practicum. Getting students into appropriate school environments at least one day per week would allow them to establish a continuous presence in the school, so the kids get to know them before their block practicum.

Other Programs

The Graduate Diploma in Education (Secondary) is a one-year program, which has been running ‘since the beginning of time’. It is exactly the same as the 4th year of the double degree program and students sit in the same classes with the undergraduates. There are about 15 science students and about 6 mathematics students.

Michael Matthews, Rick Connor
Clever Teachers, Clever Sciences

Program Description E11

UNIVERSITY OF NEWCASTLE

BACHELOR OF TEACHING/BACHELOR OF SCIENCE

This is a 4-year program that has been running for 6 years. There are 5-10 science students and 5-10 mathematics students in each year. There are 320 credit points, of which 140 are mathematics/science discipline studies and 180 are education studies. During the first three years, students do a combination of discipline studies and educational studies. The final year is all education studies.

Content/Discipline Studies

Science teaching students do a major (subjects to year 3 level) in one science and a minor (subjects to year 2 level) in another science (chosen from physics, chemistry, biology or geology). At least one of the major or minor must be physics or chemistry. All subjects are general offerings of the Faculty of Science and Mathematics.

Mathematics specialisation students do 110 credit points of mathematics subjects and 30 cp of electives (most students choose science or computing electives). The Faculty of Science and Mathematics has an appointed coordinator for the mathematics/science/component of the program. One of the mathematics subjects is specifically designed for teachers (it covers secondary syllabus content which might not otherwise be in the program) but the other subjects are all general offerings.

Curriculum Method Studies

Students do four method subjects (30cp in total) in their teaching specialisation (mathematics students often do 3 mathematics method subjects and one science method). The first subject focuses on lesson planning and management, the second focuses on teaching strategies, the third focuses on programming and assessment, and the fourth focuses on current issues. The mathematics method subjects parallel these themes.

Teaching Practice

There are two practica (4 weeks in year two and 4 weeks in year three) and there is a 9-week internship in year four. In addition, the students have observational visits to classrooms during year one as part of their general education subjects.

Literacy and Numeracy

These issues are covered in the year four subject ‘Literacies Across the Curriculum’ and also in the specialist method classes.

School/Industry Links

As part of their first science methods subject, the students attend one science lesson per week at a local high school. They are required to act as ‘teacher aides’ by performing activities such as assisting groups or individuals, teaching at workstations and preparing laboratory equipment. They are also required to observe the structure of the lessons and the management strategies used by the
teacher. The mathematics method classes are taught by casual staff who are also teachers in schools. The students sometimes visit these schools.

**Things We Like/Innovations**

Students have a rigorous discipline component, especially the mathematics students. The program has a large component of science/mathematics methods classes, which complement the discipline studies.

The internship is linked to a school-based action research project.

**Challenges**

The main challenge is to attract more students into the program. At the moment, the very low numbers make some subjects in this program uneconomical.

**Other Programs**

The Diploma in Education (Secondary) is a one-year, end-on program, which has been offered for many years. There are 15-20 science teaching students but no mathematics students. Students do 3 method subjects – in two of them they are combined with the undergraduate students, but in the third they are separate.

David Palmer

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**Program Description E12**

**UNIVERSITY OF SYDNEY**

**MASTER OF TEACHING**

This is a 2-year, end-on program for mathematics, science and TAS teacher education (it also has a primary intake, which is summarised elsewhere) which has been running since 1996. There are roughly 20 science students in each year and slightly less (15-20) in mathematics and about this number in TAS too. There are general education components, method subjects, and across-curriculum units (e.g. IT, special education).

**Content/Discipline Studies**

Admission requires a degree with a major in each of their teaching method areas: science, mathematics or TAS. Science candidates require both a major in a natural science and at least one year in another science. As well, science students need either: (A) a major in another teaching subject to do a second method, or (B) a third science (of at least one year) if they are doing science as their only method (i.e. double method science).

**Curriculum Method Studies**

Students do two method subjects (each is 4 h/wk face to face for the full year of 18 weeks - a core lecture/seminar plus 2 laboratory sessions), with double method work (8h/wk) in the one curriculum area possible. The major focus for the curriculum work is seminars (formal lectures are a minor proportion). The single science method covers mostly junior science and the double method subject covers
senior science areas. The mathematics and TAS method subjects are similar - they all do the core single method and some do the double method.

Teaching Practice

First years have a 5-week block preceded by 3 all-day visits in the 3 weeks before the block (28 days) in August/September. Second years have a 4-week block in May (5 days per week for 4 weeks = 20 days), then a 10-week internship in third term. They return for an intensive 3-day conference (the conference has presentations of their action research projects and case studies results).

During the first 6 weeks of the program they have one day per week in schools doing observations as part of their general education subjects.

Things We Like

It is seminar-based rather than lecture-based. It is based on collaborative learning and problem based learning (rather than 'lectures from the experts'). The feedback from students is positive.

Innovations

The whole program is based on the problem-based learning model. It is student-centred and issues-centred. Students look at particular case studies in depth and use them to look at educational issues. During term 1 of the program they are introduced to collaborative, case-based approaches and report their findings in seminars. The cases are developed by practising teachers and represent real school situations. Then they author and develop cases of their own based on their experiences in schools (in their day release in first term and their subsequent practicum experiences). This carries on to the science curriculum work, which integrates research findings with student research of issues and observations of issues.

The program is heavily integrated with technology, rather than as an add-on. There is a web site for chatlines, placement of student work and accessing information and resources. The technology units ensure that the students have the basic competencies to use the technology in the curriculum subjects.

Challenges

Funding is needed to acquire getting cutting-edge science laboratory equipment and to sustain a science consumable budget.

Other Programs

The Bachelor of Education (Secondary Science)/Bachelor of Science is a 5-year program which has been running for two years. Students do a major and a minor in the science faculty. There are about 10 students in each year. Their general education courses will be in years 1, 2 and 3, their professional education subjects will be in years 3, 4 and 5 and their curriculum subjects will mostly be joint classes with the MT, but the general education subjects will be less problem-based than the MT. The teaching practices will be similar.

The undergraduate program for design and technology students is a 4-year program, the Bachelor of Education (Secondary: Design and Technology) with TAFE and university studies. In year 1, students complete a level 4 TAFE certificate. In years 2 and 3 they do a TAFE course unit on design fundamentals and begin their
university based education and curriculum studies, including practicum. In fourth year they complete their education and curriculum studies, a practicum (3 weeks), an internship (5 weeks) and a school-based graduating design project. The program had its first intake in 2000 and has 15-20 students.

Tony Sperring

Program Description E13

UNIVERSITY OF TECHNOLOGY, SYDNEY

GRADUATE DIPLOMA OF EDUCATION

This is a one-year, end-on program, which has been running for about 10 years (but this is the first year that TAS has been offered). There are about 18 science students, 6 TAS students and no mathematics students. The program has general education subjects, practicum and curriculum method subjects.

Content/Discipline Studies

Science education students require a previous degree with at least a minor in one of the sciences.

TAS students do some content in design and technology as part of the program.

Curriculum Method Studies

All the curriculum method subjects are Education offerings. The science method subject and the TAS method subject (each is 7cp) are presented in four 2-hour tutorials (8 h/wk face to face) which gives students an intensive experience in basic classroom skills before their first field experience, which is after week 3.

The first semester science method subject focuses on how children learn (done jointly with the TAS group), plus lesson planning and teaching strategies. The syllabi are introduced but not in depth. The second semester subject focuses on specific sciences (physics, chemistry, biology and geology) at senior and junior level. It includes some peer teaching.

The first semester TAS method covers some D&T content and some learning theory. In second semester, they study workshop skills and have a design project, as well as a more in-depth look at the relevant syllabus for their specialisation.

The Faculty of Design, Architecture and Building is involved in the workshop and project aspects of the TAS subjects (e.g. by supervising workshops).

Teaching Practice

There is a 5-week block in each semester (at different schools). The first involves one week of observation (and some teaching) early in the semester (so students can experience a school environment, and if they don't like it they can drop out of the program before the HECS due date). There are university tutorials linked to practicum (they cover legal issues, ethical issues, social issues, sport, voice projection etc). From time to time students spend days in primary schools as part of their general education subjects.
Literacy and Numeracy

The science and literacy document is studied in the curriculum subjects.

Things We Like/Innovations

There is a strong link between the curriculum method subjects and practicum. The method lecturers do practicum supervision. The program is currently being developed to include a lot more immersion in school.

Challenges

The TAS students sometimes are asked to teach woodwork or metalwork in schools and many of them do not have these in their previous degrees. The range of subject areas in TAS is large, so it is difficult to adequately prepare teachers.

Curriculum method subjects are separate from general education subjects).

There is a lot of content to cover in the short time of one year.

How to make best use of the first practicum is problematical, given that the DET interviews these students in August, rather than towards the end of the year.

Other Programs

The Bachelor of Science (Science Education) is being phased out. It was a 3-year science degree with a Graduate Diploma in Education, but the DipEd subjects were located at the beginning of third year and the end of fourth year. This formula was not popular with students, who wanted to continue the education component after they had started it. Through this degree there were good relationships established with the science faculty and the content of the subjects was discussed.

A 4-year program in mathematics, science and technology is currently being developed.

Janette Griffin

Program Description E14

UNIVERSITY OF WESTERN SYDNEY

GRADUATE DIPLOMA OF EDUCATION - SECONDARY

This is a one-year program, which has been running for many years. There are about 190 students (about 25 science, and about 12 mathematics of whom 4 are mathematics majors) at Penrith and about 100 students (about 20 science) at the other campus. Students do 100 points comprising general education subjects, practicum and method subjects.

Content/Discipline Studies

Admission requires a previous degree with 2 science teaching areas; one as a major and the other as a minor. The mathematics requires at least a minor if in conjunction with another teaching area or a major in mathematics if it is the only teaching area.
Curriculum Method Studies

Each student does 2 method subjects in each teaching area (all are Education offerings, of 10 credit points, presented as 3 h/wk of workshop). Students doing a double method in science or mathematics do ‘Science 1A’ and ‘Science 1B’ in semester 1 and ‘Science 2A’ and ‘Science 2B’ in semester 2. Students who are doing science and mathematics do the compulsory science methods (1A and 2A) and the compulsory mathematics methods (1A and 2A). The 1A and 1B subjects focus on junior high school, and the 2A and 2B subjects focus on senior high school. The ‘A’ subjects concentrate on the syllabus, while the ‘B’ subjects emphasise other issues such as (for science) laboratory strategies, safety, classroom research and assessment and (for mathematics) extension courses.

The lecturers in the science methods subjects have links with the science faculty through their research. In the mathematics subjects, CD-ROMs are used to provide classroom vignettes.

Teaching Practice

In semester 1 there are 4-5 lead up days in schools (observation and familiarisation) then a 3-week block. In semester 2, there is a lead up of 3 or 4 days, then a 4-week block.

Literacy and Numeracy

The core method subjects contain a literacy and numeracy component. Students study the documentation and write lesson plans and units of work which incorporate strategies from the literacy/numeracy document (including assessment tasks).

School/Industry Links

Head teachers are occasionally invited to campus for tutorial input. The NSW Minerals Council representatives speak to the students each year. There is an overnight field trip associated with the environmental education guidelines. Some students join the NSW Science Teacher’s Association and help with Association activities, and some publish in the Association journal.

The mathematics students are signed up as student members of the Mathematics Association of NSW, and they attend professional development activities (including the HSC examiners day) so they get to know the professional association and have contact with teachers.

Things We Like

We model a constructivist approach, which is very hands-on. We ‘practice what we preach’ by modelling the sorts of teaching that we would want the graduates to do in schools.

The mathematics students develop as professionals through their contacts with the mathematics associations.

Innovations

The science subjects introduce strategies such as debate and role play scenarios. We emphasise that science can be interesting and motivating to kids, and it needs to be
hands-on and relevant to their real life experiences. Students develop web site material.

The mathematics students have a MAPS web site which can provide support while students are on practicum, and it contains lists of mathematics sites covering issues as well as discussion groups. The AAMT (Australian Association of Mathematics Teachers) runs a virtual conference each year to which the students have access. Technology is a strong aspect of the mathematics course (e.g. the students are very competent with graphics calculators. The links with the mathematics association are innovative. The subjects are modified according to feedback from the students.

Challenges

Students have previously been taught science by chalk and talk, so their view needs to be changed to a more student-centred approach to learning.

The limited time in the program is a major constraint. Students need time to develop a personal belief structure about teaching.

Other Programs

The Bachelor of Science/Bachelor of Teaching will begin next year.

The Master of Teaching was added about 3 years ago (in anticipation of compulsory 2-year teacher education) but nearly all the students leave with a DipEd at the end of the first year.

Kevin Watson, Alan White

Program Description E15

UNIVERSITY OF WOLLONGONG

GRADUATE DIPLOMA IN EDUCATION

This is a one-year, end-on program, which has been running for many years. There are usually about 20 science and 20 mathematics students. The program runs over an extended academic year of 36 teaching weeks. There are 48 credit points, which are all Education offerings.

Content/Discipline Studies

Students require a science/mathematics/engineering degree and a credit average to get into this program.

Curriculum Method Studies

There are two science method subjects, which are based in schools. The first half of the year concentrates on the junior syllabus, then the second half of the year covers the major senior syllabi (chemistry, physics and biology). All students study all of these. These subjects are taught by practising teachers who are employed as casual lecturers. Students work with the teachers in their school classes. Most classes are held after school at the school or university, then students go to schools to do activities related to the lectures. These are very popular with students.
Teaching Practice
Currently, there are 10 weeks of practice teaching plus some additional observation days. In 2003 we plan to extend the school-based practicum to 11 weeks and include 3 weeks of practicum at a variety of non-school education sites.
The current practicum consists of a 2-week introductory block plus a number of one-day experiences, followed by a 7-week block.

Literacy and Numeracy
These are covered in one of the general education subjects.

Innovations
The external methods lecturers help to set up very good links to schools.

Challenges
Integrating IT into the program and extending the practice teaching are the main issues. These will be incorporated into the new program.

Brian Ferry

Program Description E16

NORTHERN TERRITORY UNIVERSITY

BACHELOR OF SCIENCE/BACHELOR OF TEACHING
This is a 4-year program which has been running for 3 years. There are about 10 students enrolled. This program is designed for both secondary and primary education. Students do 320 credit points of which 150 are education, 80-100 are science faculty offerings, 20 are NTU compulsory units (e.g. ‘Northern Australian Studies’) and the rest are electives from any faculty. The difference between the primary and secondary streams occurs in the education subjects – the primary teaching students do learning areas subjects while the secondary students do secondary method subjects. Students are required to complete their science discipline studies in the first three semesters. From semester 4 onwards, the students do their electives, education and compulsory subjects.

Content/Discipline Studies
Students do a major in science (e.g. biology, chemistry, mathematics) with at least 40cp at level 3, and they must also complete a minor in a second teaching specialisation. These are general B.Sc. offerings from a selected list.

Curriculum Method Studies
Primary teaching students do primary methods subjects in mathematics, science, technology and the other learning areas (the same subjects as in the other primary programs).
Secondary teaching students typically study two methods subjects in their major and one method subject in their minor (each is 10 credit points presented as 3 h/wk face to face).
Teaching Practice

The primary students have a 20-day block, then a 25-day block, then a 36-day block. These may be done at any time but not before semester 4.

The secondary teaching students have a 25-day block, a 30-day block and a 25-day block. These may be done at any time but not before semester 4. Students often choose to do ATET (Adult Teacher Education and Training) distance subjects as electives, so they don’t interfere with practicum.

Literacy and Numeracy

The science method courses include elements of literacy and numeracy. Given the fairly extensive literacy problems in early secondary schools. These people who have primary literacy training could be teaching science (and using science to teach literacy), which is a strength of this program.

School/Industry Links

On occasion, a representative from the Minerals Council comes to talk to the students.

Things We Like/Innovations

Primary education students can do a major in science. It gives students flexibility and students can follow their interest in science. It gives them skills that are not normally available in primary schools (in a wide range of science-related subjects). It is hoped that graduates from this program can change the science situation in primary schools.

The teaching practice subjects contain a good balance of theory and practice. The science method subjects contain an information technology component. Students are able to use ‘Blackboard’ to access lecture notes. They are also required to use it to find other sites on the web to find information and to allow comments on each others’ work.

Challenges

Students transferring in from other courses create a challenge. There is pressure on resources, making it more difficult to set up specialised classrooms. Financial pressure makes it more difficult to maintain a comprehensive journal collection in the library, and to employ more than a minimum of one science education specialist.

Other Programs

The one-year, end-on Graduate Diploma in Secondary Education has been operating for about 17 years. It is designed to train teachers for secondary science and mathematics teaching (most graduates will be qualified in both areas). There are currently 13 students enrolled (about half are majoring in science and half in mathematics). They do the same method subjects as the undergraduates. There are 58 days in schools, including a pre-semester subject consisting of a 2-day introduction followed by 3 days in schools (this is designed to help students to make up their minds about whether teaching is for them).

Nola Oliver, Bill Palmer
Program Description E17

CENTRAL QUEENSLAND UNIVERSITY

BACHELOR OF HUMAN MOVEMENT SCIENCE / BACHELOR OF EDUCATION (SECONDARY)

This is a 4-year program, which is about 5 years old. In each year, about 10-15 of the students are taking science as a second teaching area. Students are required to complete 36 units (subjects). There are some discipline subjects in each year and some education subjects in each year, and on balance the discipline subjects predominate during the first three years.

Content/Discipline Studies

Students complete 14 units from the Bachelor of Human Movement Science program (e.g. human anatomy, exercise physiology) and another six units from another degree (in the case of students who wish to teach science/mathematics, these units are typically plant biology, animal biology and chemistry subjects, or mathematics subjects). These subjects are general offerings outside the School of Education, but there is some tailoring of content to suit the needs of the Education students.

Curriculum Method Studies

Students must do two units of secondary science curriculum and pedagogy. The first unit covers curriculum, learning theories and laboratory work for teaching years 8-10, and the second unit covers senior high school.

Teaching Practice

There are 100 days of teaching practice, 80 of which are under the supervision of registered teachers. In year 1 of the program there are five one-day visits to a school. In year two there is a 4-week block in February. Professional Practices three and four (year 4) are one 4-week block and one 5-week block. Students spend an extra 20 days in teaching-related activities such as coaching or teacher support. Other informal in-school experiences are often organised by individual arrangement.

Literacy and Numeracy

These are covered in the methods subjects. The new Bachelor of Learning Management will contain a numeracy and a literacy competency.

School/Industry Links

As part of the first science method subject students are required to plan and teach a mini unit to year 8 or 9 classes in a local school.

Things We Like

The combined degree is only four years so it is the shortest route to teacher education and suits students who are focussed on becoming good teachers.
Innovations
There is a shortage of science teachers and this program allows good students to get through the system quickly and efficiently and out into schools. Teachers need to be well educated about how teaching, learning and content knowledge fit together. Well-educated teachers employ innovative pedagogy that includes investigating, thinking and exploration. Just content knowledge by itself does not lead to quality teaching.

Challenges
There is a lack of control over the discipline content. Discipline subjects are selected by the cooperating faculty and are not always the best mix for teacher education students.

Other Programs
There are several other combined degree programs which have a similar structure to the above and which produce mathematics/science teachers:

The Bachelor of Science / Bachelor of Education (Secondary) which has majors in aquatic resource management (6-8 students), chemistry (5 students) and biology (12 students in total).

The Bachelor of Science (Applied Physics) / Bachelor of Education (Secondary) has 20 units of physics/mathematics discipline studies and 16 units of education studies. There are 2 students in total.

The Bachelor of Mathematical Science / Bachelor of Education (Secondary) has 14 or 15 units of mathematics, 5 or 6 units from another teaching area, and 16 units of education studies.

The Bachelor of Education (Secondary) is a 4-year program, which has about 10 science/mathematics students and is currently being phased out.

All combined degree students study the same set of 16 education courses, except in their choice of curriculum and pedagogy areas.

