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National Teaching Fellowship Final Report

ENHANCING UNDERGRADUATE ENGAGEMENT THROUGH RESEARCH AND INQUIRY

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Macquarie University

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1. Executive summary

This National Teaching Fellowship was designed to bring together a team of international experts and leading Australian collaborators to foster student engagement through *developing and sharing protocols for good practice* in engaging undergraduate students in research and inquiry in different disciplines both within the curriculum and in extra-curricular activities.

It has heightened awareness of critical issues through providing an overview of current practice and funding opportunities and exploring implications for learning and teaching in the future in a series of events for academics and university leaders and managers.

A team of national experts collaborated to share ideas, identify existing projects and resources available within Australia and link the Fellowship to existing ALTC projects, to set up regional roundtables and participate in a National two-day Summit for institutional leaders. A team of international experts also shared ideas and resources, suggested places to visit, hosted the Fellow in their institutions and came to Australia to participate in the National Summit.

Study tours overseas enabled the identification of resources and information. 22 overseas and eight Australian universities and seven other overseas organisations were visited and 14 conferences attended. Over 90 individuals and small groups were interviewed. Study tours also enabled the sharing of ideas and resources in invited keynote addresses and seminars.

The website: <http://www.undergraduateresearchAustralia.com> was established. This includes information on undergraduate research and inquiry and on the Fellowship and related projects as well as a section containing numerous artifacts, protocols and other resources, an annotated bibliography and a list of websites, including information on undergraduate research opportunities in Australia, and undergraduate journals available to Australian students. A paper-based resource manual has also been compiled.

Regional Roundtables were held in five states and the ACT. These provided opportunities for sharing good practice and examining resources available. Fifteen academics gave presentations at these events which were attended by 110 people including some undergraduate students. Presentations are available on the website.

The First Australian Summit on the Integration of Research, Teaching and Learning was a two-day event held in Sydney. The 90 attendees were senior representatives of 35 universities and other bodies with an interest in undergraduate research. International experts provided keynote addresses and the National Team provided examples of practice. A full and frank discussion was held with representatives of the Australian Research Council (ARC), Australian Universities Quality Agency (AUQA), the ALTC, The Australian Council of Deans of Science, and the National Union of Students. Summit discussions resulted in the development of a Communiqué addressed to political leaders.

A survey of undergraduate research experience programs was carried out by an undergraduate researcher. Some 1500-2000 students are engaged in such programs annually and the numbers are growing. Twenty-three universities have one or more schemes and there is a trend towards creating whole of institution schemes. Thirty-one external organisations fund undergraduate research scholarships. However, the funding for undergraduate research experience programs is a major challenge for the future.

In order to provide a basis for future dissemination and discussion, an extended network has been compiled and a newsletter (*Undergraduate Research News Australia*) established to provide a medium for sharing ideas and initiatives on an ongoing basis.

Research has demonstrated a growing interest in developing opportunities for undergraduates to engage in research. There is evidence that students who are not involved have ambivalent attitudes towards research in universities, that engaging in inquiry-based learning can cause initial disorientation but that, as students become familiar with the approach, they particularly like the opportunity to learn in a collaborating inquiry group. The benefits of undergraduates engaging in research have been demonstrated in a number of research studies. As well as the development of personal qualities and capabilities, undergraduate research has been found to have beneficial effects on first to second year retention and progression, particularly among non-traditional students, including women. It has also been found to be beneficial in preparing students for postgraduate study. The effects on non-traditional students are particularly marked. Undergraduate research consolidates career plans.

The Fellowship work has been disseminated through 25 presentations including keynote addresses and conference presentations to over 820 people in universities in Australia, the USA, the UK, Eire, and The Netherlands. One edited book was finalised during the period of the Fellowship and four refereed journal articles have been published or are in press. A further seven contributions have been accepted for presentation at conferences in 2010.

Media coverage was achieved through articles in *The Australian*, Macquarie University's "Newsroom" web page, the online Macquarie magazine "*Bowerbird*", the Macquarie University research magazine "*Quest*", and the newsletter of the Higher Education Research and Development Society of Australasia (*HERDSA News*).

The Fellowship was evaluated using a 'Theories of Change' approach involving ongoing critical reflection, record-keeping and evaluation of events. The report of the external evaluator (appended to this report) concludes: "The Fellowship has made a very significant contribution to moving the undergraduate research agenda forward at a national level in Australia and to making the benefits of strong links between research and teaching better understood".

Critical success factors included the extent to which the higher education system was ready to embrace undergraduate research ideas and practices and the willingness of university staff to engage with these ideas. The success of the Fellowship was enabled by the support provided at Macquarie University, the efficiency and commitment of the Fellowship team, the contribution of the national and international team members and participating academics and academic managers. The length of time available for the Fellowship was a limitation on what could be achieved.

2. Fellowship Outcomes

Aim

The overall aim of the Fellowship was to enhance student engagement in learning through supporting the development, in Australia, of undergraduate research and inquiry.

Outcomes

To achieve the aim it has:

- 1) identified national needs by reporting on the current state of undergraduate vacation research programs in Australia, and sources of funding Australia-wide. It has also reported specifically on undergraduate research programs at Macquarie University and suggested actions to take forward. The reports were the result of supervised undergraduate research.
- 2) established and made available, in hard copy and online, a set of practical resources (models, strategies, protocols for action) that have been used in different institutions which are designed to bridge gaps between current and future practice, and facilitate Australian academics, course teams, schools and faculties, and institutions in implementing undergraduate research schemes and integrating research and inquiry within undergraduate curricula. It has disseminated these through a website, five state-wide Regional Roundtable discussions and a newsletter.
- 3) enhanced debates concerning engagement of undergraduate students in research and inquiry by bringing together academics, academic managers, and policy makers with international and national experts in Five Regional Roundtables where institutional leaders in teaching and learning and other interested academics discussed with experts, issues related to undergraduate research and its implementation and were introduced to the practical resources for implementation. Further, it brought together national and international experts and leaders and managers of 35 Australian universities and other organisations including the Australian Research Council (ARC), the Australian Universities Quality agency (AUQA), the ALTC, the Australian Council of Deans of Science, and the National Union of Students (NUS) in a National Summit on the Integration of Research, Teaching and Learning.
- 4) provided the foundation for the establishment of a national centre for the integration of research, teaching and learning through the work of the national team of experts, the development of a newsletter and an Extended Network of some 245 Australian academics interested in furthering undergraduate research in their institutions.

ALTC Objectives

The Fellowship contributed to the objectives of the ALTC in the following ways:

By providing opportunities for the exchange of ideas, resources and expertise in engaging students in research and inquiry within curricula, the Fellowship has *promoted and supported strategic change in higher education institutions for the enhancement of learning and teaching, including curriculum development and assessment.*

By initiating and supporting debates about the role of research in students' learning and the ways in which that can be supported regionally and nationally, the Fellowship has *raised the profile and encouraged recognition of the fundamental importance of teaching in higher*

education institutions and in the general community.

By building on excellent work already being carried out in relation to the integration of research and teaching in Australian universities (some through existing ALTC projects), the Fellowship has *fostered and acknowledged excellent teaching in higher education.*

Through the establishment of a set of resources and protocols to develop practice in ways to engage undergraduate students in the joy of learning through inquiry, the Fellowship has *contributed to developing effective mechanisms for the identification, development, dissemination and embedding of good individual and institutional practice in learning and teaching in Australian higher education.*

Through the involvement of national and international experts in the integration of research and teaching the Fellowship has *developed and supported reciprocal national and international arrangements for the purpose of sharing and benchmarking learning and teaching processes.*

Through the series of Regional Roundtables and the Australian Summit on the Integration of Research, Teaching and Learning and the continuation of debates through the Extended Network, the Fellowship has *contributed to the identification of learning and teaching issues that impact on the Australian higher education system and to the facilitation of national approaches to address these and other emerging issues.*

3. APPROACHES

The Fellowship Program built upon, integrated and extended work conducted for the book *Research and Teaching: Beyond the Divide* (published in 2006 by Palgrave Macmillan); work on the integration of research teaching and learning carried out over a period of some eight years at The University of Sydney, several UK projects on related themes that I have been associated with over a number of years; and new and existing projects in a variety of disciplines including existing ALTC funded projects being carried out by members of the team.

National and international collaborators

National and International teams of expert collaborators were assembled for the Fellowship. All of the named collaborators contributed to the preparation of the proposal so were engaged in the development and progress of the Fellowship throughout.

National team

The members of the National Team came from different types of institution and were chosen to represent a range of disciplinary expertise. All team members were involved in projects to develop undergraduate student engagement in research and inquiry in their institutions so were able to provide a bridge between the Fellowship and other related projects led by team members, some of which were funded by ALTC.

The team was:

- Professor Sally Kift, ALTC Senior Fellow, Professor of Law and Director of the First Year Experience Project, Queensland University of Technology.
- Professor Kerri-Lee Krause, Dean (Student Outcomes) and Director of the Griffith Institute for Higher Education, Griffith University.
- Professor Mike McManus, Dean (Academic Programs), The University of Queensland.
- Dr Susan Mayson, Senior Lecturer in the Faculty of Business and Economics, Monash University.
- Dr Denise Wood, Senior Lecturer and Program Director (Media Arts) School of Communication, International Studies and Languages, University of South Australia.
- Professor Brian Yates, Head of the School of Chemistry, University of Tasmania.

The National Team collaborated to share ideas and identify existing projects and resources needed to make a real difference in student engagement in research and inquiry across the Australian higher education system and facilitate acceptance by academics. They met face to face in Sydney and subsequently through electronic communication, Regional Roundtables and other conferences, and at the November Summit. The team members all provided invaluable support to me in numerous ways throughout the period of the Fellowship for which I am truly indebted. Here I mention some of the more memorable contributions.

Sally Kift's ALTC Senior Fellowship focused on the first year experience was closely related to mine in that I was concerned to explore how engaging undergraduate students in research and inquiry might be harnessed to enhance the first year student experience. Sally collaborated with other Brisbane colleagues to organise the Queensland Regional Roundtable and she presented a very well regarded session at the National Summit. She was also a great ambassador for my Fellowship mentioning it in talks that she gave as part of her own. Kerri-Lee Krause was able to draw on her ALTC funded project on the teaching-research nexus to suggest ideas and resources. She co-organised the Queensland Roundtable and led a key session at the National Summit. Mick McManus had been

responsible for leading an inquiry-based undergraduate science program, so brought to the Fellowship his extensive expertise and interest in the improvement of science education. Through his knowledge of the American higher education system, he was able to suggest places and people to visit. As well as collaborating with other members of the team in Brisbane to establish the Queensland Regional Roundtable, Mick chaired the important panel session at the National Summit. Susan Mayson and her colleague Dr Jan Schapper are recognised for their research and policy development on research-led teaching at Monash University. Susan organized and hosted the Victoria Regional Roundtable and, together with Dr John Willison from The University of Adelaide, presented a great session at the National Summit. Jan Schapper also contributed a session to the Tasmania Regional Roundtable, and she and Susan have contributed resources for the website and Manual. Denise Wood is actively involved in implementing courses that engage students in research and inquiry in media arts subjects. As well as providing inspiring presentations at the NSW/ACT Roundtable and the National Summit, she organized and hosted the South Australia Regional Roundtable and provided resources for the website and Manual. Brian Yates brought to the Fellowship extensive experience in fostering student engagement in chemistry and his experience in establishing an undergraduate research journal. He contributed to the Fellowship by organizing the Tasmanian Regional Roundtable and, with his colleague Professor Sue Jones, presented a well-regarded session at the National Summit.