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Program Description E18

CENTRAL QUEENSLAND UNIVERSITY

BACHELOR OF LEARNING MANAGEMENT (PRIMARY AND SECONDARY)

The Bachelor of Learning Management is in its first year of operation. It is a 4-year program, but it can be fast tracked to 3 years by undertaking extra courses intensively in the Spring Term - a 6-week term in November/December. There are about 550 primary/early childhood students across all campuses and 90 students enrolled in the secondary program (of which 3 students are mathematics/science).

The BLM was developed to complement the Queensland New Basics program. Students do a total of 32 courses (subjects) of which 12 are discipline studies (for
the secondary students). These are done during the first 2 years. In the education component, there are 12 core compulsory courses, which all students do. These cover 4 major domains: pedagogy (KLA), futures (looking at the trends of today to plan strategies for dealing with issues and needs in schools of the future), networks and partnerships (which covers support networks for teachers, students and parents) and professional knowledge (general teaching strategies).

Content/Discipline Studies

The primary students can elect an optional mathematics/science discipline strand comprising 2 mathematics and 2 science subjects which present content knowledge for schools. These are Education offerings.

The secondary students do 6 courses in each of two teaching areas (e.g. chemistry and physics). These are faculty of science general offerings.

Curriculum Method Studies

Secondary students do 2 curriculum subjects for each of their teaching areas. The first focuses on years 8-10, and the second focuses on 11-12 (each is 3 h/wk face to face, presented as a lecture and a tutorial).

Teaching Practice

The primary students have 130 days in schools. During Term 1 they teach 2 h/wk each week with primary students. In Term 2 they are in schools one day per week doing tasks related to their professional knowledge strand, and another 15-25 hours which each student spends with a Learning Manager (experienced teacher) discussing issues related to each individual student’s needs. In year 2 there is a 3-week block in Term 1 and a 3-week block in Term 2, plus 30 hours with a Learning Manager. In third year there is a 4-week block and a 10-week internship.

The secondary students have 100 days in schools. There are 10 one-day visits in Term 2 of first year. In year 2 there are 10 days per Term (there is no block practicum because of their commitments with other faculties – the actual days are negotiated with the teachers). In year 3 there are 3 weeks in February, 10 days during first term, and 10 weeks in Term 2.

Literacy and Numeracy

The secondary students do the subject ‘Teaching Curriculum Literacies’ which covers literacy and numeracy.

School/Industry Links

The secondary students are involved in the Mathematics Challenge for primary and secondary schools (judging and helping to run it). There is an on-line mathematics club which students participate in and assist with.

Things We Like

It will get students into schools to a greater extent than other programs, so students will have more continuity in their in-school experiences. Co-operating teachers are designated as Learning Managers to help students to work through particular difficulties, and they have input into the structure of the program.
Clever Teachers, Clever Sciences

Innovations
There are strong partnerships with the teachers and educational bodies who put the program together. The program has a modular approach in which a lot of the educational psychology (for example) occurs across about 5 subjects now instead of just one. Subjects such as Learning Management are presented as a series of tutorials and each lecturer takes all the tutorials for one week of their particular topic (so students have a different tutor each week). All the university lecturers will be required to attend schools every week.

Challenges
The workload for the lecturers is continuous because it is an intensive program. There is very little time off from teaching. Trying to create a new program of high quality and to get it running is a challenge.

Pat Moran

Program Description E19

GRIFFITH UNIVERSITY

BACHELOR OF EDUCATION - SECONDARY
This is a 4-year program, which has been running since 1990. There are about 20-25 students in each year (including those in the B.Sc./B.Ed. and the end-on program, see below). The first 2 years are all discipline studies and the last 2 years are largely education studies, including science education. There are 320 credit points in the program.

Content/Discipline Studies
Students study two teaching areas (e.g. chemistry, physics, or biology and mathematics, or biology and chemistry, but not mathematics and mathematics). These are general offerings of the Faculty of Science or the Faculty of Environmental Science. Discipline studies are to second year level, but in the final semester of year 4 students can opt to complete further discipline studies.

Curriculum Method Studies
Students complete 2 subjects in each of their 2 teaching areas (each is presented as 3 or 4 h/wk face to face, in lectures and a workshop). The first subject deals with learning and developing classroom approaches that support science learning, and has a strong research base. The second subject develops awareness of reform agendas in science curriculum, knowledge and skills in curriculum planning and assessment. The first subject has more focus on years 8-10, whereas in the second subject there is more emphasis on upper secondary.

Teaching Practice
Students complete 100 days of field experience. In year 3 there are two 4-week blocks. They are also in schools one day per week where they work with one teacher for a semester. The remainder of the field experience is in year 4.
Literacy and Numeracy
This is covered in the curriculum subjects.

School/Industry Links
Students do community service days as volunteers in a range of institutions (e.g. the Science Centre, CSIRO Education Centre, national parks etc.) and other education settings.

Things We Like
The assessment tasks in the method subjects give the students opportunities to complete original tasks (e.g. planning field studies visits, developing investigation-based curriculum units). The first curriculum subject refers to research on learning, so the advocated teaching approaches are evidence-based.

Innovations
Students can experience science education in a range of non-school environments (e.g. science centres).

Challenges
Assisting students to develop confidence to adopt inquiry approaches to develop higher-order thinking and reasoning in the classroom, in contrast to prevailing transmissive models.

Other Programs
The Bachelor of Science/Bachelor of Education (Secondary) is a 4-year parallel program, which had its first intake last year. These students complete third level subjects so they qualify for a full science degree, as well as the science curriculum and other education subjects.

The Bachelor of Education - Graduate Entry (Secondary) is a 2-year program for students who have a previous degree with 2 teaching areas. The education components of the 2 programs are very similar and they do the same curriculum subjects as the undergraduates.

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Jan Wilson

Program Description E20

JAMES COOK UNIVERSITY

BACHELOR OF EDUCATION – SECONDARY

This is a 4-year program, which has been running for many years. It is difficult to estimate the numbers of students in each year in science, although about 18-30 students do science as a minor (the graduate program has most of the students). There are about 8 mathematics students in year 4 and 10 in year 3 (5 are mathematics minors). There are 96 units comprising education studies and discipline studies. Year 4 has education studies only.
Content/Discipline Studies

The content subjects are general offerings of the science faculty. Students prepare in two areas (e.g. chemistry and biology). They take one science to third year and the other to second year (i.e. a major and a minor). In year 3 students do additional discipline studies outside their major and minor (e.g. mathematics or physics at first year level).

Curriculum Method Studies

Students do method studies in mathematics and science up to year 10 level, then in their 2 senior syllabus areas. There is a method subject in year 3, which has a core of general teaching methods, a mathematics strand and a science strand. This subject mainly concentrates on junior science and mathematics (it is a 6-unit subject, presented as at least 2 h/wk face to face for each strand). There is also a year 4 subject (8 units) which has a focus on the senior disciplines (e.g. biology, chemistry, mathematics). In this subject all the science students are taught in one group but they do their assessments in the disciplines they are preparing to teach.

Teaching Practice

There is one week of school experience in year 1. In year 2 there are 2 weeks of school experience and an additional number of hours in schools. In year 3 there is a one-week block and a four-week block, and students must do 50 hours of work in other educational settings (e.g. helping students with difficulties in schools, or private providers, or helping students in year 1 of the primary program at JCU). In their final year there is 10 weeks of practicum.

Literacy and Numeracy

In first year, students do a subject called ‘Language and Literacies in Education’, which is a generic literacy subject for primary, early childhood and secondary. Numeracy is an important focus of the mathematics method subject.

School/Industry Links

Students must do 50 hours of work in educational settings other than schools. The students may do their 50 hours in the Great Barrier Reef Marine Aquarium or the museum as volunteer educational officers. These experiences are organised by the students. There is also a CSIRO Science Education centre and students may volunteer to work there as explainers. Students become aware of the potential of different locations for learning science.

There is a strong link with companies who provide graphics calculators. The students develop programs, lessons and activities using them. Students present their ideas in seminars and two students are selected to go to the Queensland Association of Mathematics Teachers Annual Conference and the company pays their fare and registration (other universities have similar links).

Things We Like

There is good student diversity in the program. Students are mixed with those from other disciplines and this allows cross fertilisation of ideas. The graduates influence the learning styles of the undergraduates in the method classes.

A main emphasis in the mathematics method classes is on the variety of learners (e.g. gifted students) and an emphasis on mathematics using technology.
Clever Teachers, Clever Sciences

Innovations
Students have the opportunity to investigate an issue in great depth in their student research project in year 4.

Challenges
The major challenge is staffing. Extra funding could be used to employ practising teachers in the teaching of the program.
There are not enough students training for mathematics teaching to keep the profession going.

Steve Ritchie, Rhonda Faragher

Program Description E21

JAMES COOK UNIVERSITY

BACHELOR OF EDUCATION / BACHELOR OF SCIENCE

This is a 4-year program (changed to 4.5 years in 2001) for science and/or mathematics teacher education. There are about 5-10 students currently enrolled, and about half are mathematics majors. Students do some education studies and some discipline studies in each of the first 3 years but the 4th year is all education. There is 50 per cent education and 50 per cent discipline in the program.

Content/Discipline Studies
Students do two majors in science (e.g. two of biology, chemistry, geology, geography, mathematics, multistrand science, physics, and information technology). All subjects are science faculty general offerings. The majors comprise science subjects to year 3 level.

Curriculum Method Studies
The education subjects are the same as the B.Ed. (secondary) and are taken in the same order. Students are combined in these classes with B.Ed. (secondary) students.
There are two Curriculum and Teaching subjects (year 3 is 6 unit and year 4 has 8 units) which are the same method subjects that the B.Ed. students do (6 units is 4 hours/week). The year 3 subject focuses on junior school and the year 4 subject focuses on the senior school. These units have a professional development strand that covers general pedagogy and two specialist strands (one for each major).

Teaching Practice
Students do 90 days in schools. These are usually in university vacations so students don't miss discipline lectures. There is one week in year 1 (in the April vacation), and a 2-week practicum in the July vacation in year 2. In year 3 there is a one-week block (in the April vacation) and a 3-week block (in the July vacation). In year 4 there is a 2-week block in January/February, as well as 2 weeks in April, one preparation week in June and 4 weeks in July. There is also a plan for an internship.
School/Industry Links
In year 2 there is a ‘Managing Teaching and Learning’ subject where students do 10 half-days in schools doing activities on management of T&L. Some other subjects also have in-school experiences.

Literacy and Numeracy
There is a subject ‘Language and Literacy in Education’ which is compulsory.

Things We Like
Students do two majors so they have a good discipline component.

Innovations
All the non-education subjects are done by the discipline departments.

Challenges
Students have a heavier load than B.Ed. students so they are required to have a higher entrance score. Students are overloaded doing two discipline majors (the program has been extended to 4.5 years in 2001 to remove this problem).

Other Programs
The Graduate Bachelor of Education - Secondary is a 2-year, end-on program, which has been running for many years. Students must have a science degree with an appropriate major (e.g. marine biology is accepted as biology). Students who have no clear minor are encouraged to make ‘multi-strand science’ their second teaching area (this is a general science syllabus for years 11 and 12 but is more vocational/applied). The program attracts high quality graduates (some have honours and higher degrees) and those students who produce exceptional work are encouraged to submit it for publication (this applies to all the programs). These students do the same curriculum method subjects as the undergraduate students. They are well prepared by comparison with graduates from southern states because they have two years of education. They have a broader range of educational experiences. However, it would be nice to have the option of giving them some science discipline study in areas which they don’t have (e.g. engineers don’t have biology).

John King, Steve Ritchie

Program Description E22

QUEENSLAND UNIVERSITY OF TECHNOLOGY

BACHELOR OF EDUCATION (SECONDARY)

This is a 4-year program which has been running since 1992. There are about 30-50 mathematics students in each year (this number includes those in the end-on programs and double degrees, below). There are about 80-90 science studies students. Students do 192 credit points of education and 192cp of discipline. The first 3 years are mostly discipline studies, with some education, but in semester 2 of
year 3 it changes to nearly all education subjects. There are general education subjects and general education electives.

Content/Discipline Studies
Students study 2 teaching areas (e.g. mathematics and biology). The discipline subjects are all Bachelor of Applied Science general offerings. These are studied to third year level.

Curriculum Method Studies
There are 2 curriculum studies for each teaching area (each subject is 12cp, presented as 3 h/wk of workshops). The first subject focuses mainly on junior level and the second mainly on senior level.

Teaching Practice
In year 2 there are 2 weeks of orientation to schools (during a university vacation). At the end of semester 2 of year 3 there is a 4-week block (around the school holidays). In semester 1 of year 4 there is a 4-week block, followed by a 6-week block at the start of semester 2. There is an option for students to do an internship and continue the last practicum to the end of semester. Clashes with discipline studies are avoided by having practica during the last 3 semesters, when there are no discipline studies.

Literacy and Numeracy
All students are required to do a unit called ‘Language, Technology and Education’ in year 2. This covers basics of language and literacy, and uses of technology in teaching.

Things We Like
The students have got a strong discipline base in mathematics and science.

Innovations
The ‘Language, Technology and Education’ unit is an important part of the program, which gives the students a wider view of literacy, equity issues and information technology (students prepare on-line learning activities).

The double degree programs are very flexible – they allow students to tailor a program that suits themselves. They have a rigorous theoretical input combined with a specific practical application. Graduates have a solid theoretical base that they can apply. There is a broad array of science disciplines that they can specialise in.

Challenges
There is limited time available for discipline studies.

It is difficult to place all the students for practicum. We need to ensure that students go to practicum classes where they can have high quality experiences (with excellent teachers).

There is a broad range of students in all the double degree programs, and meeting their requirements and expectations is a challenge.
Other Programs

The 2-year, end-on Bachelor of Education (Secondary) – Graduate Course has all the education components of the 4-year program, and they sit in the same classes as the undergraduate students. It is also offered externally. There are about 15 mathematics students (5 external). Science has a similar ratio. The discipline studies of these students vary widely and are not as recent, but they have good practical mathematical knowledge in specific areas.

The Bachelor of Applied Science/Bachelor of Education (Secondary) is a 4-year program (about 5 years old) which has about 50 students. There are 432 credit points, of which 192 are in Education and the rest are general offerings in the Faculty of Science. Students specialise in 2 sciences (which may include mathematics). The first 5 semesters are mainly discipline studies and the final 3 semesters are all education studies (the same subjects that the B.Ed. students do). The 100 days of field experience occurs during the final 3 semesters.

In the Bachelor of Applied Science (Human Movement Studies)/Bachelor of Education students can specialise in PE and one other area, including mathematics. They do the same education subjects as the B.Ed. students.

Mal Shield, Gordon Tait

Program Description E23

QUEENSLAND UNIVERSITY OF TECHNOLOGY

MASTER OF TEACHING

This is a 2-year, end-on program, which has been running for 3 years. There are about 40 students in each year, of which about 5 are secondary science/mathematics (there are other secondaries as well) and about 15 primary. The mix is about 50/50 primary/secondary. In the first year of offering we had a very small early childhood group as well. This is a preservice program which has a strong research focus and provides its graduates with a masters level qualification. It takes a critically reflective and research-based approach to the professional practice of teaching. The program is quite integrated – in the first and the fourth semesters, all students do the same 3 units, which are taught with an integrated approach. In the first semester, students are introduced to the ethos of the program and the notion of the teacher as researcher, then the students do a case study of a teaching/learning situation (e.g. a child, a group in a class). This provides an introduction to research. In the second and third semesters students develop a research focus which they report on in the final semester. The program takes the constructivist view that students are developers of their own professional knowledge through the teacher-as-researcher approach. The program is intended to address some of the long-standing issues in other teacher education programs, which can be impersonal, fragmented and unconnected in terms of a developmental sequence. This often relates to the large size of cohorts.
Content/Discipline Studies
Admission requires an undergraduate degree in a discipline other than education. This program has a higher GPA requirement than the Bachelor of Education – Graduate Entry program. Students also are required to submit an application support statement, which describes their ideas about education and where they fit as a teacher. For secondary students, the entry requirements are more specific – a third of an undergraduate degree in discipline studies relating to their first curriculum area and a sixth for the second curriculum area.

Curriculum Method Studies
These are done in the second and third semesters. The primary students do specific units that have been written for the MT program. They do two masters level units – one in literacy and one in numeracy in the first year. They also do a combined literacy/numeracy/technology unit, which is done at undergraduate level but with an additional component. They also do a masters-level unit called ‘Interdisciplinary Primary Curriculum’ which contains the science content. Science and mathematics educators co-teach these units.

The secondary students do the same units as the Bachelor of Education – Graduate Entry students. They do 2 curriculum studies for each teaching area (each subject is 12cp, 3 h/wk, in workshops mainly). The first subject focuses mainly on the junior syllabus and the second mainly on senior level. The MT students do additional work to take these units from a B.Ed. level to a masters level.

Teaching Practice
Students go to their school sites for 5 Thursdays, every Thursday leading up to their blocks (which helps to integrate theory and practice on a weekly basis) in the first and second semesters. In semester 1 there are 5 single days and a 2-week block (focussing on the teaching setting and the role of the teacher). In semester 2 there are 5 single days leading up to a block of 4 weeks (focussing on planning, management and communication). In semester 3 there is a 4-week block focussing on inclusive curriculum and the diversity of needs. In semester 4 there is a 4-week block (focussing on being a classroom practitioner as well as a contributor to curriculum decision-making across the school). All students finish the program with a 6-week internship in their final semester (whereas the internship is optional in the B.Ed. Graduate Entry program).

Things We Like
There is a small group of students, which allows a more cohesive and integrated approach to the program (in comparison the programs with large groups of students who pick and choose units). The MT is a more cohesive offering, in which threads develop from the first semester to the fourth semester. The connections are highlighted. For example, there is an issues-based education studies unit in which students will develop a particular professional interest in an issue. Then in another unit they develop a research proposal for this issue (e.g. gender balance, bullying etc). Then in another unit, students implement the research proposal and present a report in a mini conference.

There is a plan for some teachers to teach units in the program based at their schools.
All students do an information technology component (2 h/wk of workshop) in their first semester, which is tied to their first practicum (and IT is integrated into their other studies).

Innovations

The program has a research ethos.

The first and fourth semesters are taught in an integrated fashion. We’ve broken down barriers between schools and departments, and it’s had implications for staffing (staff work in teams rather than individually). While boundaries between specified units have to be kept in terms of final assessment, the way in which the units are taught during the semester is much more integrated. We highlight the links between what they do on campus and what they do in the field.

Challenges

The link to the schools must be maintained, especially communication with supervising and mentor teachers. Also, in the metropolitan area there are four universities competing for practicum placements, and they have a range of programs offered, so it is difficult for teachers to keep track of the requirements/backgrounds/year levels for all the students.

Ian Macpherson

Program Description E24

UNIVERSITY OF QUEENSLAND

BACHELOR OF SCIENCE/BACHELOR OF EDUCATION

This is a 4-year, dual degree program, which has been operating for 5 years. There are 70 students (majors and minors in science and mathematics) in year 4 (it is not possible to identify them until year 4). Over the four years the students complete 64 units of which half are B.Sc. courses and half are education. During the first three years, the students essentially complete a B.Sc. degree, and their electives within this degree are all specified general education subjects. At the end of year three they can exit with a B.Sc. or apply for entry to year 4. The fourth year comprises Education courses.

Content/Discipline Studies

The discipline studies include a full major to year three in one science (or mathematics) and a minor in another science (or mathematics). All courses are general offerings of the science faculty.

Curriculum Method Studies

In year four the students take a science area curriculum study or a mathematics area curriculum study (of 6 units) that covers middle school science or mathematics, as well as a senior syllabus (e.g. mathematics or biology). The students also do a second teaching area method subject (e.g. chemistry) that will qualify them to teach a second science at senior high school level (so graduates are trained in junior science or mathematics and two senior sciences (or mathematics and a science, for
example). A 6-unit course has 8 hours per week of face to face, and 4 units one meets for 4-6 h/wk. These method subjects are mainly presented as workshops. They contain a strong component about assessment in senior classrooms, and how the assessment system works in Qld (ie. with no external exam). These two method subjects total 10 units which is more than half the year 4 load of 16 units. The other two courses are ‘Educational Issues’ (2 units) and the ‘School Experience Program’ (4 units).