International team

A specialist group of International Experts with demonstrated achievements in encouraging the integration of research and teaching and/or implementing undergraduate research through their research and scholarship and/or practice was also assembled:

- Professor Mick Healey, Director of the Centre for Active Learning (CeAL), a Centre for Excellence in Teaching and Learning (CETL), University of Gloucestershire, UK.
- Professor Nancy Hensel, Executive Director of the Council on Undergraduate Research, USA.
- Professor Philippa Levy, Director of the Centre for Inquiry-Based Learning in Arts and Social Sciences (CILASS), The University of Sheffield, UK.
- Professor Mike Neary, Dean of Teaching and Learning, University of Lincoln, UK.
- Professor Elaine Seymour, Director Emerita of Ethnography & Evaluation Research at the University of Colorado at Boulder, USA.
- Professor Linda Slakey, Director, Division of Undergraduate Education, National Science Foundation, USA.

As well as contributing to the preparation of the Fellowship proposal, the international team provided guidance on places to visit, hosted me in their institutions during study tours and came to Australia to contribute to the National Summit on the Integration of Research Teaching and Learning in November. The richness of the resources on the website is in large part owing to the international team putting me in touch with numerous people, particularly in the USA and the UK who had extensive experience with undergraduate research. I am indebted to the generosity of these people in sharing their resources and ideas when I visited them.

Study tours

Study tours overseas enabled the identification of resources that could be drawn upon to meet national needs. They also provided valuable information which greatly extended understanding of the scope of undergraduate research and issues surrounding its practice. 22 overseas and eight Australian universities and seven other overseas organisations were visited in the course of the Fellowship. Over 90 individuals and small groups were interviewed. Study tours also enabled me to share ideas and resources in keynote addresses and seminars that I was invited to give.

During one study tour in the USA I visited key institutions and projects where undergraduate

research and community engaged inquiry are practiced. This was greatly facilitated by members of the international team of experts who provided contacts and places to visit and links to key US bodies responsible for funding undergraduate research. Elaine Seymour and colleague Anne-Barrie Hunter at the University of Colorado at Boulder made numerous suggestions as a consequence of which I was able to visit institutions and individuals in California, the University of Arizona at Tucson, and Weber State University in Utah, and to meet with the Director of the Research Corporation for Science Advancement which funds undergraduate research. Linda Slakey invited me to spend a week at the National Science Foundation in Washington, DC. The National Science Foundation, which is a federal research funding body in the USA, funds and supports undergraduate research in many ways. I was invited to give talks, participate in a committee meeting and discuss undergraduate research with numerous personnel in the National Science Foundation's Division of Undergraduate Education. Dr Slakey also arranged for me to meet with key individuals in other organisations that fund and evaluate undergraduate research, such as the Howard Hughes Medical Institute, Project Kaleidoscope, and the American Association of Colleges and Universities. Involvement of the US Council for Undergraduate Research through its Executive Director, Nancy Hensel provided valuable links to key meetings. For example, I was privileged to attend the Council for Undergraduate Research *Transformative Research Summit*, in Utah in June. This was a three-day meeting for 25 leading educators involved in undergraduate research from universities that do not have postgraduate programs (PUIs). I was the only overseas visitor and I gained valuable information about issues involved in undergraduate research across the whole USA.

During study visits to Europe, I visited the institutions of international team members located in the UK and followed up on suggestions for other institutions to visit, for example, Research Councils, UK. One highlight was a visit to the University of Lincoln where I was able to explore new classrooms that had been developed to encourage a 'student as producer' model of teaching and learning under the leadership of Mike Neary. Another highlight was a visit to York where I presented a lecture to staff at The University of York and led a discussion at York St John University on resources for undergraduate research with staff there. As well as the UK members of the International Team, I was fortunate in being able to draw upon a wide network of scholars and practitioners in different disciplines working to develop undergraduate research owing to my association with a number of Higher Education Academy (HEA) and Higher Education Funding Council for England (HEFCE) projects and centres and other organisations working to develop aspects of undergraduate research and the integration of research and teaching. For example, I was invited to provide the summary address at the Annual Conference of the Learning through Enquiry Alliance, which is a network of Centres for Excellence in Teaching and Learning focused on initiatives to extend research and inquiry-based learning in UK higher education.

I was invited to spend some time at the Leiden University in The Netherlands where I gave a keynote presentation to an audience from all over The Netherlands and Belgium and attended a number of meetings with staff interested in undergraduate research and the integration of research and teaching. I was also invited to give the keynote address at a national conference *Talent for the future: Undergraduate Research Conference*, organised by the Association of Universities in the Netherlands (VSNU), Maastricht University and the Roosevelt Academy in Middleburg, the Netherlands.

Figure 1. Organisations Visited

1. Research Councils, UK
2. National Science Foundation, USA
3. Research Corporation, USA
4. Howard Hughes Medical Institute, USA
5. Project Kaleidoscope, USA
6. Carnegie Foundation for the Advancement of Higher Education, USA
7. Association of American Colleges and University, USA

Figure 2. Universities Visited during the Fellowship

Australia

Charles Darwin University
 Griffith University
 Monash University
 The Australian National University
 The University of Sydney
 University of South Australia
 University of Tasmania
 Wollongong University

UK

Oxford Brookes University
 Sheffield Hallam University
 The Open University
 The University of Gloucestershire
 The University of Liverpool
 The University of Sheffield
 The University of Warwick
 The University of York
 University of Lincoln
 University of Oxford
 York St John University

USA

California State University, Chancellery
 California State University, Fullerton
 California State University, Los Angeles
 Harvey Mudd College, California
 University of Arizona, Tucson
 University of California, Santa Barbara
 Weber State University, Utah

Eire

Cork Institute of Technology
 University College Cork

The Netherlands

Leiden University
 Roosevelt Academy, Middleburg

Figure 3. Conferences Attended

6 April 2009	The fourth symposium on “Social Learning Spaces” at Reinvention Centre, Oxford Brookes University, UK.
20 April 2009	Higher Education Academy ESCALATE conference on “Students as researchers”, Birmingham, UK.
3 June 2009	Council for Undergraduate Research meeting <i>Broadening participation in undergraduate research</i> . National Press Club, Washington, DC., USA.
10-12 June 2009	Council for Undergraduate Research: <i>Transformative Research Summit</i> , Snowbird Resort, Utah, USA.
15-16 June 2009	Meeting of the Council of the International Consortium for Educational Development. Trinity College, Dublin, Eire.
6-9 July 2009	Annual Conference of the Higher Education Research and Development Society of Australasia (HERDSA). Darwin NT, Australia.
27-28 August 2009	Talent voor de Toekomst (Talent for the future) Undergraduate Research Conference. Association of Universities in the Netherlands (VSNU). Middleburg, The Netherlands.
9 September 2009	Conference on higher education research, CoCo research group, The University of Sydney.
10-11 September 2009	Assessment Futures: Fellowship workshop and conference, University of Technology, Sydney.
2 October 2009	Uniserve Science session on Undergraduate Research, The University of Sydney.
8-10 December 2009	Annual Conference of the Society for Research into Higher Education. Newport, Monmouth, Wales, UK.
13-15 December 2009	“Beyond teaching and research – inclusive understandings of Academic Practice” Conference. University of Oxford, UK.
11 December	Meeting on inquiry-based learning at The University of Gloucestershire, Centre for Active Learning, UK.
10-11 March 2010	Activity Theory and Practice conference. The Open University, UK.

Activities at Macquarie University

A number of activities related to developing research-based learning have taken place at Macquarie University. These include: presentation to Learning and Teaching Centre staff and Associate Deans (Learning and Teaching); presentation to the Senate Learning and Teaching Committee; presentation to the Provost's Strategy Group and a presentation to the alumni of the Foundations in Learning and Teaching Program. Associate Deans and other interested people were invited to join National Team Members for lunch at their meeting at Macquarie on 8th May 2009. Macquarie University staff were invited to the NSW/ACT Regional Roundtable and the Summit and 42 staff took up these opportunities.

Comment [PH1]: Year?

As a consequence of the presentation to the Senate Learning and Teaching Committee a group was set up to develop a discussion paper as a prelude to developing a policy on research-based learning. This work is ongoing.

Arrangements for undergraduate research scholars in the Learning and Teaching Centre were approved prior to the award of a scholarship within the terms of this Fellowship. The documentation that was prepared provides for the extension of existing undergraduate research scholarships across the University. At the request of the DVC (Research) a report on scholarships for undergraduate research at Macquarie University has been written and distributed. The report makes recommendations for the extension of existing provision. A copy of the report is available on the website.

Fellowship activities have continued into 2010 and are ongoing. There have been further discussions concerning a policy for research-based learning and the development of undergraduate research scholarships, contributions to the development of the Macquarie Academic Plan, resources and support provided for the setting up of a Macquarie University undergraduate research journal, and a workshop to staff on "Introduction to research-based learning".

Website

The website: <http://www.undergraduateresearchAustralia.com> is a key outcome of the Fellowship.

The website was designed to provide information and resources for people interested in enhancing undergraduates' engagement through involving them in research and inquiry across the curriculum and in scholarship schemes. It is intended to be used by:

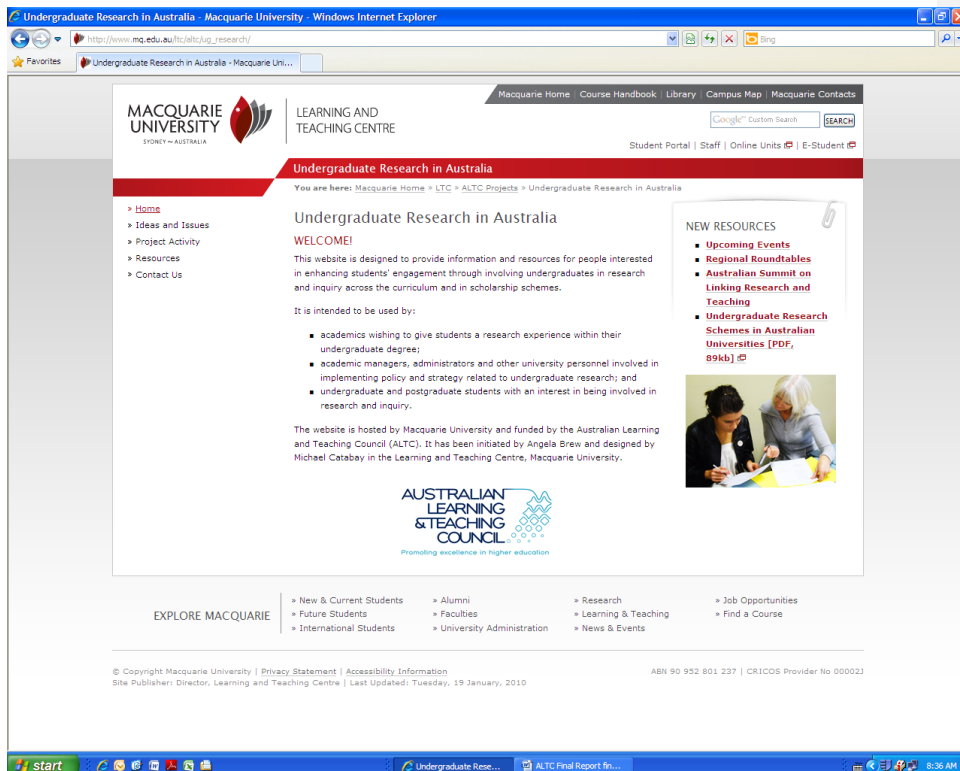
- academics wishing to give undergraduates a research experience within their degree;
- academic managers, administrators and other university personnel involved in implementing policy and strategy related to undergraduate research; and
- undergraduate and postgraduate students with an interest in being involved in research and inquiry.