Teaching Practice

During the first three years of the program, the students spend 15 days in schools as part of their general education subjects — these involve classroom observations, 1:1 tutoring, interviews and observations of teachers’ work. The School Experience Program in Year 4 contains an on-campus component (which covers classroom teaching skills) and two 7-week blocks (one after Easter and the other after July).

Literacy and Numeracy

This is taught in method classes (e.g. reading processes, cloze exercises, teaching writing and listening skills, and technology literacy). Mathematical language issues that focus on national and state numeracy policies are also addressed in these classes.

School/Industry Links

Students are required to do 9 hours of community-based science education in their own time during year 4 (e.g. working at museums, science centres, wildlife sanctuaries or school science clubs). They develop a broader view of science education and work with different age groups. It is a hurdle requirement only (the organisation writes a letter indicating that it has been satisfactorily completed).

Students enjoy it.

Things We Like

Constructivism provides strong organising principle in the program. Student-centred approaches and reflective practice are emphasised. Information technology is integrated seamlessly into the program rather than being a separate unit.

Innovations

The science staff presenting the methods courses are highly qualified. They have PhDs in physics, chemistry and biology and strong backgrounds in science and science teaching. The accelerated graduate entry program is innovative (see below).

Numeracy across the curriculum is addressed within the mathematics methods course via workshops; as well, integrated mathematics and history curriculum units have been developed in conjunction with the history methods course. The extensive use of graphic calculators has been incorporated into the mathematics methods course, so much so that the pre-service students present professional development workshops at teacher conferences and have had their work published in professional journals.

Challenges

Knowing what to leave out, and trying not to overwhelm the students with information, are the main challenges. Ongoing professional development after graduation is an idea that is being considered.
Other Programs

There is a 4-semester, end-on Bachelor of Education (Graduate Entry) program, which has been operating for 2 years. It is completed in 18 months by including a summer semester, so students finish it in June (they have had no problems getting jobs in the middle of the year). Students must complete 32 units of education subjects. These comprise general education subjects (22 units), methods subjects (10 units) and school experience (4 units). The methods subjects are shared with the students in the fourth year of the dual degree program. The methods subjects are shared with the students in the fourth year of the dual degree program. The students have a 5-week teaching block in semester 1, a 7-week block in semester 2, no practicum during the summer semester, then all of term 1 is an internship, in which the students take half a normal teaching load and are in charge of their classes (after the internship there are two compressed subjects before the students graduate). The internship is well-received by mentoring teachers. For the internship to occur, the Qld Board of Teacher Registration grants a special authorisation to teach to the interns.

There is a Bachelor of Applied Science / Education dual degree for students who do a four year science degree (or Agricultural Science) followed by education, and they do basically the same education studies.

Donna Satterthwait

Program Description E25

UNIVERSITY OF SOUTHERN QUEENSLAND

BACHELOR OF SCIENCE AND BACHELOR OF EDUCATION (SECONDARY)

This is a 4-year program, which has been running for 2 years. There are about 10 students in each year. There are 34 credit points comprising core units and general education units, discipline studies, curriculum method subjects and practica. Most of the first 2 years are discipline studies, year 3 is half discipline studies and year 4 is all education subjects.

Content/Discipline Studies

Students do two majors (subjects to third year level) to be chosen from mathematics, physics and computing. All subjects are general offerings of the Bachelor of Science. Suitable subjects have been identified as mandatory, but students may also select electives in these majors. The science faculty was initially consulted in selecting the list of appropriate content units.

Curriculum Method Studies

Students do 3 method subjects in each of their majors (each unit is 0.5 cp, presented as 2 h/wk face to face). The first unit is an introduction to the syllabus requirements and lesson planning (there is a strong emphasis on hands-on approaches to mathematics teaching for example). The second unit focuses on resources, hands-on strategies and school-based assessment structures. The third unit contains independent projects for students to focus on areas of their own needs (e.g. problem solving approaches for incorporating constructivist
epistemology, effectiveness of graphics calculators). There are also 2 generic curriculum units.

Teaching Practice
There are 100 days of teaching practice, 80 of which are supervised school experiences. In year 1 students do a block of 5 days of structured observations in primary schools (to give them an understanding of stages of development). The second practicum is PCE (Professional Context Experience) in which students do school-based tasks rather than teaching. In year 2 there is another 10 days of PCE. In year 3 there are 10 days of practicum, one day per week, in which students link with teachers in other departments in the school and assist with some phases of the lesson rather than teach the whole class (students see the children in subjects other than science), then there is a one-week block. In semester 2 they do a 3-week teaching block (clashes with discipline studies are covered by making lecture notes available or the students study them in external mode). In year 4, there are two 25-day blocks.

Literacy and Numeracy
There is a compulsory unit called ‘Learning Through Literacy’ which covers literacy and numeracy.

School/Industry Links
In the PCE units, students are able to do professional experience in locations such as museums, scientific laboratories and the Flexi School (an alternative school).

Things We Like
The program appeals to students who decide at the beginning that they want to become teachers, so they have this focus right through the whole program.

Innovations
Students may exit the program at the end of the first year and do a straight science degree.

Students can do 2 discipline majors because some units are common to both majors, so the overall number of units in the program is not too great.

Challenges
This program is presently intended for mathematics, physics, or computing majors only.

Other Programs
The four-year Bachelor of Education (Secondary) is in its first year of operation. Students do a major and a minor in biology, chemistry or physics, and mathematics (ie. one of the major or minor must be mathematics). These are general offerings of the science faculty. They do the same education subjects as the students in the combined degree.

The two-year Bachelor of Education (Secondary) Graduate Entry program has about 8 mathematics/science students. They do the same education subjects as the undergraduates.

Lesley McAuley-Jones, John Green
FLINDERS UNIVERSITY

BACHELOR OF EDUCATION: SECONDARY SCIENCE

This is a 4-year program, which has been running for 3 years. There are 49 students in total. This program was proposed by the Faculty of Science and Engineering. It has 144 units, of which 75-81.5 are science/mathematics discipline. Years 1 and 2 are all discipline studies, while years 3 and 4 are mostly education subjects. All students must do mathematics at first year level at least.

Content/Discipline Studies

Students do a major in one of the sciences or mathematics, and a minor in one of the sciences or mathematics. The major is 33 units and must include a minimum of 6 units at third year level. The minor subject area is 21 units minimum. Students select these 2 fields of specialisation from mathematics, physics, chemistry, earth science, biology and computer studies. All discipline subjects are general offerings of the Faculty of Science and Engineering.

Curriculum Method Studies

If students have mathematics as one of the teaching areas then they do 3 mathematics method subjects (3 units each, presented as 3 h/wk of workshops) and 3 science method subjects. The first two mathematics method subjects concentrate on junior secondary mathematics (including computers and graphics calculators) and the third concentrates on the new senior curriculum for SA (including assessment). The first two of the science method subjects are in junior secondary science and the third covers senior studies in their science specialisation (e.g. biology).

Students who do 2 sciences do a 6 unit method subject in semester 1 and semester 2 – half of which is junior secondary science and the other half is in the specialist science area – then the third method subject covers senior science in their two specialisations. The method subject covering junior science deals with constructivist methods, innovative teaching strategies (e.g. creative writing, drama, role play, newspapers) and students survey teachers for use of innovative strategies while they are on practicum. The second method subject covers safety, laboratory management and contemporary issues in science education.

There are links with the Faculty of Science and Engineering to establish status for students’ previous studies etc.

Teaching Practice

There are 80 days of practicum - 8 weeks in semester 2 of year 3, and 8 weeks in semester 1 of year 4. Students shift their science subjects around to avoid clashes with education subjects, and the year 3 practicum has been reduced by 2 weeks to reduce clashes.

Literacy and Numeracy

This is covered in the science method subjects.
School/Industry Links
Flinders University will soon have a specialist mathematics/science secondary school built on campus and it will have links to the program.
In some of the general education subjects students are required to interview children in schools.

Things We Like/Innovations
Students have a strong discipline preparation.
The program is innovative because it is (approximately) a 2+2 model, which allows students to graduate after 4 years instead of 5.
The method subject covering junior science deals with innovative teaching strategies.
The first two mathematics method subjects are taught by the Mathematics Association of SA. In the third subject the curriculum officer from the assessment board of SA works with the students, and their assignments are used as models for the new year 12 curriculum.

Challenges
Coordinating links to other faculties and sorting out timetable difficulties requires flexibility.

Other Programs
The Bachelor of Education (Secondary) is a 2-year, end-on program, which has been running for 6-7 years and has about 10 mathematics/science students. It is similar to years 3 and 4 of the 4-year program, but they do 2 weeks more practicum and have an option of another 4 weeks at the end of the program (which may be in non-traditional education settings). These students sit in the same classes for their junior mathematics and science method subjects as the students in the 4-year program.

Rick Lambert

Program Description E27

UNIVERSITY OF ADELAIDE

GRADUATE DIPLOMA IN EDUCATION
This is a one-year, end-on program, which has been offered for many years. There are 32 mathematics students and 34 science students currently enrolled. There are 24 points comprising teaching practice, education studies, electives and curriculum method subjects.

Content/Discipline Studies
Students who have a previous degree with a major in mathematics are allowed to teach senior mathematics, while those with first year mathematics only qualify for junior mathematics teaching. For junior science teaching, students should have two
different first year sciences (e.g. biology and chemistry). To teach a senior science, students would be expected to have studied that science to year 3 level.

Curriculum Method Studies

There is a junior mathematics method subject (2 points) which all mathematics teaching students do (2 h/wk for a semester’s worth, but because of the intervention of teaching practice, stretching over the full year). The students who wish to teach senior mathematics do another (2 points) method subject as well, which is 1 h/wk for the full year. The students also do another two points in another teaching area (e.g. science).

Science teaching students do a junior science subject that focuses on years 8-10, and at least one of the physics, chemistry, biology or geology method subjects for senior secondary, and a third area, such as mathematics, if they don’t have three science areas.

Teaching Practice

The first teaching practice is 5 observation days spread over several weeks, then a 5-week block, all in the same secondary school. The second practice is 5 weeks in another school, usually also secondary.

Literacy and Numeracy

In the senior curriculum subjects, the students study work samples and assessment criteria for the ‘writing-based literacy assessment task’ which all year 11 students in SA must prepare.

School/Industry Links

Students do group projects on ‘Mathematics in the Workplace’ or ‘Mathematics in Sport and Recreation’. They are required to contact a relevant business and go there and interview them and produce a report on the application of mathematics in that business (i.e. the everyday business applications of mathematics). The purpose is to give students an appreciation of mathematics in the workplace.

Students have the opportunity to have a one-week visit to a distant country school (35 students are involved this year). This is an awareness program, run through the Department of Education and Training, which allows students to experience life as teachers in rural towns and which is intended to encourage graduates to teach in rural schools (where there are the most teacher shortages).

Students are involved with the local CSIRO science centre.

Things We Like

The subjects present a variety of mathematics activities, including lots of ideas for how to teach mathematics without depending on a textbook.

The mathematics and science students are mixed with students from other specialisations for their general education subjects, and this allows cross-fertilisation of ideas.

At the beginning of the program there is an 'Introductory Studies' course, in which students prepare a unit for year 5/6 students, then they meet the students and their principals at the botanical gardens and have rotating teaching and discussion sessions. This gives them an early introduction to teaching and its culture.
Innovations

Staff have been involved outside of the program in setting up the new junior and senior science and curriculum in SA. This has required some modifications to the content of the science methods.

The ‘Introductory Studies’ course gets students into schools during the first week of the year and has a series of observation days in which students see what schools are like well before their first practicum.

Challenges

Having a different timetable to the rest of the university (due to practicum) is a challenge. Also, recent increases in student numbers have not been supported by staffing increases. The school curriculum is changing and we must prepare the students for the current curriculum as well as a complex new curriculum.

Brian Sherman, Chris Dawson

Program Description E28

UNIVERSITY OF SOUTH AUSTRALIA

BACHELOR OF EDUCATION (SPECIALISATION)

This is a 2-year, end-on program, which has been running for 4 years. There are about 18 science majors, 30 science minors, 5 mathematics majors, 5 mathematics minors, and 6-16 technology students. The program uses extended semesters and summer schools so students graduate in 18 months. There are 72 units, which are all Education offerings.

Content/Discipline Studies

Admission requires are a bachelor degree or equivalent. Many of the technology students have an IT degree or an information processing degree (for information technology), others are engineering, agriculture, food technology, architecture or industrial design, or students with workforce experience (advanced diploma qualifications and significant trade experience).

Curriculum Method Studies

Students do 6 method subjects in varying patterns – many do 4 in their major and 2 in their minor, but other students may do 3 and 3, some have a third learning area, and some do all 6 in one specialisation. The first science subject is a generic introduction to science teaching. The second has a middle school focus. The third has a focus on senior syllabus. The fourth subject has a technology focus (integration of computers, data loggers, the internet etc). The fifth subject deals with research methods and current issues. The sixth subject is a negotiated study (major project) or a content study in science. Each subject is 4.5 units, presented as 3 h/wk contact time. The mathematics subjects are structured in a similar way.

There are 6 technology subjects, of which 3 have a more theoretical focus (including technological literacy and critical theory in technology) and the other 3 focus on student projects (lecturers use practical examples to model appropriate
teaching behaviours). The first subject is ‘Foundations in Technology Education’, which is an introduction to philosophy and curriculum (it focuses on the broader range of technology, with the aim of dispelling stereotypes of what technology and technology education are). Some subjects are presented as 3 h/wk each week and others are presented in intensive mode in summer school or evening classes (to include practising teachers in the program).

Teaching Practice

Students are assigned to a school at the beginning of year 1, and do half-day visits to the school each week for the whole year. There is also a 2-week block in semester 1, and a 4-week block in semester 2. In semester 3 there is an 8-week block.

Literacy and Numeracy

This is covered in the curriculum subjects.

School/Industry Links

The half-day visits each week provide school links for their other subjects. A local building society provides a prize for the best student each year. There are good links with the CEO and DET (via employment sessions etc). The technology program employs practising teachers who regularly involve students in their own schools.

Things We Like

The program is well integrated because there is a small group of lecturers involved, so reflective practice, curriculum, learning and contexts are well reinforced. Having 6 curriculum units is good. Information technology is integrated in the subjects. The technology students are highly motivated to teach, and have a range of backgrounds, which encourages peer learning. There is a 50:50 balance of gender technology classes.

Innovations

The 18-month program gives students much more confidence than a one-year program. Graduating half way through the year has worked out well because there is employment available at that time. The program takes a radical approach to technology education (it is process rich). Technology students have very different content backgrounds, but the program has been successful in preparing them to teach a broad technology base.

Challenges

Finding schools and mentor teachers is difficult because teachers are always so busy.

Getting enough students into mathematics and science is a challenge.

It’s difficult to find a pathway for the technology students into the program. Students are assumed to have the prior knowledge for the program, but for technology education there is no directly applicable degree. Advertising would attract more students into the program (some students might miss the program). More time for the program would develop their wood, metal skills etc.
Other Programs
We are putting together a B.Sc./B.Ed. double degree.

Bruce White, Steve Keirl

Program Description E29

UNIVERSITY OF TASMANIA

BACHELOR OF TEACHING (7-12)
This is a 2-year, end-on program, which was introduced in 1997. The Science/Mathematics curriculum and method subjects are conducted on the Hobart campus only, with about 15 students doing mathematics and science in each year.

Design and technology curriculum and method is studied only on the Launceston campus with 13 students in year 1 and 2 in year 2. There are general education subjects, curriculum subjects and practicum on both campuses.

Content/Discipline Studies

Science/Mathematics
Admission requires a previous degree with 2 teaching areas (e.g. mathematics and science, mathematics and SOSE, or science and SOSE).

Technology
Many of the D&T students have Design degrees. There is a one-year, full-time bridging course in design and technology for students who do not have a prior degree. It covers woodwork, metalwork, technical drawing, design, photography, automotive technology, computing, food and textiles. It is an Education offering and has about 10 students (who will move on to the BT next year).

Curriculum Method Studies

Science/Mathematics
Students do two methods subjects (each is 4 h/wk of workshops for the whole non-practicum program - i.e. 4 h/wk of mathematics and 4 h/wk of science for the whole program not including practicum). Each subject represents 25 per cent of the program, so each secondary student has 50 per cent of their program in method subjects. These subjects contain content as well as methods, because students still need work with content. In science the first year subject focuses on the curriculum and the second year subject looks at authentic experiences to present the curriculum.

Technology
There are 2 D&T method subjects. Each is presented as 2 h/wk for one year. In the first subject, students study the nature of technology and lesson planning. In the second subject they plan, teach and evaluate a program of work.
Teaching Practice
There are 105 days of practicum.

School/Community Links
Mathematics students visit a school to interview teachers about the mathematics program and how it is implemented. All the secondary students visit a primary school to observe mathematics teaching, then exchange their observations about mathematics at primary level.

Science students go to a minerals centre, forestry centre, an integrated energy management centre, CSIRO and a marine studies centre to look at teaching support resources. Through liaison with the Faculty of Science the second year subject gives students experience in initiating and carrying out a Landcare project in a local gully, with conservation value, then working with schools on the project. This gives them experience working with children on extra curricular activities. It involves liaison with the local council, the Waterwatch program, the Adopt A Patch program, Greening Australia, and Parks and Wildlife. The D&T students visit the timber industry.

Literacy and Numeracy
This is covered in the curriculum subjects. Students go to a local school to tutor individual children for 2 h/wk (for about 10 weeks) on literacy and numeracy problems. It gives the students an opportunity to observe and understand children's problems. The students use a website which is related to the local newspaper (developed with the education editor of the Hobart Mercury). Students are required to pick a newspaper article from the site and develop a literacy/numeracy package to be used in schools.

Things We Like
We try to help the students develop connections across the curriculum and within the parts of the mathematics curriculum (e.g. being able to explain the relationship of place value across the 4 basic operations).

Students get in touch with many community groups (to help make the curriculum relevant to students).

The Landcare project involves SOSE students as well, which is challenging to the students. The Landcare project shows them how to use the natural environment to teach topics, rather than just the classroom.

The D&T program covers a wide range of technologies.

Innovations
The D&T bridging course is innovative. The website with the local newspaper is innovative (see above).

The involvement in the Landcare is a rich task, involving press releases and a professional development portfolio. This is a national pilot project. Also in science there is a focus on critical media literacy and multimedia in teaching.
Challenges

How to attract students who have enough mathematics and flexible thinking is an issue. Many of these students want to teach mathematics the way they were taught it (by rote learning), but we want to move them in other directions.

Timetabling constraints are an issue for technology, because some projects would work better in a large block of time rather than 2-hour tutorials. There is a lot to cover in technology in the limited time available.

Jane Watson, Natalie Brown, Harvey Wynne

Program Description E30

DEAKIN UNIVERSITY

BACHELOR OF TEACHING (SECONDARY)/BACHELOR OF SCIENCE

This is a 4-year program, which has been running since about 1993. There are about 20-30 science students in each year (mostly biology) and about 10-15 mathematics students and a smaller number of computing students. Students do 16 credit points in the Faculty of Education and 16 in the Faculty of Science and Technology. Students do 8 credit points per year (=4 subjects). Most of the discipline subjects are in the first 3 years and most of year 4 is allocated to education subjects.

Content/Discipline Studies

The discipline units are general offerings of the Faculty of Science and Technology.

Curriculum Method Studies

The secondary component of the course is comprised of two curriculum studies, each comprised of two subjects. The general science method subject is undertaken in Year 2 and is a compulsory ‘gateway’ to the other science subdiscipline method subjects in biology, chemistry, physics and earth science. This compulsory subject focuses on years 7-10 and is activity based and covers constructivist views of learning, teaching using small group work, safety, legal liabilities of the science teacher etc. The subject commences with three afternoons in a primary school during which the students have to plan and deliver three one-hour lessons to a small group of upper primary students. This experience is intended to provide the students with first-hand practical experience of planning for learning as an advance organiser to the subject’s more formal input.