The aim has been to develop facilitative models, strategies, useful artifacts, protocols and resources to assist academics: for example, in providing research-based opportunities for students; developing subjects and curricula including establishing inquiry-based units and courses; and establishing undergraduate research experience schemes.

Structure of the website

1. One section of the website provides an introduction to undergraduate research and inquiry. It is designed to answer some basic questions and to link to scholarly discussions and practical examples drawn from a wide range of sources and universities. It addresses:
 - why engage undergraduates in research and inquiry;
 - implementing undergraduate research and inquiry;
 - some definitions;
 - assessment of student work; and
 - evaluating undergraduate research and inquiry.

2. There is a section providing information on projects carried out on undergraduate research and inquiry in Australia. It provides an overview of, and links to, the ALTC projects related to the Fellowship. There are three parts in this section:
 - the ALTC National Teaching Fellowship;
 - Macquarie University Projects and Related Projects.



3. The resources section is designed to support new and emerging projects, provide opportunities for coordination and collaboration and serve to further the spread of undergraduate research and inquiry in Australian universities, providing academics and interested personnel with contacts and resources to move them along. Individuals can search a database of resources, an annotated bibliography of publications and a list of useful websites. They can also add their own ideas and resources and provide feedback on events as well as give feedback on the website itself.

Resources are in the form of models of implementation, successful strategies that have been tried and evaluated, templates, lists of do's and don'ts, advice about critical incidents in implementation, key questions to ask when implementing a particular strategy, identification of necessary administrative arrangements, likely barriers to implementation and how they have been surmounted, etc. They include, for example:

- unit of study outlines;
 - dealing with ethical issues that may arise including ethics in coursework research pro-formas;
 - implementing inquiry-based assessment;
 - funding opportunities for undergraduate research;
 - tips on writing successful undergraduate research grant proposals;
 - examples of community-based undergraduate research projects;
 - establishing an undergraduate research journal;
 - establishing administrative arrangements for undergraduate research vacation programs;
 - independent study contract;
 - working in research teams;
 - models of implementation;
 - successful strategies that have been tried and evaluated;
 - templates for conferences and awards;
 - evaluating undergraduate research;
 - lists of do's and don'ts;
 - advice about critical incidents in implementation; and
 - key questions to ask when implementing a particular strategy.
4. The administrative section of the website, which is not available to the public, provides the possibility for the Fellow and assistants to check resources that are submitted to the site and provide a 'light touch' peer review process. This involves checking to ensure that the resource is relevant to undergraduate research and inquiry and not a general teaching and learning resource, ensuring that the description of the source of the resource is clear, and that the resource has been evaluated. It also involves ensuring that copyright issues have been addressed. The administrative section also makes it possible for new resources to be added and previewed prior to making them public.

Comment [PH3]: It would be useful to have some explanation of what this involves.

Resource manual

Consolidation and adaptation of resources for use in the Australian context led to the website of resources. However, there were some resources that were not able to be included on the website for copyright reasons. For this reason, and also to meet one of the planned deliverables, a paper-based Manual of resources was also developed. This provides hard copies of the resources on the web and some additional resources. Copies of the Manual are now available to be used in workshops.

Regional Roundtables

Having developed resources, an intense period of dissemination and national engagement followed. This was achieved initially through a series of five Regional Roundtables which brought together, on a state-wide basis, members of the National Team, the Extended network, and academics interested in furthering the research experiences of their students. The Roundtables were:

- New South Wales and ACT Roundtable, 23rd September 2009, Macquarie University, Sydney;
- Tasmania Roundtable, 8th October 2009, University of Tasmania, Hobart;
- Victoria Roundtable, 15th October 2009, Monash University, Melbourne;
- Queensland Roundtable, 16th October 2009, Griffith University, Brisbane; and
- South Australia Roundtable, 10th November 2009, University of South Australia, Adelaide.



Discussion at Victoria Roundtable

These events provided a stimulus for debate with the aim of bringing about attitudinal and cultural shifts among academics and academic leaders and managers about involving undergraduates in research and inquiry. Resources were available at the Regional Roundtables for viewing and discussion. It was hoped that that the Regional Roundtables would be accompanied by media coverage so as to ensure the beginnings of widespread debates across Australia (see media section below). Further details of each Roundtable, including the presentations by the Fellow and invited speakers are available on the website.

Australian Summit on the Integration of Research, Teaching and Learning

The First Australian Summit on the Integration of Research, Teaching and Learning was held on 5-6 November 2009 at the Swiss Grand Hotel, Bondi Beach, Sydney. This brought together senior academic managers to engage in sector-wide debates about the integration of research and teaching and the role of undergraduate research and inquiry in it. One of the outcomes of the Summit discussions was the development of a communiqué addressed to Australian political leaders. Interest in the communiqué has been shown by the Deputy Prime Minister's office and this is being followed up.

Over 90 senior officials of 35 Australian universities and a number of other organisations attended. PowerPoint presentations and podcasts of keynote sessions and the panel discussion as well as presentations of examples of practice sessions and photographs are available on the website.

Keynote addresses were given by International Experts:

- *Establishing the value of undergraduate research: engaging students in real science*
Emeritus Professor Elaine Seymour,
- *National Science Foundation models for funding undergraduate research*
Dr Linda Slakey
- *Institutional strategies to integrate research, teaching and learning: The Sheffield University experience*
Professor Phillipa Levy,
- *Developing undergraduate research across the USA: The work of the Council on Undergraduate Research*
Dr Nancy Hensel
- *Institutional practices and strategies to develop undergraduate research and inquiry*
Professor Mick Healey

Following an introduction by Professor Kerri-Lee Krause who raised questions and issues for Australia, Professor Mick McManus chaired a full and frank panel discussion with invited representatives of key Australian bodies:

- Professor Andrew Wells Executive Director, Humanities and Creative Arts, Australian Research Council (ARC);
- Dr Jeanette Baird, Audit Director, Australian Universities Quality agency (AUQA);
- Professor John Rice, Executive Director, Australian Council of Deans of Science;
- Mr David Barrow, President, National Union of Students (NUS); and
- Professor Iain Hay, ALTC Discipline Scholar for the Arts, Social Sciences and Humanities, Flinders University.

Members of the Fellowship National Team and invited colleagues provided sessions where examples of current practice were discussed.

- *The teaching research nexus and the first year student experience: What are the possibilities?*
Professor Sally Kift
- *Discipline, diversity and the development of all students' research skills*
Drs John Willison, and Susan Mayson
- *Motivating the first-year learner through research informed media practice*
Dr Denise Wood
- *Students' engagement with the discipline: The impact of the undergraduate research journal 'Nexus'*
Professors Brian Yates and Sue Jones.

Communiqué

The first Australian summit on the integration of research teaching and learning has emphasised the vital importance of research experiences for undergraduates.

The summit, organised by Professor Angela Brew as part of her fellowship with the Australian Learning and Teaching Council, was attended by academic leaders from across Australia and also included experts from the US and the UK. The purpose of this Communiqué is to highlight the strategic importance of integrating research and teaching for all Australian universities and of connecting undergraduate students with research.

Australia needs creative ideas and a research-minded population to become an innovative knowledge society. Further, the undergraduate experience is arguably the most important in shaping the future career trajectories of students. A critical part of this experience is the vital connection between teaching and research.

If, as the Commonwealth's report Transforming Australia's Higher Education System states, the Federal Government's aim is to 'drive improvements in productivity and create a smarter, cleaner and more competitive economic future for Australia', higher education must teach all students, not just research students, how to engage as much in the production of knowledge as in its acquisition. All students should be immersed in an environment where their learning is based on the most recent research findings. This should occur as early as possible in their undergraduate careers and learning should be underpinned by research experiences.

Engaging undergraduate students in research and inquiry contributes to strengthening world class research and is in line with best practice in other countries. It provides a way for higher education to address the needs of a 21st century workforce through developing important graduate attributes, including the skills of critical enquiry, noted by the Bradley Review Report as being important to all Australian universities. It engages students' meaningfully in higher education and prepares them for a 21st century world of work in which knowing how to create, inquire and critically evaluate knowledge is of increasing importance.

It goes to the heart of our future competitiveness as an innovative country, is critical to retention of the brightest and best students, and to reversing the alarming decline of Australian students entering PhD programs.

To achieve this, changes are required to the ways in which funding agencies within the higher education sector interact. It is important that DEEWR, the Australian Research Council (ARC), the National Health & Medical Research Council (NH&MRC) and the Australian Learning & Teaching Council (ALTC), work together to foster an environment where the connection between teaching and research is valued. To this end, ARC and NH&MRC grants should, as a matter of urgency, have a mandate to require research outcomes to feed into education at all levels. This is similar to National Science Foundation grants in the USA, where top researchers are required to work cooperatively with university lecturers to provide a rich contextual setting for undergraduate students with opportunities for them to participate in the research.

International best practice suggests that this is needed to drive an innovative and creative Australia, and that it is likely to be matched by improvements in the quality and quantity of world class research outcomes. Not only does this suggest a defining characteristic of our 'higher' education, it represents a significant opportunity for the Tertiary Education Quality and Standards Agency in ensuring and enhancing its quality and competitiveness.

The synergistic link between an educated workforce and economic development is undeniable. Exposing undergraduates to the vital link between teaching and research is one of the cornerstones on which a competitive Australia will be nurtured. If we fail to embolden our students to be creative, the future of Australia in 2020 and beyond, when our natural resources inevitably decline, will be bleak. It is vital that we now connect undergraduate students with research clearly and explicitly, to enable Australia to be a genuinely innovative knowledge society.

Prepared by Professor Angela Brew, ALTC National Teaching Fellow, Macquarie University, in collaboration with delegates at the First Australian Summit on the Integration of Research, Teaching and Learning.

Undergraduate research scholarship

Consistent with the aims of the Fellowship, an undergraduate research project was carried out. This built on the ideas brought forward by the national team to:

- survey existing practice in undergraduate research scholarship programs in Australia; and
- identify sources of funding used for student stipends in such schemes.

In order to do this, an undergraduate scholarship was established at Macquarie University. This involved negotiating with relevant staff to establish an appointment process, advertising the scheme and awarding a scholarship to the successful candidate. Thirty-five applications were received from undergraduate students and five interviews were conducted. The successful candidate was Evan Jewell, a second year student of ancient history.

Evan then carried out research which aimed:

1. to examine the proposed aims of programs and their outcomes;
2. to assess the size of programs offered by Australian universities and external bodies, to whom they are targeted, and to what purpose;
3. to investigate levels of engagement, supervision and financial support to students;
4. to examine the nature and extent of the funding available, both university and non-university, for these programs; and
5. to identify the challenges faced in the past, present, and future.

Undergraduate scholarship schemes in Australian universities were initially researched through internet searches of the websites of 39 Australian universities. It was noted that schemes were often hard to find, hidden within university websites, and there were clearly more schemes in existence than was apparent from a cursory glance of such websites. When it became evident that there were a number of external bodies funding undergraduate research, internet research was also carried out to investigate 31 such organisations. This research was followed up with email and telephone interviews with over 100 university academics and administrators, and representatives from external funding bodies. A full report detailing the undergraduate research programs across Australian universities is a companion document to this report and is available on the website. An interim report of this work was available in the form of a poster at the National Summit.

The report concludes that:

1. Paid undergraduate research programs are widespread, being present in some form in 23 of the 39 universities surveyed.
2. The programs are operational in several disciplinary areas; however, there is a strong emphasis on the STEM disciplines.
3. The programs target an elite niche of the undergraduate population in universities.
4. The primary focus of the programs is to maintain and grow a pipeline of undergraduates progressing into Honours and HDR programs.
5. A large proportion of the programs are recent and growing initiatives of universities and date from the mid-2000s onwards.
6. The programs operate on several different administrative levels and structural models; within these there is a trend towards creating institution funded schemes offered on a university-wide basis, rather than on a divisional basis.
7. Student numbers in the programs though small in comparison to national student enrolments, are still significant (1500-2000 students annually) and increasing in some programs.
8. The outcomes of the programs are yet to be formally evaluated in most programs; the undergraduate student experience in these programs has not yet been measured.
9. Academic supervisors receive little financial or formal academic recognition from

- central university administrations for their role in the programs.
10. Funding is the primary challenge for the future of the programs, both in terms of sustainability and growth.

Extended Network and Newsletter (URNA)

An Extended Network of contacts was identified throughout the Fellowship through meetings, Roundtables, the National Summit and conference attendance. A network of approximately 350 individuals has been established; 245 of whom are in Australia. Further names are added to the Network on an ongoing basis. .

One of the proposed outcomes of the Fellowship was the development of a steering group to take forward the idea of a National Centre for the Integration of Research, Teaching and Learning (NCIRTL). While the idea of such a centre was conceived during the Fellowship, at the Summit there was a strong feeling that another organisation was not desirable. The Extended network provides a focus for the ongoing sharing of developments and resources in the integration of research, teaching and learning and it is anticipated that it will, in time, add value, to current and future funded projects in this important field. The idea of a national consortium which establishes an internet-based portal for the sharing of ideas and resources into the future (on the model of the FIRST Consortium established to share resources for supervision development) is still under consideration.

In order to provide ongoing information and support to the Extended Network, a newsletter *Undergraduate Research News Australia* (URNA) has been established and circulated. One issue of the newsletter has been produced to date and another is planned following the publication of this report. It is anticipated that URNA will provide a forum for the ongoing dissemination of ideas and practices in undergraduate research in Australia.

UNDERGRADUATE RESEARCH NEWS AUSTRALIA

Issue 1 Autumn 2010

Welcome!

Welcome to the first issue of Undergraduate Research News Australia. This occasional newsletter is designed to provide information about developments, upcoming events, and resources on engaging undergraduates in research and inquiry, primarily in Australia.

In 2009 a series of events was held and information and resources gathered as part of my ALTC National Teaching Fellowship. During this time, over 300 names of interested individuals were gathered. These constitute an extended network and the newsletter is being sent to everyone on this list.

Please circulate widely and let us know of any other colleagues that you think would like to know of recent developments and resources in undergraduate research in Australia.

Professor Angela Brew
Marquette University
March 2010

Website:
www.undergraduateresearchaustralia.com

On our website there are now links to information about undergraduate research projects. The website contains many resources to help staff setting up or extending opportunities for undergraduate students to engage in research and inquiry.

Some examples are:

- Research-based unit of study descriptions
- Writing research-based learning outcomes
- Assessing research-based learning
- Examples of ethics application forms
- Handbook for students about choosing a research topic
- Tips on writing successful undergraduate research project proposals
- How to set up an undergraduate research vacation scheme
- Evaluating undergraduate research
- Independent study contract
- ... and much, much more

Search and/or add to the resources, the bibliography and the list of useful websites or give us some feedback. We would like to know what you think.

Undergraduate Research in Australian Universities

Contrary to popular belief, undergraduate research vacation scholarship schemes are alive and well in Australian universities. A survey has identified numerous schemes.

Consistent with the aims of the Fellowship, an undergraduate research project was carried out by Iain Jewell, a second year undergraduate ancient history student at Marquette University. He surveyed existing practice in undergraduate research scholarship schemes in Australia and identified sources of funding used for student stipends. Nearly 70 individual vacation scholarship programs were noted within 23 Australian universities.

The survey also identified numerous charitable organisations that fund undergraduate research. A report will be available soon. A link to his summary poster is available on the website home page.

Key Events 2009

Five **Regional Roundtables** were held on the theme **Enhancing Undergraduate Engagement through Research and Inquiry** in 2009 in New South Wales and the ACT on 23rd September, at Marquette University, Sydney, in Tasmania on 6th October, at the University of Tasmania, Hobart, in Victoria on 10th October, at Monash University, Melbourne, in Queensland on 16th October, at Griffith University, in Brisbane, and in South Australia on 19th November, at the University of South Australia, Adelaide.

These events brought together on a State-wide basis, members of the Fellowship National Teams, associate deans and interested individuals. Further details of each Roundtable, including the presentations by invited speakers are available on the website.

The First Australian **Summit** on the Integration of Research, Teaching and Learning was held on 5-6 November 2009 at the Sainsbury Centre, Bondi Beach, Sydney. This brought together senior academic managers to engage in sector-wide debates about the integration of research and teaching and the role of undergraduate research and inquiry in it. One of the outcomes of the Summit was the development of the **Communique**.

Keynote addresses were given by international experts including Professor Elaine Seymour, Director Emerita of Citizenship & Inclusion Research at the University

of Colorado at Boulder, USA, Professor Linda Skaley, Director, Division of Undergraduate Education, National Science Foundation, USA, Professor Philippe Levy, Director of the Centre for Inquiry-Based Learning in Arts and Social Sciences (ELIAS), a Centre for Excellence in Teaching and Learning (CETL) at Sheffield University, UK, Professor Nancy Hensel, Executive Director for the Council on Undergraduate Research, USA and Professor Mick Healey, Director of the Centre for Active Learning (CoAL), a CETL at Gloucesterhire University, UK. Members of the Fellowship National Team provided examples of practice.

A full and frank panel discussion was also held with invited panellists: Dr Jeanette Baird, Audit Director, Australian Universities Quality Agency (AUQA), McQuillan Barron, President, National Union of Students; Professor Iain Hay, ALTC Discipline Scholar for the Arts, Social Sciences and Humanities, Flinders University; Professor John Rice, Executive Director, Australian Council of Deans of Science, and Professor Andrew Walls, Executive Director, Humanities and Creative Arts, Australian Research Council (ARC). The event was chaired by Professor Mick McMahon, Deputy Vice-Chancellor International, University of Queensland.

The full summit program with podcast presentations by speakers and a copy of the Summit Booklet containing the full program, abstracts of sessions and biographical details of presenters are available on the website.

Communique

At the First Australian Summit on the Integration of Research, Teaching and Learning, held in Sydney on 5th & 6th November 2009, a Communique was prepared for widespread distribution, including political leaders and the wider community. **The text of the Communique is posted overleaf.**

An electronic copy is available at: http://www.mrc.edu.au/files/ug_research%20Communique.pdf



MACQUARIE UNIVERSITY LEARNING AND TEACHING CENTRE Undergraduate Research News Australia is produced by the Learning and Teaching Centre at Marquette University

4. Literature review

Undergraduate research is defined by the USA Council on Undergraduate Research as:

“An inquiry or investigation conducted by an undergraduate student that makes an original intellectual or creative contribution to the discipline” (Beckman & Hensel, 2009, p. 40).

Beckman and Hensel argue that there are a number of tensions hidden in this definition. For example, between a focus on students engaging with research processes or students producing some kind of research outcome; between whether the research is initiated and/or defined by academics or by the student; and between whether undergraduate research is for all students, or whether it is preserved for elite students. The definition also includes tensions, between whether undergraduate research is included within the curriculum or takes place outside of it; whether students engage in collaborative research or research as individuals; and whether the research is focused in a specific discipline or is interdisciplinary. There are tensions around who the audience for the research is; whether internal to the department or presented externally, for example, in a conference or journal article (Beckman & Hensel, 2009).

These tensions are exemplified in a model developed by Healey and Jenkins (2009). Unlike the above definition which has its genesis in the common practice in the USA of engaging undergraduates in research experiences typically in vacation times, Healey and Jenkins' model emanates from concerns to extend the curriculum in ways that strengthen the relationship between teaching and research.

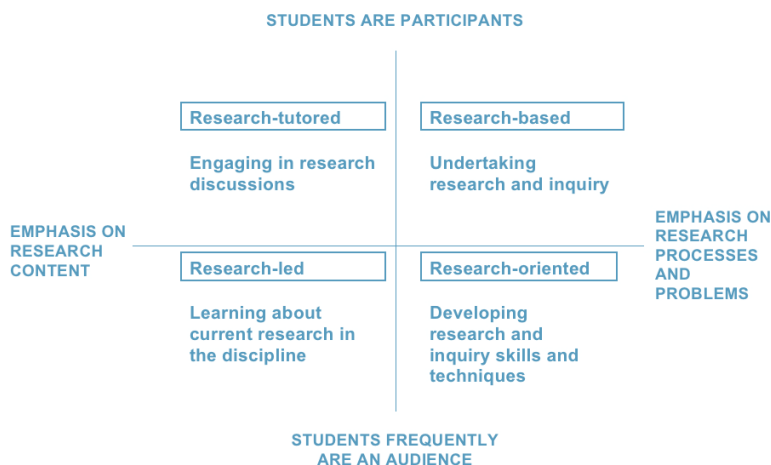


Figure 4. The nature of undergraduate research and inquiry (Healey & Jenkins 2009, p. 7)

In this model, undergraduate research and inquiry are seen along two dimensions. The horizontal axis focuses on research content on the one hand and on research processes and problems on the other, and the vertical axis distinguishes students as participants and students as an audience for research (see Figure 4). Whether students are engaging in research in their courses or outside the curriculum by, for example, participating in events, seminars and special undergraduate research programs, they may engage in research in all of the four ways indicated in this model. Extending Beckman and Hensel's definition a little provides for the integration of research-based activity within the curriculum as well as outside it and deliberately leaves vague whose understanding is developed; whether this is the understanding the student has of the discipline and/or whether the research leads to wider disciplinary or societal understanding. Such a definition would be as follows:

Comment [PH4]: This sentence is unclear: is the tension around whether the audience is “internal to the department” or external? “open to outsiders” suggests something different, as it isn’t a direct opposite to “internal to the department.”

"[An] inquiry or investigation *or a research-based activity* conducted by an undergraduate student that makes an original intellectual or creative contribution to the discipline *and/or to understanding*." (Brew, 2010 forthcoming; following Beckman & Hensel, 2009, additions in *italics*)

Comment [PH5]: Why is this in blue?

This definition takes account of the suggested tensions which are then seen as choices that need to be made about how undergraduate research and inquiry is to be implemented in specific contexts.

Students' views of research and inquiry

There has been a growing interest in understanding students' experiences of research in the past 12 years or so. Students appear to value the fact that their teachers are engaged in research. They see it as making lectures more interesting and stimulating lecturer enthusiasm for the subject they are teaching (see for example, Jenkins, Blackman, Lindsay, & Paton-Saltzberg, 1998). On the other hand, several scholars have noted among students negative attitudes towards the research of their teachers, including staff lack of availability, undue influence of staff research in the curriculum, and, importantly, feelings of being excluded from the research culture of their institution (Healey, 2005; Jenkins et al., 1998; Zamorski, 2002). A statistical study by Wuetherick, Healey and Turner (2008) which examined the views of 515 students from three institutions in Canada and the UK found differences in the extent to which students reported learning about their teachers' research, engaging in research activity, being a subject in a research study and being a research assistant, depending on their country, and whether the institution was research-intensive. However, less than a third of the students surveyed reported developing research skills (Turner, Wuetherick & Healey, 2008). Murtonen and Lehtinen (2009) found that students in Finland and the USA dislike learning about research methodology and have difficulty in learning either quantitative or qualitative research methods that they do not feel in tune with. Perceived difficulties were related to the fact that they do not consider research skills to be important to their future careers.