The other science method subjects focus on the science sub-disciplines with an emphasis upon senior levels (e.g. the science students might do a senior biology subject and a senior chemistry subject. Approximately 95 per cent of the students do the senior biology subject with the other science subdisciplines having low enrolments). Biology method covers generic senior biology and is not restricted to the Victorian syllabus. The subject adopts a pedagogical content knowledge (PCK) approach and is structured around how to teach the classical difficult subjects in biology in creative and interesting ways.
Teaching Practice

There 20 days of field experience in year 2 - in each semester, students are in schools for 10 days over 3 weeks (so they can attend classes in their other faculty on heavy days). There is a similar approach in year 3. In year 4 there is a 10-day negotiated block in semester 1 and two 3-week blocks in semester 2.

Literacy and Numeracy

This is covered in the unit, ‘Literacy Across the Curriculum’. In the first science curriculum subject students examine alternative ways of using text material (ie. creative ways of getting students to understand and apply information in texts).

Things We Like

Students graduate with 2 degrees and receive more substantial education studies than in an end-on program, plus more time in schools. They receive a sound discipline grounding, with a strong major and minor. The first method subject provides them with an experience of teaching first (in week 2), then uses this as a basis upon which to build their knowledge of science teaching and learning.

Innovations

The two units ‘Literacy across the Curriculum’ and ‘Numeracy Across the Curriculum’ are innovative. In these subjects, students are mixed with students from other discipline areas. The students conduct research in schools and the community and come back in multidisciplinary groups and deliver presentations about their findings in relation to literacy and numeracy.

The integration of web-based tasks. All science method students are required to interview a VCE teacher concerning how they implement a unit of the relevant senior science curricula. The students prepare a report which they place on the Biology method website (which also has information on resources, sequencing, excursions and experiments). This forms a rich resource of experienced teachers’ expertise on-line to which students can refer, and is a public-access website.

Challenges

Including practicum in the first year of the program while reducing clashes between the two faculties is a challenge.

Converting traditional face-to-face method subjects into on-line mode has created significant pedagogical challenges and ongoing workload issues.

Geoff White

Program Description E31

LATROBE UNIVERSITY

GRADUATE DIPLOMA IN EDUCATION (POST PRIMARY)

This is a one-year, end-on program that has been running for many years. There are 20 science teaching students and about 7 mathematics teaching students currently.
The program has a total of 120 credit points, comprising general education subjects, curriculum method subjects, practicum and education electives.

**Content/Discipline Studies**

Admission requires a bachelors degree or equivalent, with a major or submajor (a submajor being subjects to second year level) in each of two teaching areas (e.g. physics, chemistry, biology, environmental science, or junior science if students do not have a full submajor).

**Curriculum Method Studies**

**Science**

During semester 1, all science teaching students do a ‘Science Core’ subject (2 h/wk face to face) which deals with broad issues of teaching and learning in science and is only for students in this program. If students are doing only a minor in science then they only do the science core. Most students also do another science pedagogy subject, based on astronomy and earth science (2 h/wk) which is shared with BT/B.Ed. students. During semester 2 they study the senior syllabus in their specialist science area (e.g. biology or chemistry).

**Mathematics**

There is also a parallel, semester length, mathematics teaching method subject. There are two components to the subject - a school-based teaching component and a campus-based seminar program. The Dip Ed students teach for a one semester 1.5 hours/week in a local primary school in a partnership with a fellow student and an experienced classroom teacher. This collaboration provides contextual support for the trainees and offers them a chance to gain first-hand experience within a student-centred teaching and learning environment. This teaching component is in addition to the normal practicum requirement. The campus-based component (2hrs per week) offers the students an opportunity to gain further understanding of constructivist ideology, reform oriented practice and contemporary issues in the secondary school system. During the seminars students are encouraged to reflect on practice, discuss contemporary research issues such as, problem solving as a central means of teaching mathematics – mathematics method is a 4hrs per week for one semester.

Science method is 2 h/wk face to face for both semesters. A double method is 4 h/wk.

**Teaching Practice**

There are two practica. The first has an introductory week in March, followed by 4 weeks in May. The second is a block of 4 weeks in August/September.

**Literacy and Numeracy**

This is covered in the method subjects, including creative writing.

**School/Industry Links**

People doing the mathematics teaching method spend time in primary and secondary schools as observers. They observe the classroom structure and teacher-student relationships, and may work with small groups of students (this is organised through the primary program).
Clever Teachers, Clever Sciences

Things We Like

The method subjects open their eyes to the broad and current issues in science teaching and learning. The students often have not been exposed to many pedagogical techniques in the past.

In the mathematics method program, collaboration and contextual support in reformist environment and an emphasis on the role of reflective practitioner is regarded as a significant means of changing preservice teachers’ perspectives of mathematics education.

Innovations

The science method subjects emphasise creative and innovative ways to teach science, to hopefully interest a broader population of students in science. The techniques (e.g. creative writing and drama) are modelled in the tutorials and students have a chance to practise them.

The science method is structured so that the first session is fairly traditional, then through the semester it slowly changes until it is full-on constructivist in its approach.

The collaborative school-based mathematics program offers students contextual support and an opportunity to explore reform practices with experienced teachers in a conducive primary schools environment.

Challenges

It would help if there was more time to get through the material (either more hours in the week or a longer program would make it easier for the students to keep up with the material in class, and the reading and reflection required in the program).

To attract more candidates, especially in physics, is a challenge.

In mathematics education the secondary cohort would benefit from more time considering alternative approaches in mathematics, especially problem based learning from both a teachers point of view and as a learner. Making the subject more accessible to a broader range of learners and engaging students in a deeper understanding of non-standard algorithmic approaches.

Other Programs

The only other program for secondary science and mathematics is the 4-year Bachelor of Teaching/Bachelor of Education in which education is grounded throughout. Most of the students doing this program are primary education students, but there are a small number (less than 10) who, if they choose their subjects carefully, can graduate with both a primary and secondary qualifications. However, in general, secondary education students are encouraged to do the Graduate Diploma rather than the B.Ed.

Peter Cox, Steve Tobias
Program Description E32

MONASH UNIVERSITY

BACHELOR OF SCIENCE/BACHELOR OF EDUCATION

This is a 4-year program, which started 4 years ago. There are about 80 students in total, of whom 50 per cent are mathematics. Students do 96 points of science discipline and 96 points of education studies. In Years 1 and 2 students complete one education subject and 3 science subjects each semester, year 3 they do 2 education and 2 science subjects each semester and Year 4 is all education subjects. The majors offered are mathematics, chemistry, biology, physics and general science.

Content/Discipline Studies

Students do a major (3 years) in science, a minor (2 years), two additional first year subjects, and two special subjects (‘The Design of Science’ and ‘How Science Works’ are compulsory for all science students). All these subjects are general offerings of the science faculty. Mathematics students do mathematics as a major, and another science as a minor.

Curriculum Method Studies

There are 2 methods subjects in year 4 (each is 12 credit points, presented as 20 weeks of 3-hour workshops). In each of the science methods one of the hours is a multidisciplinary semistructured science program dealing with general issues of teaching science, the nature of science and learning and teaching science, then 2 hours is for the specific method (e.g. general science, chemistry, biology).

Teaching Practice

In years 1-3 there is a one-week block in each semester, which is run over two weeks to deal with clashes with discipline studies. There are two 5-week rounds in year 4. Developing reflective practitioners is important and so students are given many opportunities to reflect on their own learning, interview school students or teachers, do microteaching and teach to their peers and reflect on this experience. In year 4, the science students have a 3-day residential camp in which they teach year 7 students in the camp setting.

Literacy and Numeracy

This is covered in the subject ‘Language and Literacy in Secondary School’.

School/Industry Links

The educational electives include some subjects which have industry links. In addition, the 2 core science subjects deal with science in the broader community (e.g. BIOTA is a Monash-based science industry). A new science centre on campus will create a joint link between Science and Education. Students consider how to market their skills in non-educational settings.
Things We Like

The lecturers have a team approach and model good practice in reflection and constructivist teaching.

This program complements the DipEd because it caters for science specialists whereas the end-on program suits students with a broader high school range of subjects, but who still want to teach science.

Innovations

Students are supported to develop their ideas on what it means to be a science teacher for them. They produce portfolios expressing their aims and ideas as well as their skills and abilities. It challenges them to be reflective. They are engaged in the intellectual activities of the faculty through research seminars, websites and chat forums. Learning technologies are embedded in the method subjects. The websites are used to support method students and will be used to support distance versions in the near future.

Challenges

The decline of physics, chemistry and mathematics in schools means declining populations of appropriate teachers and it is becoming more difficult to place science students in schools for practicum, especially in country schools. This is also due to the limited numbers of places available to universities for placing secondary preservice teachers in. The cost of practicum is an issue - paying teachers and university staff is a significant expense in the development of new teachers. Flexible delivery and its resourcing is an issue.

Other Programs

The Graduate Diploma in Education is a one-year program, which is very similar to the year 4 of the double degree. There are about 80 students on campus and 30 off campus in science, and about 45 students on campus in mathematics and 23 off campus. Many of these students have worked in industry, which strengthens their teaching. Students do the same year 4 practica, plus the camp. There are currently no technology students. The Bachelor of Design (Industrial Design)/Bachelor of Education is not being offered due to lack of demand.

The Bachelor of Secondary Education is being phased out.

Debbie Corrigan

Program Description E33

ROYAL MELBOURNE INSTITUTE OF TECHNOLOGY UNIVERSITY

PEER TUTOR PROGRAM

This program is located in the Faculty of Applied Science at RMIT and mainly involves undergraduates majoring in an applied science discipline. The program started in 1998, and is based on the STAR program at Murdoch University.
The program is intended to address the declining interest in science and science education which is occurring in schools, and also to support teachers by providing motivated young volunteers in the classroom. The volunteers are intended to be role models of people who are doing science at university and who are planning careers in science, and who could relate their experiences to younger students.

As part of their degree studies, students can choose the Peer Tutoring Program as a community liaison elective. These students are placed in targeted schools, usually in years 5-10. Students go to their school for half a day per week for one term. Each half-day they would usually work with 2 mathematics or science classes, and on any topic (biology or physical science). Students take the role of a teacher’s aide in the classroom, helping students on a one-to-one basis on whatever the current topic is, or in any other way that their assistance is required. This year there are 20-25 primary and secondary schools involved in the program in the metropolitan area, and about 30 students.

About 50 per cent of the students would probably be considering teaching as a career (e.g. by later doing a DipEd). This program gives the students a taste of what to expect in schools. Even though the vast majority of them enjoy it, some decide that teaching is not what they want to do. The students are required to keep a journal while they are in schools and to write a report on their activities. Many students do extended time and continue their placements beyond what is required in the elective.

The program is also involved in schools in regional areas. A team of about 7 students visit a series of schools, spending a day in each, running activities, workshops and demonstrations for children. The volunteers take the classes for the day and deliver a structured program of activities repeatedly throughout the school day for different year levels. Then they move on to another country town. The regional schools have been very positive.

The project is funded by the state government as part of their Science in Schools program. The funding is used to organise and manage the program, and to fund the visits to regional areas (transport and accommodation).

Links

The Education staff at RMIT have been very involved in the training of the students before they go to schools. They do an intensive, half-day training program which covers issues of working in classrooms, working with adolescents and younger children, communication in the classroom and children’s learning abilities. These staff also helped to accredit the program as an elective subject and have helped with assessment.

Challenges

Communicating the purpose of the program to teachers is not always easy. The students are volunteers and the teachers are not required to mentor them or report on them, but some of the teachers tend to put the students in the category of being student teachers, so they may see it as just one more task they have to do rather than the students being there to help the teachers as well as the students.

We are considering ways of taking this program and applying it to teacher education. We are interested to share ideas and receive feedback.

Nick Besley
Program Description E34

ROYAL MELBOURNE INSTITUTE OF TECHNOLOGY UNIVERSITY

GRADUATE DIPLOMA IN EDUCATION (SECONDARY EDUCATION)

This is a one-year program, which has been running for 5 years. There are 25 science students and 8 mathematics students currently enrolled. There are 6 subjects in each semester, comprising education studies, method subjects and field experience.

Content/Discipline Studies

Most students have a degree in science or applied science. Students are required to have at least 2 years of university training in each teaching area.

Curriculum Method Studies

Students do 2 method subjects in each major teaching area (4 subjects in total). The first semester science subject covers general science (years 7-10). It is presented as 3 h/wk face to face and focuses on aspects such as small group work, problem solving approaches and school-based science activities. The second semester subject concentrates on the senior syllabus (e.g. chemistry, biology). Some students do two sciences, or science and mathematics, or science and computing.

The secondary mathematics method is taken by a local teacher and he involves them in his school.

Teaching Practice

There are 45 days in schools. The first practicum is 20 days in semester 1 after the method classes have been completed. Students are expected to teach 20 lessons in each of their 2 method areas. The second practicum is 25 days in semester 2 (students teach 25 lessons in each of their two method areas).

School/Industry Links

Students maintain regular visits to their practicum teachers and schools, to develop an ongoing relationship.

Students visit educational facilities such as Scienceworks and the zoo. They also visit the science teachers association facilities (or a member of the association comes to their tutorial to talk about the professional association).

VCE specialists are invited speakers in the general education subjects.

Things We Like/Innovations

The program is designed to be as practical as possible, to help students make the adjustment from university level to secondary level activities. The students are motivated and of high quality.

Learning technologies are regularly used in the program.

There is a Negotiated Applied Education Task in semester 2, which is a school-based action research project that students carry out in conjunction with their second field experience.
Challenges
The biggest difficulty has been placing students in schools. Getting them placed in schools to carry out preliminary observations before their first field experiences, and finding suitable placements in schools as part of their method classes have both provided challenges.

Other Programs
The Bachelor of Education (Secondary) is being phased out. One of the concerns was the lower amount of science and mathematics discipline content.

The RMIT Bachelor of Applied Science (Physical Education) program has a 4-year physical education major in which year 4 students do their second method in our Department of School and Early Childhood Education. In 2001, 12 of these students are doing science as their second teaching area. They are in a separate class from the Grad. Dip Ed students. Five of these B. Applied Science (Physical Education) students are doing Mathematics Method as their second teaching subject.

John Ravenhall

Program Description E35

UNIVERSITY OF BALLARAT

GRADUATE DIPLOMA OF EDUCATION (SECONDARY)

This is a one-year, end-on program, which has been running for many years. There are about 17 science students and 2 mathematics students. There are 120 credit points, comprising education studies and practicum.

Content/Discipline Studies

Admission requires a 3-year degree or diploma or equivalent with at least a minor in 2 teaching specialisations (e.g. 7-10 science and senior biology).

Curriculum Method Studies

Students do 2 curriculum units in each teaching area. The first semester subjects are 15cp and 3 h/wk of lecture and tutorial, while the second semester subjects are 10cp and 2 h/wk of tutorial. The first semester science subject focuses on teaching strategies, lesson planning, safety, micro skills and constructivism. The second semester subject focuses on unit planning, and curriculum and assessment issues.

Teaching Practice

Students do 45 days of practicum. In semester 1, students are in schools 2 days per week for 4 weeks, then do a 4-week block. In second semester they are in another school for 4 weeks.

School/Industry Links

Students regularly visit schools to study various issues in their general education subjects.
Clever Teachers, Clever Sciences

Literacy and Numeracy

Reading in science, and technology in science are covered in the curriculum method subjects.

Things We Like

The science units are strong on the skills aspects of teaching (e.g. classroom management skills).

Innovations

The tailored chemistry discipline subject is innovative (see below).

Challenges

There is a lack of opportunity in Ballarat for students to come into contact with children from different cultural backgrounds (compared to schools in Melbourne).

Other Programs

The Bachelor of Education is a 4-year program, which has 90-100 students in each year. The program is administered by the School of Human Movement and Sports Sciences (rather than the School of Education). Students study physical education and one other method (about 15-16 students in each year choose science as their second method, and about 10 choose mathematics). They do a minor in the Faculty of Science in nominated subjects (e.g. in science they must do first year units in chemistry, geology and environmental management, then they specialise in another 3 units). Most students choose another chemistry unit, which is designed specifically for these students. In this unit they cover the chemistry components of the Curriculum and Standards Framework, the theories and typical secondary school experiments related to these components (the experiments emphasise the use of everyday materials, so the science is related to life outside of school). The students react positively. Students also develop practical experiments – all experiments are collated on a CD-ROM which is given to the students as a resource. This subject has been running for about 4 years. The other discipline subjects are not tailored. The science curriculum method components are almost identical to those in the DipEd.

Garry Henderson, John Murray

Program Description E36

UNIVERSITY OF MELBOURNE

GRADUATE DIPLOMA IN EDUCATION (SECONDARY)

This is a one-year program, which has been running for almost 100 years. There are about 50-60 mathematics students at present, and about 130 science students (this program produces about half the total in Victoria). There are 100 points in the program, comprising general education subjects, curriculum subjects and practicum.
Content/Discipline Studies

Students have at least 2 years of science or mathematics (e.g. applied mathematics or statistics) in their previous degree. About half the students have postgraduate (or year 4 and above) qualifications.

Curriculum Method Studies

Students do 2 teaching methods (this can be a double mathematics method, which about 10 students do, or a single mathematics method and a science). Many students do 2 science methods (e.g. biology-science, or chemistry-biology). Students do 2 curriculum subjects in each teaching area, each worth one eighth of the program (12.5 points each, presented as 2-3 h/wk face to face per subject).

The single mathematics method covers years 7-12, and the double mathematics method subject covers additional topic areas in more depth (e.g. the use of computer algebra in schools).

Everyone doing a science method does the 3 h/wk school-based ‘Combined Science’ program plus additional time for campus-based specialist methods. The ‘Combined Science’ program begins at the start of the first semester – in the first hour students-staff discuss their lesson plans and surrounding issues, in the second hour students teach in pairs to small groups of children, then debrief in the third hour. This orientation to science teaching continues through the whole of first semester punctuated only by a 3-week practicum. After the practicum, the program emphasises social constructivist teaching strategies (individual students teach groups of children for 7 weeks). The program offers some primary teaching in country schools and in semester 2 includes school visits in which exemplary teachers who have had involvement with this program and STAV in the past talk about their career experiences and offer advice. The special method subjects involve practising teachers as well as curriculum specialists in each of the senior science areas.

Teaching Practice

There are 45 days of practicum - 3 weeks near the beginning, 3 weeks in July and 3 weeks at the end. There are an extra 20 or so days in the school-based method subjects. By the end of the program the students have taught in 7 schools.

Literacy and Numeracy

Literacy is covered in one of the compulsory general education subjects. Students practise teaching number and language in small rural schools.

School/Industry Links

The professional associations come to the campus. Students are involved in mathematics competitions for schools. Science students are a judging panel for the Science Talent Search, and help to organise Australian Science in Schools week and the primary science conference for Victoria. They can be involved in teaching a gifted education program in the vacation, and help in primary and secondary science professional development programs. Students can do practicum in small rural schools effectively as science specialists.
Things We Like

The students are high quality, including many with research degrees. Staff with recent teaching experience are involved in the program.

The school-based experiences between the practica help supplement the emphasis on whole class management skills on the teaching round with an emphasis on the development of communication and listening skills with a view to encouraging the students to be reflective, innovative and effective through induction into a professional discourse in schools as well as on campus.

Innovations

Getting large groups of students into schools in the school-based methods subjects and using videos of their teaching small groups to aid analysis and reflection as a group. Use of the mathematics CD-ROMs as well.

Challenges

The program should be longer, but few students are interested in the 2-year Bachelor of Teaching program.

Some students are recent migrants to Australia and they have excellent mathematics qualifications but often struggle in Australian schools (e.g. Asian and Eastern European students).

There was pressure from the university to move towards mass lectures and large tutorials, which threatened the school-based program. The staff have chosen to preserve the school-based component.

Other Programs

The Bachelor of Teaching is a 2-year, end-on program, which has attracted only about 10 science and mathematics students in the secondary stream.

Kaye Stacey, Rod Fawns

Program Description E37

VICTORIA UNIVERSITY

GRADUATE DIPLOMA IN SECONDARY EDUCATION

This is a one-year program. There are about 30 mathematics method students and about 50 science method students (about half are PE students doing a junior science method and about half would be interested in senior science). The program is about 13 years old. Students do 120 credit points. There are core education subjects (e.g. basic planning and management strategies and educational issues), method subjects and practicum.

Content/Discipline Studies

Admission requires an undergraduate degree or equivalent. The degree should include sufficient studies in science and/or mathematics to meet Ministry
requirements for teaching in those fields. Under certain circumstances students may be allowed to study additional mathematics or science subjects during the DipEd year.

Curriculum Method Studies

Students take two method subjects (each is 20cp, presented as 3 h/wk face to face). The most common combination is PE and science. The science method runs for the whole year, starting with junior science and then specific workshops in senior discipline areas (e.g. physics, chemistry) in second semester. The mathematics method subject covers junior and senior mathematics methodology. Normally, students with a science only background do the mathematics method as a second area, but have insufficient mathematics to teach at senior levels without further study.

Teaching Practice

There are 45 days of practicum. In semester 1, 2001, students had three days of visiting their school then a 17-day block, and in second semester there was a 5-week block.

Literacy and Numeracy

These are emphasised in core subjects and methods with specific assessment tasks related to teaching strategies in literacy and numeracy across the curriculum. Sociolinguistic issues related to a multicultural society are also emphasised (e.g. bilingualism, cultural sensitivity in choosing materials etc).

Things We Like

The student intake is quite varied, and very multicultural. They learn from one another and there is a lot of peer support within the group. Students are very positive about the program (course experience questionnaires rate 4 or 5 out of 5). We do a good job of linking theory and practice and we produce some very good teachers. We are flexible and can cater for people with special needs. The course is 29 weeks long (longer than at some other universities).

Innovations

The Applied Curriculum subject is a school-based project to give students experience in a specific part of the syllabus (mainly emphasising literacy and numeracy). It gets students into schools, and planning curriculum projects/units related to the curriculum. There is a huge variety of these projects (e.g. helping to plan and implement a camp, doing science in primary schools, outdoor environmental projects, preparing activities for Siemens Science School projects, and creating activities for students with mathematics difficulties).

Challenges

Lack of resources within the school (personal and physical), inadequate funding support for school placements, and increasing difficulty with finding placements are the main challenges. There is a need for funding to support students on country placements.

Jan Thomas
Program Description E38

CURTIN UNIVERSITY

BACHELOR OF EDUCATION (SECONDARY)

This is a four-year program, which has been running for many years but has been revised recently. There are about 28 mathematics students (majors and minors in the mathematics curriculum unit). There are 800 credit points, of which half are in the science faculty and half in the education faculty. In each semester there are education units and discipline units (except for the final semester, which is an internship).

Content/Discipline Studies

Students do a major and a minor (they can do an additional minor if they want to). The major contains third year units in mathematics or science. The minor contains second year units. If they have two minors then only first year units are required. The mathematics students do a major in mathematics and a minor in another area such as chemistry. The science students do a major in a science such as chemistry and the minor would be in another area such as mathematics. These subjects are science faculty general offerings.

Curriculum Method Studies

There are two ‘Curriculum and Instruction’ subjects for mathematics (and corresponding ones for science). The first covers junior high school and the second covers the senior school syllabus in their major (2.5 h/wk face to face).

Teaching Practice

In year 1 there is one week of observation in semester 1, then a 3-week block in semester 2. Clashes with discipline subjects occur but university policy is that the students must not be disadvantaged (students catch up in their own time). In year 2 there is a 3-week block, in year three there is a 3-week block and in year 4 there is a 10-week internship (in which they can take up to a full teacher's load). Some students do additional 2-week voluntary practica.

Literacy and Numeracy

Literacy is covered in the method subjects. Teaching strategies for literacy are covered in a separate subject which covers literacy through all learning areas (the critical inquiry unit in year 4, which includes the ‘Stepping Out’ literacy program).

School/Industry Links

There is an arrangement with the mathematics head teacher in a local middle school for the mathematics students to spend time in his class every three weeks to work with him (as teacher aides).

They go to schools for various other units. For example, the year 4 students do a ‘Critical Inquiry’ unit which involves research in a school. In the first year educational psychology unit they have to interview students in schools. Speakers from the Curriculum Council etc are invited into the units from time to time.
Things We Like

Students learn a lot of different student-centred teaching strategies (getting away from chalk and talk).

Innovations

There is a lot of communication with their general education subjects so the teaching strategies are reinforced (we work horizontally as well as vertically). Plus, students get a lot out of the field experience because they are armed with a lot of practical skills and strategies which they have practised in micro teaching sessions (these are videotaped to encourage reflective practice).

Challenges

Maintaining the face to face hours with reduced funding is a challenge, and especially maintaining small group workshops rather than mass lectures.

Other Programs

The Graduate Diploma in Education (Secondary Education) has the same mathematics and science method subjects. Students are combined with the undergraduates and are able to complement each other in these classes. These students are very busy for their one year but after they begin teaching there are few apparent differences to the bachelors graduates. They have a 4-week practicum in semester 1 and a 6-week practicum in semester 2.

Joy Yukish

Program Description E39

CURTIN UNIVERSITY

BACHELOR OF ARTS (EDUCATION) SECONDARY, BACHELOR OF SCIENCE (MATHEMATICAL SCIENCES)

This is a 4-year program, which is in its second year. There are about 6 students enrolled over the two years. The program comprises education subjects, core mathematics discipline subjects and a mathematics elective stream in applied mathematics or operations research or combinatorics or statistics. There is about 50 per cent mathematics and 50 per cent education in the program.

Content/Discipline Studies

All the mathematics discipline units are general offerings of the mathematics department. Their major in mathematics includes at least two third year units.

Curriculum Method Studies

There are 2 Curriculum and Instruction (methods) subjects in year 3 – one for the junior school and the other for senior secondary mathematics. Each is 2.5 h/wk face to face.
Teaching Practice
There are 4 weeks of practicum in first year, 3 weeks in second year, 3 weeks in third year and 10 weeks in fourth year (totalling 20 weeks). Students negotiate missed work with their discipline lecturers.

Literacy and Numeracy
All students sit a literacy test and do a special unit which covers general secondary school literacy (including the ‘Stepping Out’ program).

School/Industry Links
There is a critical inquiry unit in year 4, which involves research in schools. There is a mathematics research project (part of their discipline studies) and most of the education students do a mathematics education project on topics such as resource development and evaluation.

The mathematics graduates are eligible for membership of the professional association. The faculty has strong professional associations with many local schools (for research projects and professional development programs)

Things We Like
There is strong mathematical rigour in the program. There is concurrent development of mathematics and education over the four years.

Innovations
There is a student-centred philosophy of teacher education. The focus is on teaching and learning using collaborative approaches and cooperative learning (including peer assessment, critical inquiry and research skills) with a view towards lifelong learning.

Challenges
Classes need to be scheduled with other faculties to avoid clashes (ie. mathematics classes versus education classes). If students get out of step in the program it can create clashes.

Other Programs
There are double degrees planned in biological science and education, physics and education, and chemistry and education, which should be offered in 2002.

Many subjects are shared with students in the Bachelor of Education (Secondary) program (described in a separate program description).

Rob Cavanagh
Program Description E40

EDITH COWAN UNIVERSITY

BACHELOR OF ARTS (EDUCATION)/BACHELOR OF SCIENCE

This is a 4-year program, which has been running for 3 years. There are about 30 students in each year, most of whom are biological science majors (there are less than half a dozen mathematics students). Students complete 16 units of science/mathematics discipline subjects (mostly in the first two years) and 16 units of education subjects (which are concentrated in years 3 and 4). Students do 4 units each semester, except in the long practice semester.

Content/Discipline Studies

Students do a major and a minor. Mathematics majors may do a minor in science, computing or physical education; biological science majors may minor in mathematics or computer education or physical education; and physical science majors may minor in mathematics only. The students complete specified units up to year 3 level for the major. There are close relations between the science and education staff because of the previous history of the institution.

Curriculum Method Studies

Students do four curriculum method subjects for their major. The first two focus on junior secondary curriculum and teaching strategies and the others are aimed more at the senior syllabus (the students split into their senior specialisations). Each unit is 3 h/wk face to face. Students do the first two subjects only for their minor.

Teaching Practice

In year 2 there is a 2-week block. In year 3 there is a 2-week block and a 4-week block. In year 4 there is a 10-11-week assistant teacher program in term 2 (which is a well-supervised practicum, rather than an internship),

Literacy and Numeracy

There is a unit called ‘Literacy Across the Curriculum’, which is compulsory.

School/Industry Links

Students visit Scitech (an interactive science centre) and the interactive centre in the zoo to study how to use them as teaching resources.

Things We like/Innovations

Lecturers in the science education units model the teaching strategies and assessment strategies that are advocated for constructivist learning (e.g. portfolios, self-evaluation, practise tests are integral parts of the units). They practice what they preach. There are opportunities for peer teaching and presentations.

There is a lot of technology integrated in the teaching we have published videos and CDs.
Challenges

The lack of full-time staff to service the program, is a challenge.

Other Programs

There is a one-year, end-on Graduate Diploma of Education (Secondary) which has about 36 students in science (and less in mathematics). These students sit in the same classes as the undergraduates for their minor teaching methods, but they are in separate classes for their majors. Like other DipEd programs, it is a pressure cooker year. They do 3 practica – two 2-week blocks and a 6-week block.

The Bachelor of Education (Secondary) in science and mathematics is being phased out.

Jack Bana, Dennis Goodrum

Program Description E41

MURDOCH UNIVERSITY

SCIENCE/TECHNOLOGY AWARENESS-RAISING PROGRAM (STAR)

This is a peer tutoring and mentoring program, which has been running since 1994. Its purposes are to raise students’ awareness of science and technology, to give science students the opportunity to be involved in classrooms, to encourage them to go on to teaching in science and to develop a community commitment through their mentoring role. It also adds to students’ employability – surveys indicate that employers acknowledge that peer tutoring adds value to the students’ degree by developing communication skills, teamwork, leadership and problem solving skills.

The program is not attached to a faculty - Russell is attached to the community relations section of the university. The program has been funded by corporate sponsorship (BP, the WA Department of Commerce and Trade, Hamersley Iron, Ian Potter Foundation). These groups also sponsor STARnet, which provides desktop videoconferencing to children in remote areas, and the STARtrek Science Show, in which a group of STAR peer tutor-volunteers present hands-on activities in country schools twice each year.

There are 80 peer tutors currently in the program, and about 30 of these are in science/mathematics (and a small number in technology). These students are doing degrees in biology, environmental science, physics, chemistry, mathematics, biotechnology, mineral science etc. Students participate in the program in their own time and there is no accreditation.

Students peer tutor each week for a minimum of 3 h/wk. They go into a number of different classes from year 8 to year 12 in each school (there are 25 metropolitan secondary schools in the program). Students may work 1:1 with children in the classroom, or may be used by the teacher to help with laboratory activities, project work, revision, or group work. Students can alternatively work in STARnet at any time of the day and use the desktop videoconferencing to talk to kids in country schools. Students may enter the program after one semester at university, and may stay in the program as long as they wish.
Teachers volunteer to participate in the program (e.g. by word of mouth or negotiation). Teachers are very enthusiastic and report that the peer tutors are good role models for promoting science. The peer tutors report they have grown in confidence in their skills and have learned how to share knowledge.

Links
Renato Schibeci in the Faculty of Education is about to launch a program in science communication, and peer tutoring will be a part of it.

The education faculty (and the Pimlico Connection) was also involved in the development of the half-day training program which all students must do before they begin the STAR program. The training program covers group dynamics, questioning, and classroom do's and don'ts.

Challenges
More peer tutors are needed in the sciences (there is demand in schools for 3-4 times as many peer tutors as are currently involved). Many teachers don't know how to use peer tutors effectively (e.g. students been given menial tasks like photocopying). Brochures and a professional development session have been developed to address this problem.

Other Programs
This program is based on a long-established program at London's Imperial College, called the Pimlico Connection. The Pimlico Connection has been the basis for about 200 peer tutoring programs across the UK.

The Perach program in Israel has about 26,000 peer tutors (who are eligible for scholarships to assist with their university education).

The STAR model has also been adapted by RMIT, LaTrobe, Monash and Edith Cowan (and some universities in New Zealand and Malaysia).

Russell Elsegood

Program Description E42

MURDOCH UNIVERSITY

BACHELOR OF SCIENCE + BACHELOR OF EDUCATION (SECONDARY)

This is a 4-year program, which has been running for 2 years. There are about 12 students in each year (less than half are mathematics students). There are 96 points, of which 42 are in education. Students do B.Sc. subjects and B.Ed. subjects in each year, although there is more science early in the program and more education later in the program.

Content/Discipline Studies

The B.Sc. units are general offerings of the science faculty. Students do a major and a minor in mathematics or science. If students decide not to teach then after year 1 they can drop education and then complete a standard B.Sc.. The Education staff have extensive links with Science staff.
Curriculum Method Studies

Students do one subject for their major (in year 3) and one subject for their minor (in year 4). The majors do a 4-point unit and the minors do a 2-point unit. The two groups are combined for half of the major unit, as they concentrate on junior secondary (3 h/wk face to face for internal students). Then the minors stop and the majors continue in second semester, where the focus is on the senior syllabus (physics, chemistry, mathematics etc).

Teaching Practice

The school experiences are not regarded as ‘teaching practice’ because they are intended to provide students with rich professional experience, rather than just practice teaching. In year 1 students do a unit called ‘Introduction to Teaching’ which has a campus component, plus 5 days in a primary school and 5 days in a secondary school (mainly doing observations). Then students do 2 block practica which are linked to the teaching major and minor - they spend 10 days teaching in their major area and 10 days teaching in their minor. They also do the Assistant Teacher Program in year 4, which is a 10-week block, in which they may teach both areas.

Literacy and Numeracy

Staff have developed a program on literacy for science and mathematics teachers. The science communication subject is especially strong in this area. Literacy is present in a deep sense in all the units, and the mathematics units are concerned with the nature of mathematical numeracy.

School/Industry Links

Students are required to trial techniques in schools as part of their other education units.

Things We Like/Innovations

The school experience program is a highlight. The work in schools is intrinsically linked to the work on campus, to break down the barriers between theory and practice. Students do a school experience in association with each of their curriculum units (Murdoch pioneered this system, which has been operating for many years). University supervisors are located on-site in schools for the duration of the school experience (e.g. in a caravan or other arrangement) so supervision is permanently located in schools (rather than supervisors driving from school to school).

The program is very flexible, enabling students to switch to a full B.Sc. if they want to.

Many students have environmental science in their B.Sc. studies, and this is a plus for schools.

WebCT in the mathematics subjects allows students to get a good feel for mathematics teaching via some of the resources on the web.

The teacher retraining program (below) is intended to address the shortage of mathematics teachers.
Challenges

Things get added to, but not taken away from, teacher education programs, creating overcrowding.

The graduates need to be able to make science exciting for students. We want to produce future scientists and engineers, but we want all students to be scientifically literate.

Mathematics students have a good grasp of mathematics but they need to realise the difficulties that learners have in understanding the subject. Students need to recognise that their own (sophisticated) ways of learning are not necessarily helpful to children struggling with mathematics in secondary school.

Other Programs

There is a one-year, end-on Graduate Diploma in Education (Secondary) which has about 40 science students this year (but the normal number is about 25). There are about 12 mathematics students. It is a 30-point program whereas a normal one-year load is 24 points. They do the ‘Introduction to Teaching’ subject in January and have their first field experiences before semester starts. They do the same curriculum subjects as the undergraduates and sit in the same classes.

The Graduate Certificate in Mathematics Teaching is a 6-months full time or equivalent program, which started last year and is offered in distance mode. There are about 8 students currently enrolled. It is intended to enable practising teachers (not mathematics specialists) in primary and secondary schools to move into junior secondary mathematics teaching. Teachers do a range of entry level and undergraduate mathematics units and the minor curriculum method unit (above). There is significant on-line support and the fees, books etc are paid for by the Department of Education. Most of these students have struggled with the mathematics subjects, because of their work commitments and limited mathematics experience.

Renato Schibeci, Barry Kissane

Program Description E43

UNIVERSITY OF WESTERN AUSTRALIA

GRADUATE DIPLOMA IN EDUCATION

This is a one-year, end-on program, which has been operating for many years. There are 21 mathematics students, 25 science majors and 37 science minors currently enrolled. Students complete 60 points of work, comprising general education subjects, curriculum method subjects and general education electives.

Content/Discipline Studies

Admission requires a previous degree or equivalent status. Mathematics students typically have a mathematics-related previous degree (such as engineering or physics) or work experience that is mathematics-related. A major in science is required for science teaching to senior high school level. Students must have 2
teaching areas (a major and a minor, or a double major) one of which may be mathematics.

Curriculum Method Studies

There are two mathematics curriculum subjects – one is for the students doing a major in mathematics (8 points) and the other is for the minors (4 points). The major subject focuses on all levels up to senior high school, whereas the minor focuses more on junior high school.

The science subjects contain both lectures and workshops. Students are required to present areas of the curriculum to their peers during the course (peer teaching exercises).

Teaching Practice

There is an introductory unit ('Introduction to Teaching') which is a 2-week, pre-semester unit held during February. During the first week the students are on campus and in the second week they are observing in schools (the same schools that they go to during their first practicum, so they meet their mentor teacher in that week of introductory teaching).

There are two practica. The first is 5 weeks in June/July, and the second is 6 weeks in August/October.

Mathematics students also have in-school experiences as part of the mathematics method subject.

Literacy and Numeracy

This is covered within the mathematics and science method subjects. For example, in science, students study the ‘Stepping Out: Literacy and Learning Strategies’ program, which is used in schools throughout the state.

School/Industry Links

In the subject ‘Mathematics Curriculum 472’ (and 462 combined) there is a partnership with a local independent Anglican boys school. The purpose of the program is to link theory and practice. Each week, students spend about an hour at the school either observing or assisting in the classroom or teaching a class. There is regular communication between the classroom teachers and the university lecturer via a school coordinator. The students and the school staff have given very positive feedback about it. In addition, the teachers have helped the students to prepare their resumes for employment, and provided references for them.

Innovations

The school–mathematics partnership described above is innovative.

The science classes are strongly rooted in science education research. They integrate the theories of science learning and the philosophies of science and science teaching (e.g. students study research in science education, the nature of scientific knowledge, constructivist learning theory and questions such as ‘What is science?’). Expert practitioners are regularly brought in to give guest lectures. Students’ peer presentations on the high school science curriculum are used to put together a CD-ROM of resources which is given to all students at the end of the year. WebCT is used to allow students to view and comment on their lesson plans and programs (the lecturer posts lesson plans and programs, and the students use the bulletin
board for writing their comments, which are used to amend their work before they prepare a final draft. All assessments and assessment feedback are submitted using the World Wide Web.

The unit ‘Competencies for Teachers’ requires students to put together their professional portfolio.

Challenges

There is limited time available in the program. More time in the curriculum method classes would allow more depth and more time for students to reflect. More funding would improve resources such as classroom materials and library books.

Creating a good balance between theory and practice in the science education classes (e.g. should they have a large theoretical component or be primarily practical?) is another issue.

Sharron Wheeler, Khim Harris

Program Description E44

UNIVERSITY OF WESTERN AUSTRALIA

BACHELOR OF SCIENCE/ BACHELOR OF EDUCATION (COMBINED COURSE)

This is a 4-year program, which is currently in its second year of operation. It is designed to train teachers for science and mathematics teaching (most students will be qualified in both areas). There are four students enrolled in second year and six in first year. Students do a minimum of 200 points and a maximum of 224 points. During the first three years the students study mostly science, with one or two education subjects in each year. The fourth year is all education subjects. Students may exit at the end of year three with a B.Sc. if they change their mind about being a teacher.