In a New Zealand study, Robertson & Blackler (2006) found that students in different disciplinary areas have different ideas about research and that the visibility of research and perceptions of where research is conducted varied for students in different disciplines. Physics students, they found, saw research as the process of 'breaking new ground, moving forward; as a process of exploration and discovery'. They indicated that research was visible in the presence of laboratories and machinery which was often 'behind closed doors'. Geography students viewed research as 'gathering information in the world; answering a question'. They considered that research was most visible and was done by lecturers and students 'in the field'. English students saw research as 'looking into; gathering; putting it together; focus of interest' (p. 226). They considered that research was not visible but manifested itself in dialogue. It was carried out by lecturers and by students in the library or in people's heads.

Research on students' perceptions of inquiry-based learning suggests that students respond differently according to the discipline in which the inquiry-based learning is situated (Abrandt Dahlgren & Dahlgren, 2002) and according to their epistemological beliefs (Tsai, 2000). There is evidence that students experience initial uncertainty within inquiry-based learning situations; that it creates 'psychological dilemmas or disjunctions in students' experiences of the learning context and their lives' (Abrandt Dahlgren & Dahlgren, 2002, p. 124) but that uncertainty fades as they become more familiar with this approach to learning. Sadlo and Richardson (2003) found that students tend to adopt deep approaches to learning within a problem based curriculum.

There is a commonly held assumption that students who engage in problem based learning within a hybrid curriculum which includes traditional teaching, do not rate their curricula as highly as they rate more traditional approaches. However, a meta-analysis of evaluative

research of problem-based learning (Vernon & Blake, 1993) found that students' evaluations of problem-based learning were consistently more positive than their evaluations of conventional courses. Students appear to appreciate the authenticity of the tasks and the assessment (Abrant Dahlgren & Dahlgren, 2002) in problem or inquiry-based learning and express positive attitudes to the 'fellowship' and 'community' that students experience in learning in a supportive PBL tutorial group.

The benefits of undergraduate research

An analysis of the results over time of the National Survey of Student Engagement (NSSE) in the USA carried out by Kuh (2008) resulted in the identification of 10 'high impact' educational practices. These are practices which increase rates of student retention and student engagement. Undergraduate research is one of the 10 high impact educational practices, suggesting that it has a positive effect on levels of student engagement.

Capabilities

Seymour, Hunter, Laursen, & Deantoni (2006) summarise the benefits to students of engaging in undergraduate research projects during vacation in terms of ***personal and professional gains*** such as increased confidence (for example in their ability to do research, contributing real knowledge as a scientist, or feeling like a scientist) and ***intellectual development in thinking and working like a researcher*** including improved ability to apply knowledge and skills, development of critical thinking and problem solving skills and a more advanced understanding of the nature of science/ how scientific knowledge is built.

Lopatto (2004, p. 270) examined the benefits of undergraduate research experiences as indicated by students from 41 institutions who completed an online survey. Participants (n=1,135) indicated gains on 20 potential benefits. These included:

- Understanding of the research process
- Readiness for more demanding research
- Understanding how scientists work on real problems
- Learning lab techniques
- Tolerance for obstacles
- Learning to work independently
- Skill in the interpretation of results
- Ability to analyze data
- Understanding how knowledge is constructed
- Becoming part of the learning community
- Ability to integrate theory and practice
- Understanding primary literature
- Assertions require supporting evidence
- Understanding science
- Understanding how scientists think
- Self-confidence
- Clarification of a career path
- Skill in oral presentation
- Skill in science writing
- Learning ethical conduct

Similar benefits have been found in other studies. For example, Blackmore and Cousin (2003) demonstrated the ways in which engaging UK students in research can develop important skills, for example, of structuring one's workload, time management, a wide range of research skills including bibliographical searching, organisation of data, experimental skills and so on. Students commented upon the need to be able to focus on a number of tasks simultaneously. The experience demonstrated the complexity of research work and the need for patience and meticulousness. Similarly, students in the study by Seymour, Hunter, Laursen, & Deantoni (2004) commented on the length of time involved in research, the care needed to make accurate observations and keep detailed notes, how much attention to detail was required, the tedium and repetition of some lab tasks, the long hours researchers worked, and their difficulties in achieving desired results.

Baxter Magolda, Boes, Hollis, & Jaramillo (1998) reported similar findings in a study of students who had engaged in a 10 week summer research experience. They found students had increased confidence as learners, developed more capability for thinking independently, more awareness of learning as a life-long process and more capability for achieving career goals. In addition, they found that students had developed more complex conceptions of knowledge as a consequence of engaging in the research experience. Particularly notable is the finding that students valued the opportunity to work with academics in a one-to-one relationship. Commenting on the undergraduate research scheme at The University of Warwick (Blackmore & Cousin, 2003) similarly report that students on this scheme appreciated the opportunity it provided to play a role in knowledge production through participating in a culture of inquiry.

Retention, progression and career choice

In a paper commissioned by the National Academy of Science, USA, Gregerman and colleagues reported on the University of Michigan Undergraduate Research Opportunities Program (UROP). The program involves over 1000 first and second year students annually in undergraduate research. It has a particular focus on engaging historically underrepresented students and women in research in the sciences. The program evaluation found that students who participated in undergraduate research were significantly more likely to go on to graduate and professional school across all racial and gender groups, they were more likely to pursue medical, law, or Ph.D. programs than students in the control group. They also found that undergraduate research students spend significantly more time talking with professors, participating in academic discussions, working, and studying. It was found that participation in undergraduate research increases the retention rates for African-American students and second year participants across the board, that it increases degree completion for African-American males. Undergraduate research participation was found to increase engineering degree completion rates for African-American and Latina women in Engineering. Undergraduate research participants are more likely to see academics and graduate student tutors as positive influences and interested in their academic success (Nagda, Gregerman, Jonides, von Hippel, & Lerner, 1998). These findings reflect those of Laursen, Hunter, Seymour, Thiry and Melton, (2010) who found that a summer research experience lead to clear gains in the orientation to a scientific career particularly among students from non-traditional groups.

Over 83% of participants in Lopatto's (2004) study either continued pre-existing plans for postgraduate education in the sciences or developed new plans. A small percentage changed their original plans deciding not to go to graduate school.

In the Australian context there is growing evidence that engaging in undergraduate research has positive benefits in encouraging more students to undertake honours and continue to doctoral study (Jewell & Brew, 2010).

Effects on academics and researchers

There is a good deal of evidence that undergraduate research can have beneficial effects on research output particularly in some disciplines (Laursen et al., 2010). Further, Zydney, Bennett, Shahid and Bauer (2002) suggest that undergraduate research provides important teaching and mentoring experience for graduate students who supervise undergraduates.

5. Dissemination

A key aspect of the Fellowship has been raising awareness of the importance and possibilities for undergraduate research in Australian higher education. Therefore dissemination has been viewed as an important aspect throughout. The Regional Roundtables and the Summit were designed to foster national debate concerning policies and practices in engaging undergraduates in research and inquiry and all together involved some 200 participants nationally.

Presentations

During the period of the Fellowship, the work of the collaborating groups and the development of resources and protocols were also the subject of conference presentations and seminars given in universities and other organisations. Numbers in square brackets indicate approximate numbers of participants. The total audience is approximately 820 participants. Further workshops and presentations are planned for 2010. The list below does not include presentations given at Regional Roundtables and the National Summit, nor does it include conference presentations on other topics.

Presentations on undergraduate research during the fellowship

1. *Enhancing undergraduate engagement through research and inquiry*. Presentation. University College Cork, Eire. 21st January 2009. [50]
2. *Research and inquiry in undergraduate courses*. Cork Institute of Technology, Eire. 27th January 2009. [10]
3. *In Conversation with Angela Brew*. Workshop session, Sheffield Hallam University, UK. 21st April 2009. [25]
4. *Teaching enhanced research*. Workshop. The University of Sheffield, UK. 22nd April 2009. [8]
5. *Integrating teaching and research: What do we know?* Open lecture presentation, The University of York, UK. 23rd April 2009. [45] Lecture is available online at: <http://www.transit.york.ac.uk/angelabrew>
6. *Enquiry based undergraduate education*. Workshop with staff at York St John University, UK. 23rd April 2009. [15]
7. *Engaging undergraduates in research and inquiry*. Macquarie University. 30th April 2009. [10]
8. *Research and Teaching: new connections for new times*. Keynote address to Faculty Forum, University of California, Santa Barbara. 18th May 2009. [40]
9. *Brown Bag session*. Carnegie Foundation for the Advancement of higher education. Menlo Park CA. 26 May 2009. [9]
10. *Presentation to the Research Experiences for Undergraduates Committee*, National Science Foundation, Arlington VA, USA. 2nd June 2009. [7]
11. *Undergraduate research in context: institutional accountability and strategies to develop research-enhance learning in Australian universities*. Seminar to National Science Foundation. 3rd June 2009. [15]
12. *Enhancing undergraduate engagement through research and inquiry*. Presentation at University of Leiden, The Netherlands, 17th June 2009. [50]
13. *Disciplinary affiliations of researchers*. Discussion presentation. Leiden University, The Netherlands. 19th June 2009 [9]
14. *Integrating research and teaching: What do we know?* Lecture presentation at The University of Liverpool, UK. 30th June 2009 [24]
15. *Strategies to develop research-enhanced learning in Australian universities*. Presentation to National Science Foundation program leaders. June. [9]
16. *Enhancing undergraduate experiences through research and inquiry*. Workshop presented at the Annual Conference of the Higher Education Research and

- Development Society of Australasia (HERDSA), Darwin, NT, July 6-9. [40]
17. *Introducing undergraduate research to enhance student learning at university*. Keynote address presented at Talent voor de Toekomst (Talent for the future) Undergraduate Research Conference. Association of Universities in the Netherlands (VSNU). Middleburg, The Netherlands. 27-28 August. [200]
 18. Effects of the Teaching Index on improving students' course experiences: Evidence of change? Workshop to Macquarie University staff. 25th September 2009. [15]
 19. *Can undergraduate students do real research?* Uniserve Science Conference Discipline Day. 30 September 2009. [12]
 20. *Higher Education Engagement- or – “doing a degree backwards”* Presentation to the University of South Australia. 11 November 2009. [20]
 21. Strategies for integrating research and teaching. Presentation to Macquarie University Foundations in Learning and Teaching Alumni 16 November 2009 [8].
 22. *Research now and in the future: Challenges and opportunities*. Keynote address to Student ResearchFest. The Australian National University. 6 April 2010. [175]
 23. Academic development for undergraduate research in Australia. Presentation at The University of Sheffield. 22 March 2010. [9]
 24. *Introduction to Research-based Learning*. Workshop for Macquarie University. 23 April 2010. [10]
 25. *Introduction to the scholarship of teaching and learning*. Workshop to Macquarie University staff. 28 April 2010. [6]

Comment [PH6]: Date?

Comment [PH7]: Day?

Comment [PH8]: Day?

Publications

Dissemination has also been through publications that have been worked on or published during the period of the Fellowship. Some conference presentations and publications are in preparation and there are a number planned for the future.

Book, book chapters and journal articles

Brew, A. (2010). Imperatives and challenges in integrating teaching and research. *Higher Education Research and Development*, 29 (2) 139-150.