Content/Discipline Studies

All the science and mathematics content studies are general offerings. These would typically make a minimum of 110 points. Students may do a major and a minor or a double major. Students must do either physics or chemistry, and they typically also do biology and mathematics. A major is subjects taken to third year, which will qualify them to teach senior high school. A minor is subjects to second year and is usually equated with teaching to year 10 level. Because of the high TE scores of these students they are often encouraged to do a double major. Most students will be qualified to teach mathematics and a science.

Curriculum Method Studies

In year four there will be a science curriculum subject (8 points) and a mathematics curriculum subject (8 points) for students who have completed a major, and there will be a six point minor method subject in each of these areas. Students may not enter year four until they have completed the requirements of year three.
Teaching Practice
We are currently planning that double degree students will do 14 weeks of teaching experience in their fourth year – two initial practica of 3 weeks each and finally in September/October an 8-week placement. In addition, at the beginning of year two the students do a one-week observation in primary classrooms before the beginning of semester (in the subject ‘Teachers Work, see below) and a similar week is planned for year three. This will mean 16 weeks of school experience within the four years. If students choose the year four elective ‘Education in Rural Australia’ they will visit a rural school for 3 or 4 days.

Literacy and Numeracy
These will be covered in the methods subjects in year four.

School/Industry Links
In year four the mathematics students will hopefully be able to join the program at a local Grammar School (see the GradDipEd mathematics).

Things We Like
The program attracts bright, young, highly motivated students and gives them a strong content base in mathematics and physics or chemistry.
They are a small group of students so they develop strong peer support in the education subjects in first and second year (whereas undergraduates in large units may not develop such an esprit de corps).

Innovations
At the beginning of year two the students spend a week observing in primary schools rather than secondary schools. The purpose of this is for the students to see ‘where the high school students are coming from’ (the students were initially a bit sceptical about this, but came back very positive about the experience of mixing with real teachers and being part of the school environment).
The program was set up after discussion with the Science Teachers Association of WA specifically to produce secondary teachers in the critical areas of physics, chemistry and mathematics.

Challenges
It is difficult to get a lot of school experience into the program, because of time constraints (in the four years the students must complete a full B.Sc. as well as their education subjects, so it is difficult to find more time for practicum) and because of the cost of paying for school supervision (especially in primary schools as the rate is double that in high schools).

Other Programs
Some of the subjects are shared with mathematics and science students in the Graduate Diploma in Education program (separate program description).

Clive Whitehead
Appendix F  Descriptions of secondary technology teacher education programs

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PROGRAM DESCRIPTIONS

Program Description F1

AUSTRALIAN CATHOLIC UNIVERSITY

GRADUATE DIPLOMA IN EDUCATION (SECONDARY)

This is a one-year, end-on program, which has been running for many years (although it has been frequently modified). There are usually 5-12 mathematics students in the Victorian campuses. There are usually 16-22 science students and 10 mathematics students in the NSW campus. The NSW campus has about 15 TAS students in a sponsored (by CEO and DET) cohort. Students do some general education subjects, field experience and curriculum subjects to total 120 credit points (each subject is 10cp).

Content/Discipline Studies

Previous requirements are a degree with a major in one curriculum area and a minor in another (ie. students need at least a minor in mathematics to enter mathematics teaching). Academic or industry credentials may be accepted for TAS.

Curriculum Method Studies

Victorian students do 2 method subjects in each of their two teaching areas (e.g. science plus another subject such as mathematics or PE). The first semester science method subject focuses on general science techniques, especially for junior high school. The second semester science subject breaks into specialty areas for the senior science specialisation. The first mathematics method subject covers mainly junior mathematics and the second has more senior mathematics content (each subject is 3 h/wk face to face, as a tutorial or workshop).

NSW students do two senior science methods and one junior secondary method). The first TAS method subject focuses on the Computing Studies and Design and Technology 7-10 syllabi, and students focus on individual lessons and short lesson sequences. In the second TAS subject students do either computing or industrial technology at senior high school level.

Teaching Practice

The Victorian students have two field experiences in semester 1 and one in semester 2, totalling 9 weeks (45 days in schools). The NSW students have 6 weeks of practicum. They also have 9 days of lead-up visits to their practicum school in which they do a range of tasks (this is a strong, school-uni link).
School/Industry Links

As part of the mathematics method subjects, Victorian students assist with the judging of the mathematics talent quest, with teachers from schools. Students sometimes work in a local school which has a special mathematics program. They are encouraged to tutor children in mathematics. Students visit the offices of the professional associations and meet the staff and look at their resources and discuss the issues facing the wider community. There are some common classes and workshops with VUT.

Literacy and Numeracy

This is covered in the general education subjects, and mathematics literacy is covered in the mathematics method subjects (e.g. reading a mathematics textbook, reading a train timetable).

NSW TAS students cover the literacy of technology in their method subjects.

Things We Like

Students find the work practical because it focuses on student learning: how to get students involved in their learning and taking control of their learning (this is particularly important in mathematics, where there is a lot of negativity amongst school students); and strategies for coping with mixed abilities and challenging brighter students.

The TAS students show great improvement in their skills and have reached a good standard in information technology. We are developing software-based teaching resources.

The NSW program has strong links to schools.

Innovations

The school/industry links (above) and the graduate certificate program (below) are noteworthy. Student learning is supported by a website and the program emphasises authentic tasks.

Challenges

Getting enough students who have studied mathematics in their previous degree is a challenge.

Some technology students come in wishing to teach woodwork or textiles and do not realise that TAS teaching now has a much wider scope. Many TAS students don’t have a very academic background.

Building more teaching practice into the program is a challenge.

Other Programs

There is a Graduate Certificate in Middle School Mathematics, which has about 60–70 students and is funded by the Catholic Education Office, so students don’t have to pay fees. This program is for practising teachers who are currently being asked to teach mathematics in schools, but who don’t feel they have the mathematics background to do so (some schools also pay for programs like this because it is hard to find qualified mathematics teachers). There are 4 units, which are mostly mathematics content, with some pedagogy. The mathematics is taught by modelling good secondary pedagogy. It doesn’t include senior level mathematics.

Mary Horne, Martin Maguire, Peter Taylor
Program Description F2

UNIVERSITY OF CANBERRA

BACHELOR OF EDUCATION: SECONDARY TEACHING (DESIGN AND TECHNOLOGY)

This is a 4-year program, which began this year. There are about 13 students enrolled. Students do a major in education, a major in design, a technology specialisation and teaching practice. The ACT program is based on the national documentation for Technology. The education core of six subjects includes the principles of general education from areas of psychology, history, philosophy, sociology, construction of pedagogy, diversity, special needs education and information technology.

Content/Discipline Studies

Within the technology specialisation (which can be engineering, or food technology, or information technology) students do a major at the university and a minor at Canberra Institute of Technology (CIT). The design core comprises general offerings of the School of Design and the CIT Faculty of Design.

Curriculum Method Studies

There are 3 curriculum method subjects in year 4. One covers design and another covers their specialisation (engineering or food technology or information technology – further specialisations will be added). Each subject is 4 h/wk face to face as 2 tutorials. The third subject focuses on teaching in vocational education subjects.

There was extensive consultation with other faculties in setting up this program. CIT were very interested in the program, as were Applied Science and Information Technology staff.

Teaching Practice

There are 70 days of field experience. In year 1 there are 2 weeks of observation. In year 2 there is a 2-week block. In year 4 there are 25 days of practicum in semester 1 and 25 days in semester 2. Discipline lectures are taped so students can refer to them after practicum. Otherwise personal arrangements are made to deal with clashes with discipline studies.

School/Industry Links

Students have a one-hour professional experience tutorial each week, which often involves guest lectures by teachers and visits to schools to observe teaching models.

Students visit industries as part of their CIT subjects.
Literacy and Numeracy

These are across-curriculum expectations which are covered in the curriculum method subjects. Information technology literacy is dealt with in the information technology subject.

Things We Like/Innovations

There is a good liaison with CIT, and students graduate with dual accreditation (including CIT certificates) and a vocational education qualification.

The design core is the underpinning of the whole program. As the students do their design core subjects they are also required to observe the strategies used by their CIT instructors (they observe the process of teaching as they are being taught). They also have a year 12 student buddy working with them, and they observe how the year 12 student is learning. There is also an education subject in which they reflect on the teaching they have experienced at CIT. In year 3, students do an ‘Integrated Design Project’ which draws together the other aspects of their program.

The curriculum method subjects have innovation projects, in which they work together as a team to design, make and evaluate a project (e.g. a courtyard redevelopment project, which involves developing a brief and researching environmental design industries such as recycling industries, furniture industries etc, then manufacturing the final design).

Information technology flows through all the subjects. Web CT is used to facilitate communication.

Challenges

Managing field experiences during semester time, while the students have discipline studies at the same time, is an issue.

It is necessary to ensure that the students feel they belong to both organisations (university and CIT) when their subjects are spread across three campuses.

Other Programs

The Graduate Diploma in Education: Secondary Teaching is a one-year program, which has about 19 D&T students. They have previous degrees in diverse areas including information technology, environmental design, food and nutrition. Their program is very similar to the education component of the 4-year program above. They do one method subject in D&T and another in another area (which might be a technology specialisation or another subject such as mathematics or science).

Rosemary King
Program Description F3

CHARLES STURT UNIVERSITY

BACHELOR OF EDUCATION (TECHNOLOGY AND APPLIED STUDIES)

This is a 4-year program, which has been running for 5 years. There are up to 30 students in each year. The graduates are qualified for TAS 7-12 teaching in two curriculum areas and Design and Technology. They are also trained as vocational education trainers in the area linked to their major discipline study (e.g. VET Hospitality links to Food Technology). There are 32 subjects in the program, comprising 4 education subjects (e.g. rural education, educational psychology, sociology), core studies in computing, materials, design and marketing, curriculum method subjects, and major and minor discipline subjects as electives.

Content/Discipline Studies

Students do a major (7 subjects) and a minor (4 subjects) from agriculture, computing, food technology, industrial arts and textiles (students are choosing these disciplines in roughly equal proportions). These are selected general offerings from other faculties (e.g. food technology subjects are offered by the science faculty). Industrial arts majors do engineering subjects at university plus woodwork and metalwork at TAFE. All textiles content is at TAFE (they do TAFE studies at night for two years then get back credit from the university). The core subjects in computing, materials, design and marketing are taught by other faculties. Some of the subjects are designed for these students only (e.g. one of the design subjects and the engineering materials subject) and others are general offerings. There has been extensive communication with other faculties about prerequisites, delivery and content for these subjects.

Curriculum Method Studies

There are 4 method subjects - one for each of the major/minors plus a technology education curriculum subject and a D&T curriculum subject. The technology education subject deals with the nature of technology, approaches to technology education, approaches to its teaching and the national and state statements. The D&T subject looks at the curriculum implementation in D&T. The other two are methods for their major and minor. Each subject has about 4 h/wk of face to face (lecture, tutorial and workshop) and is taught by Education staff.

Teaching Practice

In year 2 there is a 3-week practicum in semester 1 and 3 weeks in semester 2. In year 3 there is one week of observations (which students use to prepare a program) plus 4 weeks in semester 2. In year 4 there is a 10-week internship in term 2 of semester 1, then they are back on campus in semester 2 to finish their discipline studies and some more education studies. Clashes with other disciplines are reduced by: reducing the discipline subjects to one in semesters where there are practica; using university vacation times; negotiation between students and discipline.
lecturers; and many of the discipline subjects are available by distance education enabling some students to enrol in mixed mode when there are clashes.

School/Industry Links

Students visit schools as part of their education subjects for instruction/observation in specific aspects.

In the VET part of their program students have a one-month industry placement which they organise themselves (ie. they work in the hospitality industry or the computing industry etc) during the university breaks (this is part of the requirement to be an industry trainer).

Literacy and Numeracy

The content of one of the practicum subjects is focussed on literacy across the curriculum (general literacy and technological literacy).

Innovations

It was the first program in Australia that had preservice training in vocational education. It was one of the first programs to have formal arrangements with TAFE as part of the program. It covers a broad range of technologies. There is a credit arrangement with students who already have a trade background or equivalent.

Challenges

Students have timetables across 4 different faculties so there is a need to organise to avoid clashes.

Other Programs

In the Graduate Diploma of Education program there have been a small number of students (less than 10) who have done TAS as a method, although it has not formally been offered as a major. For example, some students do science and D&T (food technology). Starting next year it will be offered as a full teaching area. Students who wish to teach TAS will do three curriculum subjects (e.g. D&T, agriculture and science).

Rod Francis

Program Description F4

SOUTHERN CROSS UNIVERSITY

BACHELOR OF TECHNOLOGY EDUCATION

This is a 4-year program, which has been running for 3 years. Its core themes combine innovation, research and foresight integrated in the study of technology, design and scientific principles. There are about 70 students spread across the first 3 years. There are 32 units comprising a compulsory major in design and technology (including several general education units) and an elective stream which can be chosen from ‘wood technology and engineering studies’, ‘IT and multimedia’
or ‘tourism management and food technology’. Also, students choose 3 enrichment units in any area excluding textiles.

All students must do a research honours component which involves a mini thesis (whether they are awarded honours is based on grade point average). This research core is central to the innovation theme and purpose of the degree.

Content/Discipline Studies

The elective streams are delivered by 5 other faculties in the university (e.g. the School of IT and Multimedia delivers the subjects in IT and multimedia, and the nutrition units are delivered by the School of Naturopathy). Units were selected from the other faculties but these were purposely not tailored to education students because students are expected to become knowledgeable and skilled to the level of that professional degree (ie. the students get a professional version of the content rather than a schools version). Some subjects can be done by distance education mode.

Curriculum Method Studies

The compulsory core subjects in D&T are Education offerings. Some of these are school-based, which are delivered at local schools and taught by teachers (e.g. managing resources in a school context) or by university lecturers.

The curriculum method subjects (which include the Technacy or Design and Technology subjects in the common core) focus on transferring discipline content from other faculties into classroom situations (e.g. by using microteaching and other strategies).

Teaching Practice

In year 2 there is a 17-day block (students miss some lectures in other subjects and solutions are negotiated individually). In year 3 there is a 23-day block (this is in university vacation time to avoid clashes with lectures in other subjects). In year 4 students spend 8 weeks in school as an intern (during this time they also finish a project and do their industry experience, and do an external elective, so there is no formal campus component).

Literacy, Numeracy and Technacy

This is covered in the design and technology methods. Students must include literacy, numeracy and technacy education in the units of work they plan and teach in the internship. The concept of technacy is core to the degree as endorsed by the Australian Science, Technology and Engineering Council, see:


School/Industry Links

Students are in schools at least twice a week every week in the program to do coursework (they do microteaching and mix with school students who are staying back and working on projects). In year 4 students do 18 days of industry experience.

In the final project, students are required to research, hypothesis test, analyse and interpret in an industry or school innovation issue in technology education.
Things We Like/Innovations

It is a full forward-looking university degree at a high level (TAFE studies are optional usually as articulation pathways). The program is delivered with a formal and close link to schools. It has a philosophy of combining science, technology and design. The philosophy of the program is that students should have an understanding of science as well as technology processes and design solutions (ie. the teachers need to be technologists, scientists and designers, a combination which we call innovation education when you add the industry placement and research core studies). It seeks to graduate holistic thinkers and doers who help schools, students, employers and community groups set progressive standards rather than only follow them in technology education.

There was a development committee for this program, which included personnel with national and international experience in technology innovation, science and design (including indigenous representation, a futurist professor and a Clunies-Ross Award science researcher).

There are 3 high schools involved in the program delivery and also as part of our local knowledge incubation strategy. Students do some of the D&T subjects after hours at these schools for lectures/tutorials, which are taught by head teachers or university staff. Students feel this is relevant, and it creates a good link with the schools. Intellectual property and research are exchanged between university staff and school staff to progress the field.

Challenges

The views of the advisory panel for this program in places not the same as the views of the NSW DET, so the original program had to be slightly stepped back to meet current, mostly outdated curriculum content in technology education. Reaching agreement was a challenge but mutual ground was found. This experience indicates that federal policy in Technology education ought to provide State incentives to boost the higher end of technology understanding including research and a forward view for industry and community. VET in schools is very important for its niche, now it is time to also look at attracting high performers capable of integrating science, general technology and design studies to better position school leavers to the modern technology and ideas-driven global economy.

Kurt Seemann

Program Description F5

UNIVERSITY OF NEWCASTLE

BACHELOR OF TEACHING/BACHELOR OF DESIGN AND TECHNOLOGY

This is a 4-year program, which has been running for 4 years. There are about 20 students in each year. There are 320 credit points, comprising 140cp of discipline studies and 180cp of education studies. During the first three years, students do a combination of discipline studies and educational studies. The final year is all education studies.
Content/Discipline Studies

All the discipline studies are non-Education offerings. There is a compulsory design core of 70cp that represents the students' major study area. This core presents students with the design process and skills related to recording, working and presenting information in the design process. Most of the design core subjects have been specifically developed for education students, but all the rest of the non-education subjects are general offerings. The students also choose two other elective content areas (i.e. food technology, industrial design, engineering science, textile and design, visual communication, multi media and computing studies). After graduating, they will have a background in at least two of the Technology and Applied Studies HSC subject areas.

Teaching Practice

Students are located full time in schools for 20 days in Year 2, 20 days in Year 3 and a 50-day internship in Year 4.

Literacy and Numeracy

There is a specific subject, called 'Literacies Across the Secondary Curriculum' (Year 4), in which the students are taught about current policy issues such as literacy and numeracy, and how to implement them.

School/Industry Links

There are various professional experiences located within the curriculum method subjects. In Year 2 the students team teach specific content in schools, in Year 3 they visit a range of other schools, and in Year 4 they participate in a mentoring program in which they mentor senior students in one of the TAS elective areas (the program is designed to give the students a working knowledge of a senior syllabus and the nature of the students they will be teaching). They are required to reflect on themselves as a mentor and to measure the effect they have had.

Innovations

It's a futuristic program in that it's getting away from the notion of industrial education technology teaching. The unique part about this course is the core design subjects. Traditional courses were driven by specific content areas like metals training and skills acquisition for a specific vocational niche. Whereas this program focuses more holistically at future teaching for the workforce.

Challenges

The program is designed to offer maximum flexibility options for students to train in this huge technology area, and the limitation is that they can't know all of it because that's an impossible ask in teacher education. Deciding how many options to give the students and what depth of content knowledge to give them has been difficult.

Increased funding would allow more hours to be spent teach students workshop skills and computer skills, and would also provide more equipment.

It is difficult to get full-time staff who are qualified to teach this program.

Other Programs

The institution also offers a Bachelor of Education (Design and Technology) under a 'recognition of prior learning' arrangement. This course is available to anybody with
a trade certificate and industry experience who can demonstrate lifelong learning. The main difference between this program and the BT/BD&T is that the former assumes that the students already have most of the content skills and knowledge, so the course consists mainly of Education subjects, and there is only a small amount of content study.

Kath Grubka

Program Description F6

UNIVERSITY OF SYDNEY

MASTER OF TEACHING

This is a 2-year, end-on program for mathematics, science and TAS teacher education (it also has a primary intake, which is summarised elsewhere) which has been running since 1996. There are roughly 20 science students in each year and slightly less (15-20) in mathematics and about this number in TAS too. There are general education components, method subjects, and across-curriculum units (e.g. IT, special education).

Content/Discipline Studies

Admission requires a degree with a major in each of their teaching method areas: science, mathematics or TAS. Science candidates require both a major in a natural science and at least one year in another science. As well, science students need either: (A) a major in another teaching subject to do a second method, or (B) a third science (of at least one year) if they are doing science as their only method (i.e. double method science).

Curriculum Method Studies

Students do two method subjects (each is 4 h/wk face to face for the full year of 18 weeks - a core lecture/seminar plus 2 laboratory sessions), with double method work (8h/wk) in the one curriculum area possible. The major focus for the curriculum work is seminars (formal lectures are a minor proportion). The single science method covers mostly junior science and the double method subject covers senior science areas. The mathematics and TAS method subjects are similar - they all do the core single method and some do the double method.

Teaching Practice

First years have a 5-week block preceded by 3 all-day visits in the 3 weeks before the block (28 days) in August/September. Second years have a 4-week block in May (5 days per week for 4 weeks = 20 days), then a 10-week internship in third term. They return for an intensive 3-day conference (the conference has presentations of their action research projects and case studies results).

During the first 6 weeks of the program they have one day per week in schools doing observations as part of their general education subjects.
Clever Teachers, Clever Sciences

Things We Like

It is seminar-based rather than lecture-based. It is based on collaborative learning and problem-based learning (rather than 'lectures from the experts'). The feedback from students is positive.

Innovations

The whole program is based on the problem-based learning model. It is student-centred and issues-centred. Students look at particular case studies in depth and use them to look at educational issues. During term 1 of the program they are introduced to collaborative, case-based approaches and report their findings in seminars. The cases are developed by practising teachers and represent real school situations. Then they author and develop cases of their own based on their experiences in schools (in their day release in first term and their subsequent practicum experiences). This carries on to the science curriculum work, which integrates research findings with student research of issues and observations of issues.

The program is heavily integrated with technology, rather than as an add-on. There is a website for chat lines, placement of student work and accessing information and resources. The technology units ensure that the students have the basic competencies to use the technology in the curriculum subjects.

Challenges

Funding is needed to acquire getting cutting-edge science laboratory equipment and to sustain a science consumable budget.

Other Programs

The Bachelor of Education (Secondary Science)/Bachelor of Science is a 5-year program which has been running for two years. Students do a major and a minor in the science faculty. There are about 10 students in each year. Their general education courses will be in years 1, 2 and 3, their professional education subjects will be in years 3, 4 and 5 and their curriculum subjects will mostly be joint classes with the MT, but the general education subjects will be less problem-based than the MT. The teaching practices will be similar.

The undergraduate program for design and technology students is a 4-year program, the Bachelor of Education (Secondary Design and Technology) with TAFE and university studies. In year 1, students complete a level 4 TAFE certificate. In years 2 and 3 they do a TAFE course unit on design fundamentals and begin their university-based education and curriculum studies, including practicum. In fourth year they complete their education and curriculum studies, a practicum (3 weeks), an internship (5 weeks) and a school-based graduating design project. The program had its first intake in 2000 and has 15-20 students.

Tony Sperring
Program Description F7

UNIVERSITY OF TECHNOLOGY SYDNEY

GRADUATE DIPLOMA OF EDUCATION

This is a one-year, end-on program, which has been running for about 10 years (but this is the first year that TAS has been offered). There are about 18 science students, 6 TAS students and no mathematics students. The program has general education subjects, practicum and curriculum method subjects.

Content/Discipline Studies

Science education students require a previous degree with at least a minor in one of the sciences.

TAS students do some content in design and technology as part of the program.

Curriculum Method Studies

All the curriculum method subjects are Education offerings. The science method subject and the TAS method subject (each is 7cp) are presented in four 2-hour tutorials (8 h/wk face to face) which gives students an intensive experience in basic classroom skills before their first field experience, which is after week 3.

The first semester science method subject focuses on how children learn (done jointly with the TAS group), plus lesson planning and teaching strategies. The syllabi are introduced but not in depth. The second semester subject focuses on specific sciences (physics, chemistry, biology and geology) at senior and junior level. It includes some peer teaching.

The first semester TAS method covers some D&T content and some learning theory. In second semester, they study workshop skills and have a design project, as well as a more in-depth look at the relevant syllabus for their specialisation.

The Faculty of Design, Architecture and Building is involved in the workshop and project aspects of the TAS subjects (e.g. by supervising workshops).

Teaching Practice

There is a 5-week block in each semester (at different schools). The first involves one week of observation (and some teaching) early in the semester (so students can experience a school environment, and if they don’t like it they can drop out of the program before the HECS due date). There are university tutorials linked to practicum (they cover legal issues, ethical issues, social issues, sport, voice projection etc). From time to time students spend days in primary schools as part of their general education subjects.

Literacy and Numeracy

The science and literacy document is studied in the curriculum subjects.

Things We Like/Innovations

There is a strong link between the curriculum method subjects and practicum. The method lecturers do practicum supervision. The program is currently being developed to include a lot more immersion in school.
Challenges
The TAS students sometimes are asked to teach woodwork or metalwork in schools and many of them do not have these in their previous degrees. The range of subject areas in TAS is large, so it is difficult to adequately prepare teachers. Curriculum method subjects are separate from general education subjects).

There is a lot of content to cover in the short time of one year.

How to make best use of the first practicum is problematical, given that the DET interviews these students in August, rather than towards the end of the year.

Other Programs
The Bachelor of Science (Science Education) is being phased out. It was a 3-year science degree with a Graduate Diploma in Education, but the DipEd subjects were located at the beginning of third year and the end of fourth year. This formula was not popular with students, who wanted to continue the education component after they had started it. Through this degree there were good relationships established with the science faculty and the content of the subjects was discussed.

A 4-year program in mathematics, science and technology is currently being developed.

Janette Griffin

Program Description F8

UNIVERSITY OF WESTERN SYDNEY

BACHELOR OF EDUCATION - SECONDARY: TECHNOLOGY

This is a 4-year program, which began this year. There are about 6 students currently enrolled. There are 320 credit points in the program. At the moment, in each year there is some general education, some TAS method subjects, a design and technology compulsory discipline core and one elective strand to be chosen from engineering studies, industrial technology and computing (there are plans to include food science, and wood and metal technics). In future, the early years of the program will be more dominated by content.

Content/Discipline Studies
Students do two specialisations from the School of Engineering, the School of Design and the School of Science. All students take a major strand (at least 10 subjects) in design and technology - these are a tailored sequence of general offerings from the other faculties. The elective strands are 5 subjects (all subjects are 10cp).

In future years there will be virtually no open electives, and students’ subjects will be determined by the strand they wish to pursue.

Curriculum Method Studies
Students do 4 method subjects (each is presented as 3 h/wk of workshop). The first is a general TAS method for years 7-10, the second is a general TAS method for
years 11-12, the third is a 7-10 subject specifically for Design and Technology, and the fourth is for senior Design and Technology. (However, in future years, the new TAS subjects will all be generic TAS.) The TAS method subjects are taught by a casual who is a teacher at a local school.

Subject sequences were negotiated with the heads of the other faculties.

Teaching Practice

In first year, students are attached to selected TAS departments for one day per week (observing and team teaching) during 2 semesters (15 days total). There is a 4-week block in year 2, a 3-week block in year 3 and a 4-week block in year 4. The practica are in semesters where discipline subjects are not scheduled (to avoid clashes).

Literacy and Numeracy

There is a special subject on language and literacy for all secondary students.

School/Industry Links

In year 4 students will do an additional industrial experience subject in which they go into the workforce (to work/observe) in an area related to their specialisation.

Innovations

The program gives students a broad university perspective, by involving other faculties.

Challenges

We would like to have entry points into the program which recognise prior learning and work experience.

It is difficult to run classes for each TAS specialisation because of the cost of running small classes.

Other Programs

There are about 15 TAS students in the Graduate Diploma of Education - Secondary. These students often have degrees in either food technology or design. They do the same method subjects as the undergraduate students (and in the same classes).

Wayne Sawyer

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Program Description F9

**GRIFFITH UNIVERSITY**

**BACHELOR OF TECHNOLOGY EDUCATION**

This is a 4-year program, which has been running in its present form since 1996. It is designed to prepare teachers for industrial technology and design, technology education (senior engineering, senior technology studies, junior and senior graphics, junior and senior design and technology) and VET. There are about 50 students in each year. There are 320 credit points, comprising discipline studies, education studies and practicum. All subjects are Faculty of Education offerings (as this is a
specialised degree, there was no specific faculty for the discipline studies, so it is all
offered inside the Faculty of Education).

Content/Discipline Studies
Students do a major in industrial design and technology, and do a minor in VET
(there is a suite of 5 VET subjects). The major includes subjects on design,
information technology and graphics, engineering and construction. As these are
Education offerings, much of the pedagogy is embedded within the discipline
subjects.

Curriculum Method Studies
There are 3 method subjects specifically for technology (each is 10cp). The first
subject concerns the technology workplace and its issues. The second covers
teaching strategies. The third covers program development. Each is about 3 h/wk
of face to face (a lecture and a tutorial) and some subjects are flexibly delivered.

Teaching Practice
There is a 3-week block in year 1. There are three weeks in each semester of year 2,
and 3-week and 4-week blocks in year 4. These are held during semester time and
the other subjects are shortened to accommodate them.

Literacy and Numeracy
This is covered in a year 1 general education subject.

School/Industry Links
In third year there are two industry placements (3 weeks in a manufacturing
industry and 3 weeks in a construction industry).

In the final year students do a design and technology project in which they contact
an industry or community organisation and construct a project for them (e.g.
designing and making facilities for the disabled) and present it as a Powerpoint
presentation.

Things We Like
It is a coherent degree and has a lot of depth. The technology education staff have a
close relationship with the students. Lecturers model the types of teaching
behaviours they would like the students to adopt in schools. The students have a
good knowledge and are regularly sought interstate and overseas.

Innovations
The final year D&T project interacts with the ‘real world’ (see above). The subject
‘Issues in Technology Education’ keeps students up to date with the latest policies
and their classroom implications.

Challenges
Getting sufficient funding to meet the students’ needs is a challenge – all the lab
work is done on campus so it’s expensive to run.

Howard Middleton
Program Description F10

UNIVERSITY OF SOUTHERN QUEENSLAND

BACHELOR OF EDUCATION (FURTHER EDUCATION AND TRAINING)

This is a 4-year program, which has been running for about 18 months and has recently been accredited. There are about 30 students currently enrolled in the industrial design and technology major. It is offered by distance education only. The program is primarily for the vocational education sector, but it does have a major in industrial technology and design, which is aimed at secondary design and technology. There are 32 credit points, of which 15cp are content studies and the rest are education studies (each subject is one credit point).

Content/Discipline Studies

The program is only open to mature age students who have prior qualifications and experience in an industry relevant to what they will be teaching in schools. Many students have trade qualifications, but some have diplomas or degrees (e.g. in engineering). Students are granted exemptions in the content studies according to their previous qualifications (e.g. a person with a trade qualification may be granted up to 7 units exemption).

The remaining content studies are general offerings of non-education faculties. Each student has an individualised course of study designed for them, which builds on their past qualifications and experience. There are strong links to the faculties of engineering and surveying (which were consulted in the design of the program, and which have created many units in distance format).

Curriculum Method Studies

There is one unit on program design and implementation, another covers curriculum implementation, and another covers assessment.

Teaching Practice

There are 100 days of field experience. Students negotiate their practica directly with schools. Students are supervised by university staff or approved proxies during their practica.

Literacy and Numeracy

There is an optional unit at the moment, but a core unit is currently being developed in a distance format and will be offered in future years.

School/Industry Links

There is an industry placement subject, which is intended to give students industry experience in areas that they did not experience during their previous working lives. Students spend at least one week in their placements, and many do much more than one week.

Things We Like

The program provides teacher education for people who would not otherwise be able to become teachers. The staff work closely with schools right across Australia.
to develop productive partnerships for practica. There is a technology focus, and students participate in on-line learning as part of this course. The students’ prior industry experience, in combination with this program will produce graduates who can implement technology curricula for the future.

Innovations
The flexibility of this program is innovative. Each student has a program tailored to suit their individual needs, based on their past experiences.

Challenges
The main challenge is arranging practicum supervision. This includes ensuring that the sites are appropriate, that the supervision of students is of a high standard, and ensuring that these can be verified to ensure a quality outcome.

Mark Dawson

Program Description F11

UNIVERSITY OF SOUTH AUSTRALIA

BACHELOR OF EDUCATION (SPECIALISATION)

This is a 2-year, end-on program, which has been running for 4 years. There are about 18 science majors, 30 science minors, 5 mathematics majors, 5 mathematics minors, and 6-16 technology students. The program uses extended semesters and summer schools so students graduate in 18 months. There are 72 units, which are all Education offerings.

Content/Discipline Studies
Admission requires are a bachelor degree or equivalent. Many of the technology students have an IT degree or an information processing degree (for information technology), others are engineering, agriculture, food technology, architecture or industrial design, or students with workforce experience (advanced diploma qualifications and significant trade experience).

Curriculum Method Studies
Students do 6 method subjects in varying patterns – many do 4 in their major and 2 in their minor, but other students may do 3 and 3, some have a third learning area, and some do all 6 in one specialisation. The first science subject is a generic introduction to science teaching. The second has a middle school focus. The third has a focus on senior syllabus. The fourth subject has a technology focus (integration of computers, data loggers, the internet etc). The fifth subject deals with research methods and current issues. The sixth subject is a negotiated study (major project) or a content study in science. Each subject is 4.5 units, presented as 3 h/wk contact time. The mathematics subjects are structured in a similar way.

There are 6 technology subjects, of which 3 have a more theoretical focus (including technological literacy and critical theory in technology) and the other 3 focus on student projects (lecturers use practical examples to model appropriate teaching behaviours). The first subject is ‘Foundations in Technology Education’,

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which is an introduction to philosophy and curriculum (it focuses on the broader range of technology, with the aim of dispelling stereotypes of what technology and technology education are). Some subjects are presented as 3 h/wk each week and others are presented in intensive mode in summer school or evening classes (to include practising teachers in the program).

Teaching Practice

Students are assigned to a school at the beginning of year 1, and do half-day visits to the school each week for the whole year. There is also a 2-week block in semester 1, and a 4-week block in semester 2. In semester 3 there is an 8-week block.

Literacy and Numeracy

This is covered in the curriculum subjects.

School/Industry Links

The half-day visits each week provide school links for their other subjects. A local building society provides a prize for the best student each year. There are good links with the CEO and DET (via employment sessions etc). The technology program employs practising teachers who regularly involve students in their own schools.

Things We Like

The program is well integrated because there is a small group of lecturers involved, so reflective practice, curriculum, learning and contexts are well reinforced. Having 6 curriculum units is good. Information technology is integrated in the subjects.

The technology students are highly motivated to teach, and have a range of backgrounds, which encourages peer learning. There is a 50:50 balance of gender technology classes.

Innovations

The 18-month program gives students much more confidence than a one-year program. Graduating half way through the year has worked out well because there is employment available at that time. The program takes a radical approach to technology education (it is process rich). Technology students have very different content backgrounds, but the program has been successful in preparing them to teach a broad technology base.

Challenges

Finding schools and mentor teachers is difficult because teachers are always so busy.

Getting enough students into mathematics and science is a challenge.

It's difficult to find a pathway for the technology students into the program. Students are assumed to have the prior knowledge for the program, but for technology education there is no directly applicable degree. Advertising would attract more students into the program (some students might miss the program). More time for the program would develop their wood, metal skills etc.
Clever Teachers, Clever Sciences

Other Programs

We are putting together a B.Sc./B.Ed. double degree.

Bruce White, Steve Keirl

Program Description F12

UNIVERSITY OF TASMANIA

BACHELOR OF TEACHING (7-12)

This is a 2-year, end-on program, which was introduced in 1997. The Science/Mathematics curriculum and method subjects are conducted on the Hobart campus only, with about 15 students doing mathematics and science in each year.

Design and technology curriculum and method is studied only on the Launceston campus with 13 students in year 1 and 2 in year 2. There are general education subjects, curriculum subjects and practicum on both campuses.

Content/Discipline Studies

Science/Mathematics

Admission requires a previous degree with 2 teaching areas (e.g. mathematics and science, mathematics and SOSE, or science and SOSE).

Technology

Many of the D&T students have Design degrees. There is a one-year, full-time bridging course in design and technology for students who do not have a prior degree. It covers woodwork, metalwork, technical drawing, design, photography, automotive technology, computing, food and textiles. It is an Education offering and has about 10 students (who will move on to the BT next year).

Curriculum Method Studies

Science/Mathematics

Students do two methods subjects (each is 4 h/wk of workshops for the whole non-practicum program - ie. 4 h/wk of mathematics and 4 h/wk of science for the whole program not including practicum). Each subject represents 25 per cent of the program, so each secondary student has 50 per cent of their program in method subjects. These subjects contain content as well as methods, because students still need work with content. In science the first year subject focuses on the curriculum and the second year subject looks at authentic experiences to present the curriculum.

Technology

There are 2 D&T method subjects. Each is presented as 2 h/wk for one year. In the first subject, students study the nature of technology and lesson planning. In the second subject they plan, teach and evaluate a program of work.
Teaching Practice
There are 105 days of practicum.

School/Community Links
Mathematics students visit a school to interview teachers about the mathematics program and how it is implemented. All the secondary students visit a primary school to observe mathematics teaching, then exchange their observations about mathematics at primary level.

Science students go to a minerals centre, forestry centre, an integrated energy management centre, CSIRO and a marine studies centre to look at teaching support resources. Through liaison with the Faculty of Science the second year subject gives students experience in initiating and carrying out a LandCare project in a local gully, with conservation value, then working with schools on the project. This gives them experience working with children on extra curricular activities. It involves liaison with the local council, the Waterwatch program, the Adopt A Patch program, Greening Australia, and Parks and Wildlife. The D&T students visit the timber industry.

Literacy and Numeracy
This is covered in the curriculum subjects. Students go to a local school to tutor individual children for 2 h/wk (for about 10 weeks) on literacy and numeracy problems. It gives the students an opportunity to observe and understand children's problems. The students use a website which is related to the local newspaper (developed with the education editor of the Hobart Mercury). Students are required to pick a newspaper article from the site and develop a literacy/numeracy package to be used in schools.

Things We Like
We try to help the students develop connections across the curriculum and within the parts of the mathematics curriculum (e.g. being able to explain the relationship of place value across the 4 basic operations).

Students get in touch with many community groups (to help make the curriculum relevant to students).

The LandCare project involves SOSE students as well, which is challenging to the students. The LandCare project shows them how to use the natural environment to teach topics, rather than just the classroom.

The D&T program covers a wide range of technologies.

Innovations
The D&T bridging course is innovative. The website with the local newspaper is innovative (see above).

The involvement in the LandCare is a rich task, involving press releases and a professional development portfolio. This is a national pilot project. Also in science there is a focus on critical media literacy and multimedia in teaching.
Challenges

How to attract students who have enough mathematics and flexible thinking is an issue. Many of these students want to teach mathematics the way they were taught it (by rote learning), but we want to move them in other directions.

Timetabling constraints are an issue for technology, because some projects would work better in a large block of time rather than 2-hour tutorials. There is a lot to cover in technology in the limited time available.

Jane Watson, Natalie Brown, Harvey Wynne

Program Description F13

LATROBE UNIVERSITY

GRADUATE DIPLOMA IN TECHNOLOGY EDUCATION

This is a 2-year program, which was offered for the first time in 2001. It is delivered through a cooperative arrangement between TAFE and Latrobe University. It has been designed to address the shortage of technology teachers in Victorian schools by attracting qualified trades-people to become VET teachers and teachers in the Technology: Materials and Systems curriculum at the junior secondary and senior (VCE) level. It is currently operating through the Bundoora, Bendigo and Wodonga campuses of LaTrobe University. There are approximately 40 students currently enrolled (most are at Bundoora). The program consists of 9 University Education subjects of which 4 are practica and 3 TAFE subjects. Students are able to continue with their normal work commitments as their studies are at weekends and during holiday periods (except during the practicum). Students study 'design, make, appraise' approaches to the VET in schools curriculum within their particular specialisation (e.g. woodwork). They also become familiar with the broader Technology Materials and Systems curriculum.

The pre-requisite for this program is a trade certificate and 8 years of industrial experience (e.g. carpentry, automotive, building, chef, electronics). Alternative pre-requisites such as a Post Year 12 Diploma in Technology with 2 years of industrial experience are also acceptable.

Content/Discipline Studies

There is an information technology subject in year 1, which is offered through TAFE at the level of Certificate 2 in Information Technology. The subject 'Studies in Technology: Materials and Systems' covers new materials, design and development of technological systems, and the relationship between technology and society. There is a significant workshop component relating to these studies.