Brew, A. & Lucas, L. (Eds.). (2009). *Academic Research and Researchers*. London: Open University Press and Society for Research into Higher Education. [Edited book includes a chapter on undergraduates' engagement with research]

Brew, A. (in press, 2010). Transforming academic practice through scholarship. *International Journal for Academic Development*, 15 (2). [Refereed journal article accepted 27/01/2010]

Brew, A. (in press, 2010). An Australian perspective on undergraduate research. *CUR Quarterly*. Council on Undergraduate Research. [refereed journal article]

Bartimote-Aufflick, K., Brew, A., & Ainley, M. (in press, 2010). University teachers engaged in critical self-regulation – How may they influence their students? In A. Efklides & P. Misailidi (Eds.), *Trends and Prospects in Metacognition Research*. USA: Springer. [Accepted 2/11/2009]

Brew, A. & Boud, D. (forthcoming). Influences on the formation of academics: perspectives of Australian academics. *Studies in Continuing Education* [submitted January 2009]

Conference presentations

Brew, A., Boud, D., & Namgung, S. (2009). The professional formation of academics: Constraints and enablements in becoming researchers and teachers. Paper presented at the Annual Conference of the Society for Research into Higher Education. Newport, Monmouth,

Wales, 8-10 December 2009.

Brew, A. & Boud, D. (2009). Influences on the formation of academic practice: the academic's perspective. Paper presented at the conference: "Beyond teaching and research – inclusive understandings of Academic Practice". University of Oxford, 13-15 December.

Brew, A., & Boud, D. (accepted for presentation). Reconceptualising academic work as professional practice: implications for academic development. Paper to be presented at the Conference of the International Consortium for Educational Development, Barcelona, Spain, 28-30 June 2010.

Brew, A., Cahir, J., & Jewell, E. (accepted for presentation). Experiences of research-based learning: A national project to enhance quality learning in Australia. Paper to be presented at the Conference of the International Consortium for Educational Development, Barcelona, Spain, 28-30 June 2010.

Brew, A. & Boud, D. (accepted for presentation). The challenge of researching absences: bridging the theory-practice divide in research on the formation of academics. Higher Education CloseUp Conference, Lancaster University, UK. July 20-22, 2010.

Bartimote-Aufflick, K., Ainley, M., Brew, A. (2010 forthcoming). Critical self-regulation – Bringing together disparate traditions for teacher development. Paper to be presented at the 4th Biennial Meeting of the EARLI Special Interest Group 16 Metacognition. May 26 - 29, 2010 / Muenster, Germany.

Brew, A., (accepted for presentation). Faculty development for undergraduate research in Australia: A local project in a global context - Longer Paper to be presented at the Conference of the International Society for the Scholarship of Teaching and Learning, Liverpool UK, October 2010.

Brew, A. (invited presentation). *Issues in comparing national systems*. International Society for the Scholarship of Teaching and Learning (ISSoTL) seminar on 'International perspectives on undergraduate research and inquiry: a scholarly discussion'. Liverpool UK, 18th October 2010.

Brew, A, Jewell, E & Cahir, J. (invited poster). *The Australian National System for undergraduate research*. International Society for the Scholarship of Teaching and Learning (ISSoTL) seminar on 'International perspectives on undergraduate research and inquiry: a scholarly discussion'. Liverpool UK, 18th October 2010.

Media

Media coverage was achieved through articles in *The Australian*, Macquarie University's "Newsroom" web page, the online Macquarie magazine "*Bowerbird*", the Macquarie University research magazine "*Quest*", and the newsletter of the Higher education research and development society of Australasia (*HERDSA News*):

- 'New Life Members of HERDSA: Reflections by Angela Brew'. *HERDSA News*, September 2009, pages 7-8.
- 'Undergraduates devalued'. *The Australian* Wednesday 14 October 200, page 26, Col 3.
- Calling for new order: extending research beyond the elite. Macquarie University Newsroom, 24 September 2009. Available at <http://www.mq.edu.au/newsroom/control.php?page=story&item=3923>
- Calling for new order: extending research beyond the elite. *Quest: Research at Macquarie University*, Issue 4, 2009, page 21.
- First Australian Summit on the Integration of research, teaching and learning. *Bowerbird*, the online magazine of the Learning and Teaching Centre, Macquarie University, Issue 1 2010. Available at <http://www.mq.edu.au/lte/magazine/issue2010-01/issue2010-01-05.htm>

6. Evaluation

Theory of change

The strategy used to evaluate the Fellowship was an adaptation of the 'Theories of change' approach to evaluation developed in the Centre for Inquiry-based Learning in Arts and Social Sciences (CILASS) at The University of Sheffield. Professor Philippa Levy, the Director of that centre was external evaluator. The evaluation, by its very nature took place throughout the Program, commencing with the establishment of the theories of change framework and detailed evaluation plan for the Program at an early stage. Therefore I met with Professor Levy four times during the Fellowship and email contact was maintained throughout.

The theory of change approach was chosen because of the way in which it matched the ALTC dissemination framework while providing a structured approach to evaluation. The theory of change that was developed in collaboration with Professor Levy was a constant reference point in evaluating particular aspects of the Fellowship. Professor Levy's report, which details the theory of change developed and the overall outcomes, is appended. In this section of the report, I highlight some of the issue that emerged from discussions, observations and events.

Record keeping

Throughout the Fellowship, extensive notes on discussions were taken. They were compiled and fed into future discussions. Many issues raised are discussed on the website and/or have been addressed with resources being made available, e.g. evidence that student engagement is linked to student outcomes, streamlining ethics processes for undergraduate research, assessing inquiry-based learning, and information about how to set up undergraduate research scholarship schemes.

Issues still requiring attention are, for example, the challenges of teaching being done by casual staff particularly in the early years, the importance of developing new kinds of spaces for study and creativity, the challenges of setting up new kinds of organisations within universities that merge different disciplines, how some universities may have redefined their missions away from research-based learning following AUQA reports, the need for definitions of research impact to include the impact of research on education, issues of how to recruit PhD candidates if not from honours, issues of academic workload, and the need for a new theoretical framework for understanding how undergraduate research develops community.

Roundtable evaluation

Each event was evaluated using the same set of questions. Sixty Roundtable participants responded (i.e. 66% of participants) and the following gives a flavour of their responses. These detailed comments are included because they bring to life the nature of the kind of discussions and issues raised and bring into this report the voices of the academics who have participated.

Most meaningful thing gained

Asked 'what was the most useful, or meaningful, thing you gained during this roundtable?' many participants pointed to the fact that they had gained an appreciation/awareness of the range of exciting initiatives/ concrete resources/ opportunities/examples of undergraduate research-based experiences. Some pointed generally to: "*Hearing good ideas*"; "*Varieties of experience in the design and implementation of RBT/L*"; and "*The possibility to excite students about their learning in research type activities*".

Some participants pointed to specific resources they had heard about: "*Chance to see conference papers and journals*"; "*Ideas about how to engage first year students in*

research"; and *"The sense that undergraduate research at 1st year level is possible and makes a positive impact on students learning and engagement."* Some participants commented upon the value of undergraduate research:

"It was good to hear again reinforcement of how central research is to our teaching and the examples provided of ways to engage students in research/ inquiry in the undergraduate curriculum were fascinating."

"To realize how many others are doing this and thinking about how to articulate the understanding of research already occurring. It never occurred to me before that we could/should teach research and inquiry to UG students. I will take this into the curriculum development discussions."

"The great importance of research-based inquiry and undergraduate research within the university experience for all students (from all disciplines)."

Some participants pointed to the value of the discussion of the Australian Universities Survey of Student Engagement (AUSSE) and the importance of undergraduate research to affect this, and to more general ideas about how to increase student engagement, from colleagues in other universities.

Many participants mentioned the value of meeting/ discussion with other colleagues from other disciplines and universities, hearing: *"The diversity of views on what UR actually is"* and *"Hearing about challenges and potential solutions to problems colleagues have in different contexts and universities and disciplines."*

Questions remaining

Asked about the questions that remained uppermost in their mind at the end of the roundtables, participants mentioned a number of issues about how to use the ideas and progress the opportunities presented. As one said:

"Where to next I suppose. It is all well and good to have such conversation but it is all about developing an action plan and actually making progress towards improving the problem."

Some participants were concerned about how to assess research-based learning. Others wondered about how to *"[roll] out the good ideas on a wider basis"*. Some participants questioned how to engage students in research-based learning in their particular discipline or: *"How to support research in larger classes"*. Some participants pointed to the problems associated with academic contracts and workload. *"How do we deal with consistency in research-led teaching when, increasingly with short contracts, there is no guarantee of consistency in teaching staff."* Related to this were a number of concerns about *"How to get senior management to see the value and increase support for undergraduate research."* Indeed, funding and resources to support undergraduate research were uppermost in many participants' minds. Tensions between different priorities were the concern of a few.

One area of concern was the workload of students and how to change students' expectations of university. *"The biggest problem(s) I would still encounter is the culture that shapes the behaviour of students and general environment of university education including heavy content curriculum;"* and *"How to shift cultural attitudes within schools, universities and industry forward deeper learning facilitated by undergraduate research"*.

"My main questions are still around better ways of supporting academics to undertake research into their teaching so that innovative curricula such as enhancing undergraduate engagement in research are developed in sustainable ways. It seems to me that we have teaching and learning frameworks that argue for these developments but they are often not based on rigorous research and/or evidence of outcomes – and if we are to encourage undergraduates to partake in research then surely we should be researching, and be supported to research, our teaching practice more effectively also? My other main query

about undergraduate research relates to the ethics of students engaging in research – it is difficult to construct a practical way of gaining ethics approval for UG research projects and I would be very interested in hearing of any effective models or practices relating to this. "

Further assistance

When asked 'What activities, events, or resources would assist you and your colleagues to develop undergraduate research in the future?' many participants pointed to the desire to have accessible online resources, for example, "*for large units*"; "*examples of research in undergraduate curriculum*"; "*Online examples of student research*"; "*case study examples from all disciplines*"; "*subject specific examples of successful activities*"; "*Exemplars*"; "*Models of successful unit delivery/ Teaching resources/ Assessment resources*"; "*List of possible journals suitable for publishing undergraduate research/ This list would also be the best place to look for publications and references*"; "*More ideas about engaging students*"; "*It would be good to have a bibliography of all the references cited during today's presentations.*" Resources on many of these issues have subsequently been made available on the website. "*Website sounds like it will be a good place.*" One person indicated: "*I have enough information and printouts to get started*".

Some Roundtable participants were considering what needed to happen in their own university. The following were all desired: "*More support for teaching in the University*"; "*Better integration between teaching and learning units at the institution with academics to assist in the process*"; "*Collegiate support and institutional for this and from them*"; "*Department based seminars to challenge my colleagues*"; "*[University] internal discussions*"; "*changes in funding*"; "*Clearly articulated university policies*"; "*At [University] we need more flexible teaching and learning spaces*". One person commented that they needed: "*Faculty support in the form of acknowledging the extra resources that are required and providing for them*".

There was a desire for "*More roundtables like this one*"; further sharing of ideas and good practice, national networking and support, and also for discussions within specific disciplines.

Proposed actions

An important question asked of Roundtable participants was: Will you change anything as a consequence of being here today? A number of participants indicated specific actions they were considering taking. Numerous others outlined more general actions. Specific actions included: "*I will change my third year subject substantially*"; "*Will think about being more proactive in embedding research into our first year course*"; "*Yes I feel that it is important to engage students in research in their first year*"; "*Most probably change one assessment task*"; "*I will try and include discussion and/or tasks around research process in my statistics bridging course*"; "*I will look more critically at our first year program with a view to increasing research/inquiry opportunities for these beginning students*"; "*Yes I will use 'research and inquiry' as a term and watch the narrowness of just 'research' I will try and link 'research and teaching' more within my institution*"; "*Perhaps as well as using a poster display of student projects then add an abstract booklet as part of the celebration of their work*"; "*Yes, mapping research across the curriculum*"; "*Think about how to construct assignments*".

More general actions and responses included: "*Will incorporate some new learning and teaching activities*"; "*Yes. I'll experiment with some new ideas in research led teaching*"; "*Definitely both in my teaching and my research*"; "*Yes, will be more conscious of promoting research*"; "*I will just keep working on these issues*". A number of participants pointed to their desire to investigate further, reviewing curricula, investigating the literature or researching and writing about the issues, for example in how to measure the effectiveness: "*Gave me direction to pursue research in this area*".

Other participants pointed to a range of staff development activities and processes including sharing ideas and resources with colleagues. For example, "*I will be happy to communicate with my peers that these conversations are being had by academics. I am sure they will be*

very pleased to hear that such improvements are being worked towards"; "I will plant the seed of this idea with the school; "Yes, I think that I will raise the profile of this integrative aspect within my own university". "I will discuss the issues raised today at our schools upcoming academic staff meeting. Will endeavor to support colleagues in taking steps to incorporate further their and others research explicitly into teaching." "I was already convinced but now feel armed with more information to support staff".

Further ~~Roundtable~~ roundtable comments

An opportunity was provided for participants to make additional comments. These were overwhelmingly positive with many participants indicating their thanks. The following is a sample of responses:

"Thanks for a great day."

"Loved the case studies presented throughout the day. Thank you."

"Great presentations!"

"Wonderful 'think-tank' thank you so much!"

"The range of talks was great. It is great to get glimpses across different disciplines."

"Great learning curve. Thank you for the opportunity to participate"

"Excellent! Really useful as a way of raising the profile of this topic in our university."

"I enjoyed this event. It is very useful."

"A very thought provoking session."

"Excellent workshop, where the student remained at the heart of the conversation."

"I'll reiterate my view above that I think this is an extremely valuable area for academics to focus on. My relatively brief experience at university (six years) has only recently enlightened me to exactly what the benefits of research can be. I feel it is the best way to learn and gives the researcher that opportunity to focus on what is of specific interest to them. These sorts of opportunities should definitely be cultivated at all levels of tertiary study. Good luck with the remainder of the fellowship Angela!"

Summit evaluation

Summit participants were largely senior institutional representative. As one person put it: they "appreciated gaining an understanding of the US work in this area, as well as opportunities and think with others about what this means for further developments in the Australian higher education sector", but this went alongside an appreciation of: "The depth of the political obstruction, at least in some areas/universities". One undergraduate student commented: "From a student's viewpoint, it was excellent to see these issues being addressed by academics – across the country. It can often be hard to see what is being done behind the scenes so it was an invaluable experience for me to be involved in the discussion."

Key questions that remained uppermost in participants' minds at the end of the Summit included:

- How major changes can be achieved at national levels, how to get policy people and ARC and ALTC to talk, and whether ALTC will take leadership on this initiative.
- How to carry the idea of undergraduate research forward, how to challenge institutional culture and bring about change in the institution, how to embed undergraduate research in the university curriculum and academics' capacity to change/adapt to embedded undergraduate research especially in the financially constrained workplace.

Suggestions for activities, events, resources that would assist in developing undergraduate research at the national level included:

- The formation of an Australian Council on Undergraduate Research (CUR) with a broad conception of CUR in terms of research and inquiry (Support network, annual

- meetings or biennial/web resources);
- National conference: A biannual conference for both staff and students;
- National funding suggestions included: link with ARC, grants targeting undergraduate research and a change of priorities for funding; National Science Foundation style funds for undergraduate research especially for sites of excellence; multiple studentships;
- Additional sources of funding to facilitate UG research;
- An ALTC focus in 2010 on research and teaching integration (i.e. grants);
- Federal honours scholarships like APA's for PhD candidates; and
- Continuing research into the benefits for all; good measures (valid and reliable) to evaluate impact and outcomes.

A number of suggestions for further resources were made, many of which are now available on the website.

- Exemplars spanning a range of activities of students at different levels.
- A report like Healy and Jenkins 2009 but focusing on Australia (note: this has been completed as part of this Fellowship).
- Presentations made available on the web (this has been done).
- Documentation of evidence to support the concept.
- Discipline-specific case studies.
- Dissemination of websites and other outcomes from others' enterprises in undergraduate research in the sciences. Small disciplines simply do not have the human resources to develop such things.

As one said: *"I am looking forward to seeing a rich and useful resource (website) development."*

Suggestions for developments at an institutional level included:

- Funding and staff time;
- A workshop on embedding UR in programs/across universities;
- Workshops – "useful to hear some of the other experiences as keynotes but very useful to discuss issues;" and
- Local professional development.

Further comments made:

"A well organized and insightful summit."

"An engaging and inspiring couple of days. IT was great to hear from the international speakers as a way of contextualizing the Australian experience."

"Well done to the organizing team."

"A terrific initiative".

"Thank you for the initiative!"

A number of participants indicated that it would have been useful to have more general discussion time and/or more roundtable discussions in the Summit. One would have liked to see a dedicated discussion on ethics.

As one participant commented: *"All politicians need to do an UG research project during their degree in order to become wiser research consumers and funders!"*

7. Critical Success factors

Readiness of the system

The Fellowship was driven by an underlying vision of universities as inclusive scholarly knowledge-building communities, where academics and students at all levels work together in inquiry and learning partnerships (Brew, 2006). Ideas about research and inquiry-centred undergraduate student experiences and how to nurture and foster them are central to this. The vision addresses the needs expressed in the Government's response to the Bradley review of higher education for critical creative thinkers within the Australian workforce (Commonwealth of Australia, 2008; Commonwealth of Australia, 2009a); people who can solve problems that we currently cannot contemplate; for skills and abilities to gather and evaluate evidence; in short, the skills of inquiry.

A critical factor influencing the success of the Fellowship has been the readiness of the Australian higher education system to embrace the inclusion of undergraduate students in research. However, there are a number of structural and attitudinal barriers that work against this.

Structural challenges are embedded in the very fabric of our political system. At the highest levels, research and innovation on the one hand, and higher education on the other, are legislated through different government departments. In 2009 two major governmental reviews were carried out (the Bradley and Cutler reviews), neither of which addressed the issue of research conducted by undergraduates (see Commonwealth of Australia, 2009a; and 2009b). Yet we now know, from our research within this Fellowship, that this is a significant and growing area of practice within the higher education community. It is both part of the 'innovation system' and part of higher education teaching and learning.

Factors working against the integration of undergraduates into research and inquiry go further. Key aspects are the attitudes and objectives of research funding bodies. In the USA, undergraduate research is an accepted part of the national research effort. The National Science Foundation, for example, views undergraduate research as a vital part of the nation's research effort (National Science Foundation, 2001). Other research funding bodies in the USA, such as the Research Corporation for Science Advancement and the Howard Hughes Medical Institute have long traditions of funding and supporting undergraduate research. Some Canadian research councils also fund undergraduate research, and in the UK the government's investment of some 40 million pounds to develop 'research-informed teaching' together with the establishment of six well-funded Centres for Excellence in Teaching and Learning focused on undergraduate research and inquiry in the last five years, has led to many curricular and co-curricular research-based experiences for students. Engaging undergraduate students in research is seen not only to benefit student learning, but also to benefit universities' research efforts and staff engagement.

In Australia, there is a need for further national debates about the role of undergraduate research in the research funding system. At national levels, it is imperative that research councils take seriously the potential contribution of undergraduate students to each university's research effort. This is not in any way to deny the importance of the highest standards of excellence in research, but it is to recognise the need expressed in the government's response to the Bradley Review (Commonwealth of Australia, 2009a) to address the projected shortfall of future academics and provide for professionals capable of critical creative thought. Falling domestic PhD enrollments make this an imperative.

The Fellowship has provided opportunities for academics and academic managers to examine policy and practice in terms of the need to set as goals the interrelationship of students as participating scholars and to break down barriers to this. However, much more

discussion is needed and the ALTC has a critical role to play in this. The report of Professor Philippa Levy, the Fellowship external evaluator (see Appendix) has suggested some ways in which this might be achieved.

The divide between considerations of teaching and of research seen at the national level is mirrored in institutions. For example, many universities have committee and performance management structures that separate considerations of teaching and research. Undergraduate research sits within the interstices of research and teaching structures, policies and practices. Enabling mechanisms and policies for considering them together are frequently lacking. There is a need to ensure that the organisation of learning and of research are facilitative of research and inquiry-based modes of teaching and learning at the undergraduate level and that opportunities for undergraduates to contribute to the university's research effort are provided. One important aspect of this is the need for clear ethics policies and procedures that facilitate students engaging in research.

Universities are inherently hierarchical and this has been reinforced by mass higher education which has resulted in large cohorts of students. Hierarchical organisational structures tend to define undergraduate students as 'other' and to construct them as deficient, lacking the necessary skills and abilities to undertake research. Research tends to be preserved for the higher years and especially for postgraduate study; as if it were a kind of reward for hard work. There is a tendency in some subject areas to view knowledge in hierarchical ways and requiring a step by step process to accumulating knowledge of the subject. This effectively excludes all but the most advanced students from doing research. The Fellowship has contributed examples that critically question such attitudes but they are widespread and this has been a critical factor influencing the extent to which it has been successful.

If students are to engage in learning through research and inquiry, there is a need within university departments to explore and discuss attitudes that support and sustain particular views of research and teaching and views of students and what they are capable of. Students who become research associates when engaged in undergraduate research experience programs are reported to feel part of the research community. They are treated as junior colleagues rather than just 'students' engaged in courses. As noted above, their relationship with academics changes to a more inclusive one. Developing opportunities for students to undertake research depends on changed relationships between students and academics.

Universities need to set as goals the interrelationship of students as participating scholars and to break down barriers to this. This is now happening through, for example, academic development which encourages critical questioning of the relationships between academics and students; the design of collaborative research projects with undergraduate and postgraduate students including research on teaching and learning projects; the setting up of undergraduate research scholarship schemes, undergraduate journals and conferences; the redesign of curricula to include more research-based learning and the planning of new spaces within universities for intellectual collaboration and socializing of students and academics. A critical factor influencing the success of this Fellowship has been the readiness of sizable numbers of academic and other university personnel who are already working to engage their students in various forms of research and inquiry, who participated in the Roundtable discussions and the Summit and who have joined the Extended Network. The success of the Fellowship in changing practice is dependent upon the extent to which these people take forward planned initiatives in their institutions.

Enablers and Limitations

Critical to the success of the Fellowship was the support from Macquarie University. In particular, the Provost and Deputy Vice Chancellor, Professor Judyth Sachs recognised the importance of the Fellowship in furthering a key strategic aim of the University to develop

research-based learning and provided support throughout. The staff of the Learning and Teaching Centre, under the leadership of Associate Professor Ian Solomonides, provided a congenial context for me to work and assisted in numerous practical ways as well as providing moral support and friendship.

A further critical success factor was the excellence of the team of staff with whom I worked on a day to day basis. The Fellowship required a large amount of organisation to ensure the success of the Roundtables and the Summit, to organise complex travel arrangements for myself and the national and international teams, to liaise with web designers, to co-construct the manual, record evaluation data, manage the finances and many more administrative tasks too numerous to mention. The Fellowship administrator, Jayde Cahir, carried out this work with extraordinary efficiency. Her attention to detail was truly remarkable and was, for example, a key factor in ensuring the success of the Summit. The other member of the small Fellowship team was the undergraduate student researcher, Evan Jewell. Evan's work to investigate undergraduate scholarship schemes in Australian universities was carried out with commitment, enthusiasm and a high level of academic scholarship. His report, which is a key outcome of the Fellowship, is a shining example of undergraduate research.