Curriculum Method Studies

In ‘VET Teaching Method’ students explore relationships between competency-based education, vocational training, VET in schools programs and teaching to achieve stated outcomes. In year two, the ‘Methods of Teaching Technology’

Teaching Practice
These students are required to have a minimum of 82 days of supervised teaching. Sixty of the days must be in secondary school (one practicum may be in a non-school setting such as a TAFE). The practicum component is over four small blocks so that there is time for them to build teaching skills steadily. Students must complete a teaching method (e.g. VET Teaching Method) before their first practicum. The timing of the practica is by individual arrangement with students (because of their work commitments).

Literacy and Numeracy
This is covered in the general education subject ‘Issues in Education’ in year 2.

Things We Like
The program has flexibility. It recognises that the students are typically full-time tradespeople who are often running their own businesses. So there is flexibility built into the program so they are able to cope with it as well as their other commitments.

The enthusiasm of the students. They are mature age students who are looking for a fresh start. The program is designed so that theory is linked to practice.

Innovations
The relationship with TAFE is innovative. Students may begin the TAFE component of the program prior to commencing the university subjects or they can do the TAFE subjects concurrently. The whole course is innovative in that it fills a gap in the preparation of teachers. It’s suitable for people from a range of different backgrounds and builds on their expertise. All of the subjects are offered in block mode during weekends and holidays. This enables students who have work commitments and those from regional areas to do the course.

Challenges
Because of their diverse backgrounds and the distances involved, the students don’t see much of each other between classes. A Web-based Forum for on-line discussion has been set up to provide support and a means of communication for students. To assist students to adapt to the requirements of university assessment tasks, some additional classes in academic writing skills have been arranged.

Les Lyons, Marion Sargeant
EDITH COWAN UNIVERSITY

BACHELOR OF EDUCATION - SECONDARY (Design and Technology specialisation)

This is a 4-year program, which has been running for about 7 years in its present form. There are about 20-30 students in each year (it is the only undergraduate program for design and technology in WA). There are 32 units, comprising education studies, discipline studies and electives (each subject is one unit). Nearly all the education and discipline studies units are taught within the School of Education.

Content/Discipline Studies

Students complete a specialist major of 11 units in design and technology, most of which are offerings of the School of Education (one unit is taught at TAFE and sessional staff are contracted from TAFE for another). These units cover drawing, wood, metal, computing, design process, materials science, design projects, hydraulics, systems, photography, digital media and electronics. Students may study 5 electives in other faculties or in Education. Students have the opportunity to pursue major design projects in the final year (e.g. designing and making furniture for a local primary school).

Curriculum Method Studies

Students complete 4 method subjects (each is 3h/wk face to face). The first gives an overview of the Technology and Enterprise Learning Area (ie. design and technology, business education, home economics). The others focus on curriculum construction and preparation for practicum in Design and Technology. In the final semester, some students are able to complete an Internship where they are able to work full-time and obtain course credit.

Teaching Practice

In year 2, semester 2 students spend one day per week in schools for 5 weeks, then do a 2-week block. In year 3 there is a 2-week block then a 4-week block. In year 4 there is a 10-week block in semester 1. There are other informal school experiences in the curriculum units.

Literacy and Numeracy

There is the compulsory unit, ‘Literacy Across the Curriculum’ in year 3. There is also a compulsory Information Technologies and Research unit.

Things We Like

There is good integration in the program because most units are taught within the School of Education.

Innovations

The internship is unique to this university. In the year 4 internship, students are employed by the Department of Education or other educational systems full-time.
Clever Teachers, Clever Sciences

for 6 months (they also finish a research project in on-line mode, and keep a professional diary). They have a teacher mentor, a university mentor and a closed website and chat facility. Interns are placed in schools where there are vacancies in D&T (some interns have been re-employed in the same schools after the internship). Not all students do the internship - they are invited to express interest, and the better students are selected as placements become available (18 students in the first year, and 36 students last year, including primary interns, were placed).

The Graduate Diploma of Education - Technology Education is innovative (see below).

Challenges

How to recruit more students into the program is a challenge. There are large numbers of sessional staff in the program. Obtaining funding for new equipment is a challenge.

Other Programs

The Graduate Diploma of Education (Secondary) is a one-year, end-on program, which has 13 D&T students. Students have previous degrees in areas such as architecture, fine arts and business. They do 2 D&T method subjects and are in the same classes as the undergraduates (although they do some different tasks). They do 10 weeks of practicum in 3 blocks.

There is a B.Ed. program to upgrade D&T teachers in Mauritius and the Seychelles, and teachers from Botswana.

The Graduate Diploma in Education - Technology Education is an intensive one-year program, which currently has 17 students in its first cohort. Students have degrees (some higher degrees) in science, media, IT, geophysics, business and agriculture. The program covers D&T, home economics, business and IT, so it includes discipline content as well as methods. It is fully funded by the Department of Education - students have a training wage and are guaranteed employment in rural schools. IT is integrated through the program, and all students are given laptops. This is a special course funded for 2001.

John McQueen
Appendix G  Descriptions of middle school and P–12 teacher education programs

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PROGRAM DESCRIPTIONS

Program Description G1

UNIVERSITY OF QUEENSLAND

BACHELOR OF BEHAVIOURAL STUDIES/BACHELOR OF EDUCATION (MIDDLE YEARS OF SCHOOLING)

This is a 4-year program, which commenced in 2001 with 56 B.Behav.Stud. students officially nominating for the dual degree. However, students can change to the dual degree pathway anytime before the end of their second year provided they complete appropriate electives in the first 2 years. Therefore numbers will change.
A small number of the 2000 B.Behav.Stud. intake changed to the dual degree when it became available in 2001. The program prepares teachers for the middle years of schooling (years 6-9), teaching all key learning areas (KLAs) in years 6&7 and 2 specialist areas in years 8&9 (currently SOSE & Mathematics or English). Students study 2 degrees over 4 years, completing 64 units. The first 2 years are predominantly Behavioural Studies with years 3&4 predominantly Education.

The B.Ed.(MYS) component in years 3&4 draws on the philosophy of Queensland’s New Basics/ Productive Pedagogies/ Rich Tasks initiatives and ‘learning to teach’ literature. The teacher education curriculum does not include traditionally separated discipline content courses and KLA ‘methods’ courses. Rather, discipline content, pedagogy and curriculum is integrated across KLAs around ‘rich tasks’ which allow students to display evidence of their learning across a range of curriculum areas and a range of outcomes. In these integrated courses, students complete modules designed to develop discipline content knowledge in all areas (including science and mathematics), participate in workshops focussing on KLA curriculum and pedagogy, participate in practicum experiences and complete rich tasks.

Content/Discipline Studies

During year 1&2 students choose 3 extra Mathematics courses (2 units each) offered by the Department of Mathematics if they wish to specialise in Mathematics for years 8&9. This is in addition to the discipline content modules for all KLAs integrated into the B.Ed.(MYS) component in years 3&4, as outlined above and below.

Curriculum Method Studies

There are no traditional ‘methods’ courses. This program aims to model middle-schooling principles by using negotiated learning pathways, an integrated curriculum and teaching teams. For example, ‘Frame 2 for Middle Years of Schooling’ is a large 4-unit course in Year 3 which aims to develop content, curriculum and pedagogical knowledge in The Arts and Science KLAs. This will be linked to practicum experiences in a middle schooling context and focussed towards a culminating rich task. In a similar way, ‘Frame 3’ will focus on Mathematics and Health & Physical Education KLAs, and ‘Frame 4’ on Technology and English. Each of the five ‘Frame’ courses will integrate content, curriculum, and pedagogy and be developed and taught by teams of academics and school teachers including staff from the faculty of the relevant discipline, staff from the School of Education and teachers in partner schools. The program aims to have the discipline content modules (e.g. science or mathematics) developed and taught by the relevant discipline experts within the university, but within the structure of an integrated program.

Teaching Practice

The students will complete 80 days of supervised practicum in schools: in year 3 a 10-day block in semester 1 and a 20-day block in semester 2; in year 4 a 30-day block in semester 1 and a 20-day block in semester 2 followed by a 30-day internship where interns have an ‘Authorisation to Teach’ issued by the Qld Board of Teacher Registration and take a 50 per cent teaching load as a beginning teacher.
School/Industry Links

Students also complete 20 days of community-based projects linked to specific Education courses prior to year 4. Students will participate in community-based youth focused projects managed by the Faculty’s Community Services and Research Centre. An internship agreement has been negotiated between relevant employers, unions and professional bodies.

Things We Like/Innovations

This program has attempted to restructure the way in which content, pedagogy, and curriculum knowledges are developed in a teacher education program and the way in which discipline experts, school teachers and community members participate in teacher preparation.

Challenges

Integration – of content; of KLA; of getting teams of people together to develop and teach courses; of incorporating school teachers. Time is needed to build trust and rapport for the teams to work together well.

Program Description G2

FLINDERS UNIVERSITY

BACHELOR OF EDUCATION (UPPER PRIMARY/LOWER SECONDARY)

This is a 4-year program, which has been running since the early 1980s. There about 300 students in total and about 5-10 per year are doing mathematics/science. During the first 2 years students do discipline studies in other faculties. Graduates will be specialists in two secondary subject areas, and will have studies in a range of other primary KLA areas.

Content/Discipline Studies

Students must do 2 compulsory foundations subjects (offered by Education staff, during the first 2 years) to be chosen from ‘Communication Skills in the Workplace’ or ‘Professional English for Teachers’, ‘Mathematics for Primary School Teachers’ and ‘Rediscovering Science’. Many students are poor in mathematics and science. These subjects are Education offerings and the science one covers the communication of science ideas (e.g. matter, energy, magnetism, light, astronomy etc) and is very hands-on. The mathematics subject is offered on-line, and takes an independent learning approach. It incorporates history and social impacts of mathematics. Students also do an independent investigation in mathematics.

Students also do discipline subjects in 2 teaching areas. Students who wish to teach junior secondary science/mathematics are expected to do 33 units of any science/mathematics at first and second year level (and for science, this must include some physical science).

Diane Mayer
Curriculum Method Studies

Students do 3 method subjects in each of their teaching areas (each is 3 h/wk face to face, and all are Education offerings). The first 2 are the same as the junior science subjects in the secondary B.Ed. program. The last one emphasises teaching outside of the classroom (e.g. evaluating excursion destinations for science education), emphasising the interaction between science, technology and society, and developing strategies for making students more aware of science careers.

There is a method subject for primary science, which covers models of constructivist teaching and problem solving approaches (e.g. using Lego Technics, tinkering etc).

Students do one mathematics method subject which is taught by the Primary Mathematics Association, so there are direct links to schools. The people who teach it also do the inservice workshops for teachers who are implementing the new curriculum.

Teaching Practice

There are 18 weeks of practicum – a 4-week block and a 6-week block in year 3, and an 8-week block in year 4. There is also the option of a further 4 weeks in Semester 2 of the final year.

Things We Like

The science and mathematics components are high quality. Teachers have commented that the students do good things with science in the classroom after doing the science curriculum subjects.

Innovations

It was the first upper primary/lower secondary program in Australia.

‘Rediscovering Science’ and ‘Mathematics for Primary School Teachers’ are innovative content subjects.

Challenges

Not many students are interested in choosing to specialise in middle school science and mathematics.

There is not a good career path for teachers who are restricted to middle school years, even though these years are very important.

Other Programs

There is a 2-year Bachelor of Education (upper primary/lower secondary) Graduate Entry program, which has 13 students. These students have 2 teaching areas in their previous degree. Not many specialise in mathematics/science. Their studies are basically the same as the last 2 years of the undergraduate program.

Rick Lambert
Program Description G3

UNIVERSITY OF TASMANIA

BACHELOR OF TEACHING (5-8, MIDDLE SCHOOL)

This is a 2-year, end-on program, which began in 2000. There are about 30 students in each year. It is designed to educate teachers for middle school programs in which teachers teach across all subject areas (some 7-10 high schools are reorganising grades 7-8 into middle schools). It's like a primary program but it includes the literature and ideas from middle schools programs. The general education subjects are shared with students in the secondary and primary programs, but the other subjects focus on middle school. All students do the same program.

Content/Discipline Studies

Admission requires a previous degree. Some of the students have a degree with science or mathematics components and may do some secondary science or mathematics teaching (about 10 students).

Curriculum Method Studies

All students do 4 hours of mathematics every week when they are not in schools. They have 2 h/wk of science and SOSE (the same as the primary education students do). There are extra tutorial sessions for science (which look at laboratory management and other high school science issues).

Teaching Practice

There are 105 days of practicum.

School/Industry Links

The students use a website which is linked to the local newspaper (developed with the education editor of the Hobart Mercury). We are working with the museum to prepare an experience for primary students. Several organisations (including Parks and Wildlife, The Environment Centre, and representatives from the hydro-electric, forestry and minerals resource industries) give guest lectures to explain the classroom support they offer. The resource industries take the students on an excursion to explain science in industry.

Literacy and Numeracy

Students go to a local school to tutor individual children for 2 h/wk (for about 10 weeks) on literacy and numeracy problems. This gives the students an opportunity to observe and understand children’s problems.

The students use the website linked to the Hobart Mercury. Students are required to pick a newspaper article from the site and develop a literacy/numeracy lesson plan to be used in schools (primary and secondary students do this too).

Things We Like

The students are quite forward-looking. They are an adventurous group in their thinking, and are amenable to new ideas in mathematics and science. There is a shortage of mathematics and science teachers and these graduates will free up the
teachers with mathematics and science qualifications to teach at higher levels of high school.

Innovations

There are not many programs specifically aimed at this level of schooling.

Modelling of integrated curriculum in Science and SOSE.

Challenges

Some of these students don't have adequate backgrounds in mathematics so it is necessary to work intensely with them. High school laboratory aspects of middle school teaching are covered in the program.

Jane Watson, Natalie Brown

Program Description G4

DEAKIN UNIVERSITY

BACHELOR OF TEACHING (PRIMARY AND SECONDARY)

This is a two-year, end-on program, which qualifies students to teach in both primary and secondary. There are about 200 students (on two campuses) in each year (there is also an off-campus cohort of about 100). There are about 8 students in secondary mathematics method and about 35 in secondary science. Students do subjects in all the primary curriculum areas and two secondary method areas as well as general education subjects. All subjects are Faculty of Education offerings. About half the students go to primary schools and half to secondary after they graduate.

Content/Discipline Studies

In their previous degree, students must have the qualifications for 2 secondary methods.

Curriculum Method Studies

This course includes a primary science education subject and two primary mathematics education subjects. The mathematics method has also been offered off-campus. In the second science method subject students come to the same classes as the students in the undergraduate program. The primary science education subject is also school-based. The workshops are held in schools then the students work with small groups of children for 1 hour (over a 10-week period) then they come back together and discuss the issues that have arisen.

There are 2 curriculum studies in the secondary component of the course, each comprised of two subjects. The general science method subject is a compulsory 'gateway' to the other science subdiscipline method subjects in biology, chemistry, physics and earth science. This compulsory subject focuses on years 7-10 and is activity based and covers constructivist views of learning, teaching using small group work, safety, legal liabilities of the science teacher etc. The other science method subjects focus on the science sub-disciplines with an emphasis upon senior
levels (e.g. the science students might do a senior biology subject and a senior chemistry subject. Approximately 95 per cent of the students do the senior biology subject with the other science subdisciplines having low enrolments). Biology method covers generic senior biology and is not restricted to the Victorian syllabus. The subject adopts a pedagogical content knowledge (PCK) approach and is structured around how to teach the classical difficult subjects in biology in creative and interesting ways.

Teaching Practice
There are 45 days of primary practicum in year 1 and 45 days of secondary practicum in year 2 (all students do both practica).

School/Industry Links
The school-based curriculum subjects have been used to set up partnerships with schools.

Things We Like
Graduates are qualified to teach in both primary and secondary, and P-12 schools. The combination of primary and secondary methodologies means that graduates complete with very strong understandings of teaching and learning issues. There are strong links with schools built into the science and mathematics methodology units.

Innovations
This program is also offered entirely off campus (using print materials and videos, which are activity driven). Students produce a portfolio and have on-line chat tutorials. The general education subjects have a substantial on-line component.

One of the primary mathematics education subjects, the primary science subjects and one of the secondary science subjects are offered in school-based mode for on-campus students. The classes are run in schools and the students work with small groups of children.

There is a large 'Science in Schools' project at Deakin so there are a lot of staff with expertise in science education, and the lessons from this project are incorporated into the units.

Challenges
Fitting everything into the program is a challenge. It is a 2-year program that covers a lot of territory.

There is some difficulty in finding schools with the facilities available for school-based teaching.

Dealing with students' lack of confidence in science is a challenge.

_Susie Groves, Russell Tytler, Geoff White_
Program Description G5

VICTORIA UNIVERSITY

BACHELOR OF EDUCATION - FOUR YEAR PRESERVICE (P-12)

This is a 4-year program, approved in 1991 and revised in 1998. There are about 150-170 students in each year. Graduates will be qualified to teach both primary and secondary. There are 480 credit points of which half are in education and curriculum and half are discipline studies (students may choose to major in mathematics, science, information and communication technology, language and literacy studies, physical education, outdoor education, drama, visual art, social inquiry or any other area as negotiated with the University). Each year there are general education subjects, curriculum subjects and electives (which are discipline subjects). Currently, three or four students on each campus are specialising in science and up to 20 in mathematics.

Content/Discipline Studies

Students do majors in 2 discipline areas. The major in mathematics or science is made up of general offerings of the science faculty, up to year 3 level. Students also do one core discipline study subject in each of the other KLA areas. The subject ‘Social and Scientific Inquiry’ focuses on inquiry in the sciences and is a basic introduction to observation and experimentation in the sciences. The subject ‘Numeracy and Mathematics’ covers the concepts and practice of mathematics, especially in everyday situations (subjects are 15cp and presented as 3 h/wk face to face).

Curriculum Method Studies

In year 2 there is a mathematics method subject, which is linked to their Tuesday school visits (see below). The lecture and tutorial program concerns children’s understanding of mathematics, the mathematics curriculum and the teaching of mathematics in primary schools. The school visits enable students to further inquire about mathematics learning and teaching. The tutorials operate as workshops so that students use their experience within schools to investigate and develop skills in teaching mathematics and analysing children’s mathematical work. Students reflect upon the teaching of mathematics in schools (including their own teaching) and write reports relating their learning about mathematics teaching and learning to the theory.

The third year science method subject has a similar structure but the school visits are in secondary schools (they document, and participate and inquiry about science learning and teaching, then bring work samples to university and do peer teaching exercises to help them with physical science).

Teaching Practice and Project Partnerships

The course is Partnerships based and there are about 130 days in schools. The year 3 practicum is in secondary school and the practica in other years are in primary schools. Students spend every Tuesday of every week in the same school and work on curriculum initiatives and development and teaching practice which respond to
the learning needs of the school students. In year 1 there is a 2-week block in June, then every Tuesday until the end of October. In year 2, the Tuesday visits start in early March, continue until the end of term 3, and there is a one-week block at Easter and 2 weeks in June. In year 3, the Tuesday visits start in early March and they have one week of practicum in May and 2 weeks in August. The year 4 Tuesday visits start in early March and students also have a 7-week block in August/September.

Occasional clashes with discipline studies are worked out by individual arrangements and negotiations (e.g. students may leave school for the afternoon and go back to campus for a class that they can't miss). Staff members are allocated to school to facilitate this.

School/Industry Links

Students may choose to do one year long partnership practicum in a non-school setting such as the museum, zoo, a grasslands project, outdoor environmental camps, and a range of other community education programs. There has been participation in the Siemens Science festival in conjunction with the science faculty.

Things We Like

The partnerships with schools involve working alongside teachers and taking shared responsibility for students' learning. Children's learning is the central feature.

Innovations

The teaching practice is 130 days (see above). The program is linked to 160 schools each week. We were the first to do large-scale partnerships with schools. The experiential approach of participating in a range of schools and the cross fertilisation of sharing their experiences are important. The science and mathematics students help to develop the school programs.

Challenges

Extending the partnerships in schools, by extending their breadth outside the classroom, adding the value of the visits to schools, and funding the schools visits are the main challenges.