The work and commitment of both the national and the international teams of experts also represented a critical factor in the success of the Fellowship. From the very beginning, they provided support in preparing the application for the Fellowship and, as detailed above, provided ongoing sources of ideas, contacts, resources and support. This is continuing. An especially important enabling factor was the advice and support of the Fellowship external evaluator, Professor Philippa Levy. She contributed the evaluation framework and a collaborative space for critical questioning and reflection.

Also important to the success of the Fellowship was the welcome received from numerous individuals in the USA, the UK and The Netherlands who responded to my requests to meet with them and who willingly shared their ideas, resources and support. Also critical were the individuals including undergraduate students who gave up their time to attend events and share their ideas. Each Roundtable included presentations by leading practitioners at host universities which contributed greatly to the success of these events.

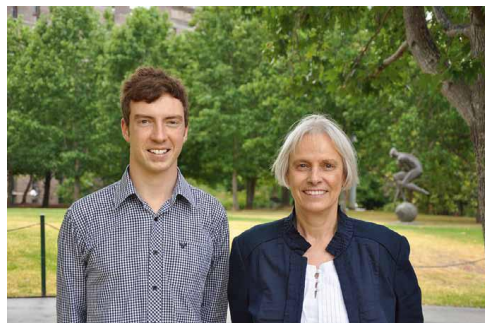
A key limitation was the amount of time available for the work. The Fellowship was able to raise issues and provide resources for universities to extend opportunities for undergraduates to engage in research and evidence from evaluations of Fellowship events suggests that many people had intentions to do this. The lack of willingness of some organisations to engage with this agenda, combined with the lack of time to follow them up has meant that the Fellowship has not yet had more impact at the political level in raising awareness of the importance of undergraduate research. This work is inevitably ongoing. Longer-term development is clearly needed across the sector. There is a need for sustained debate at a national level and there is a need for ideas to be developed that link undergraduate research to other national agendas, such as, for example, graduate capabilities and questions of academic standards.

8. Conclusion

This Fellowship set out to enhance student engagement in learning through supporting the development, in Australia, of undergraduate research and inquiry. As such, it has been a catalyst for development in this regard.

Serious attention to engaging students in research and inquiry, points to challenging national and institutional and policy structures that separate considerations of teaching and research. It involves organisations responsible for both teaching and research to work together and it rests on challenging assumptions of academics, academic managers and policy-makers about what students are and are not capable of. Models, resources, and protocols which assist in developing pedagogical practices that structure knowledge and learning in new ways, which this Fellowship provided are critical and they need to be discussed in the context of debates about who should do research and who should not, about how teaching and research should be organised, about the kinds of learning support and resources that should be provided for students, and about how spaces are used.

For students who are the professionals of the future, developing the ability to investigate problems, make judgments on the basis of sound evidence, take decisions on a rational basis, and understand what they are doing and why is vital. Research and inquiry is not just for those who choose to pursue an academic career. It is central to professional life in the twenty-first century. So developing understanding and practice in engaging undergraduates in learning through research is important. The Fellowship has contributed opportunities for discussion and debate as well as resources to further this agenda.



Evan Jewell, undergraduate scholar and
Angela Brew, ALTC National Teaching Fellow

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Appendix A

Australian Learning and Teaching Council (ALTC) Fellowship 2009-10: 'Enhancing Undergraduate Engagement through Research and Inquiry' External Evaluation Report by Professor Philippa Levy, The University of Sheffield, UK

Introduction

1. This report reviews the significance and achievements of Professor Angela Brew's Fellowship project and emphasises the importance of ensuring that on-going, sector-wide momentum in Australia relating to its focus on undergraduate research and inquiry is maintained once the Fellowship itself comes to an end. The report also draws attention to a number of points for consideration by ALTC that may have more general relevance to the Fellowship scheme and provision of support for projects.

Evaluation Approach

2. The evaluation approach adopted for this Fellowship was an adaptation of the methodology used by CILASS, the Centre for Inquiry-based Learning in the Arts and Social Sciences, at the University of Sheffield. This combines *Theory of Change* evaluation with the use of *EPO (Enabling, Process and Outcome) Performance Indicators*, as described by Hart et al (2009), and provides a framework for practitioner-led critical reflection on practice. The focus of evaluation is on 'enabling' and 'process' factors as well as on outcome and impact factors, and on understanding the relation between these.

3. The approach works as follows. Through backward mapping, a causal narrative or 'theory' for the educational change initiative is established, that identifies evaluation indicators and provides the basis for an evaluation plan (collection of evidence). For example, 'to achieve the desired impact on student learning experiences, the outcomes of the initiative need to be x, y and z; in order to achieve these outcomes, the processes or activities a, b and c need to happen; in order to carry out a, b and c, the enabling factors and resources d, e and f are required'. The narrative thus identifies three different types of evaluation indicator: *enabling* indicators concerned with structures and support, *process* indicators concerned with what needs to happen, and *outcome* indicators concerned with intermediate outcomes of an initiative that are tied to broader and longer-term impact goals. Importantly, the approach distributes weight between outcomes, processes and enabling factors and identifies them all as valid indicators of impact. Underlying the ToC narrative are various assumptions, beliefs and values relating to the change initiative, its context, purposes and so on. Exploring these in the course of impact evaluation affords insight into why and how impact occurs. The framework offers scope for identifying emergent enabling and process factors, and unanticipated outcomes. The approach acknowledges that desired outcomes may change as change initiatives progress and that adjustments may be made to processes and activities.

4. The approach was applied to Professor Brew's Fellowship project by establishing a poster-style *outline* representation of the ToC underpinning the Fellowship and its key evaluation indicators (as reproduced in Appendix 1). An evaluation plan was developed, based on the following sources of evidence: stakeholder feedback (formal and informal, including from participants in events); documentary evidence (resources review); project-leader review and reflection (reflective conversations with evaluator). Professor Levy's role was to assist in the

development of the ToC and evaluation plan; to facilitate Professor Brew's on-going reflection and act as a 'critical friend' to the Fellowship; to scrutinize documentary evidence (e.g. website and stakeholder feedback); to provide a synthesis report with commentary from the external perspective. Professors Brew and Levy met four times over the course of the Fellowship, initially to establish the ToC and evaluation plan, and subsequently to conduct in-progress and then 'summative' reflection. Originally a final 'stakeholder feedback' phase was envisaged in which additional feedback on impact would be gathered from members of the national and international teams. In the light of the large amount of impact evidence from these sources through other channels it was decided that this was not needed.

A Theory of Change

5. The ToC underpinning the Fellowship can be summarised, in simplified form, as follows: "There is a compelling rationale for increasing the role of inquiry and research in mainstream undergraduate education in Australia. However, a number of attitudinal and structural barriers work in the sector against the inclusion of undergraduates in research as this is currently defined, and the development of new practice and policies is constrained by a lack of practical guidance (strategies, protocols, models etc). In the light of these circumstances, the main desired outcomes of this Fellowship are (a) *enhanced engagement and new thinking among key stakeholders*, in particular policy-makers and academic leaders; and (b) *concrete action-plans for new practice and policies at institutional and national levels*. In terms of longer-term impact, these outcomes will have the effect of strengthening the role of inquiry and research in students' experiences of undergraduate education, with benefits for their engagement in learning.

6. "To achieve the outcomes, it will be valuable for the project to: facilitate meetings and events that stimulate wide engagement and debate around key issues; publicise and promote the issues through other relevant channels; carry out and disseminate relevant research; collect and disseminate relevant resources for action-planning. Key 'enablers' for these activities are expected to be: the expertise and input of the project leader and other participants (including national and international teams); logistical resources such as time, funds, appropriate meeting spaces; institutional support (host institution) and ALTC support; appropriate communications and engagement strategies".

7. As indicated in the Fellowship Agreement, key deliverables for the Fellowship were: (a) a set of online and hard-copy resources for action; (b) research reports on the state of undergraduate research schemes in Australia; (c) regional roundtables; (d) a national summit; (e) a website; (f) a progress report and a final report. From the perspective of the ToC, with the exception of (f) these are *process* deliverables that are expected to help achieve the Fellowship's desired outcomes. All the Fellowship deliverables were achieved, with minor adjustments to initial plans resulting from logistical issues.

Outcomes and impact

Enhanced engagement and new thinking among key stakeholders

8. The Fellowship's success in stimulating enhanced engagement and new lines of thinking is reflected in particular in the very positive feedback (via structured feedback forms and informal, unsolicited comment) from those who attended regional roundtables and the national summit, as well as in feedback about the value of its website resources. It is especially

encouraging to see feedback that indicates expanded conceptualisations of research as related to undergraduate activity and more strategic, 'joined-up' thinking about undergraduate inquiry and research across curriculum and co-curriculum; these aspects are a strong and distinctive contribution of the Fellowship to discussion and conceptualisation in this area. Professor Brew's on-going conceptual work will continue to inform the wider field. In having established a new network of over 300 people the Fellowship has laid the groundwork for on-going debate and dissemination of new perspectives and ideas beyond the duration of the Fellowship. The Fellowship newsletter, if continued, will contribute to keeping this network of people informed and engaged.

9. The positive response to the Fellowship from the Deputy Prime Minister's Office is a highly encouraging sign of recognition of the importance of the work at the level of national government and it is to be hoped that future follow-up will lead to further impact in this arena.

10. The Fellowship has highlighted clearly the need for two-way dialogue and joined up thinking across the structural divide between research and teaching in Australia. It worked at a number of levels to engage a range of stakeholder groups. Its aim to engage those with leadership responsibility for universities' research missions, as well as for their teaching missions, was a major challenge. It seems clear that policy-makers and leaders in the research arena (among national research bodies as well as in institutions) were the most 'difficult to reach' group among those targeted. This is not surprising given the history of structural separation between research and teaching policy and strategy in HE, and the Fellowship has made a significant intervention in terms of raising awareness and stimulating dialogue in this respect. It will be important that its work in highlighting and strengthening the connections between research and teaching at the level of policy continue to be taken forward after its close. New insights gained by the Fellowship leader from her study tour of the US are pertinent here, for example in noting the lack of transfer of principles and ideas from the domain of co-curricular undergraduate research to the domain of teaching and learning not only at the level of policy but also by individual researchers. The Fellowship gathered valuable evidence that in Australia there is a greater focus than in the US on the role of undergraduate inquiry in teaching and learning but this does not appear to translate across to the domain of research — and yet at the same time, a profusion of relatively 'invisible' co-curricular undergraduate research activity is supported.

Concrete action-plans for new practice and policies at institutional and national levels

11. It was anticipated that the Fellowship would lay the foundations for a new national co-ordinating organisation — perhaps a 'National Centre for the Integration of Research, Teaching and Learning' — to take the work forward. Feedback on this at the national summit was mixed, with some participants suggesting that a more effective strategy might be to utilise existing bodies to pursue the same agenda. However, it is not clear how this would be achieved and plans for a Centre are evolving. Evidence from the Fellowship does suggest the need for some form of co-ordinating body, possibly based on a collectively-funded consortium model. It might be helpful to examine the role, organisation and impact of similar national Centres (e.g. in Ireland) as part of a feasibility study, and to conduct further consultation among Australian universities on this issue.

12. Some stakeholder feedback indicates intent to take new ideas and resources from the Fellowship back to institutions and to feed them in to new developments; however, it is too early to know if concrete changes in policy or practice have resulted beyond the Fellowship

leader's own institution, and the desired longer-term impact — to “enhance student engagement in learning” — cannot be measured yet. Based on the evidence of the positive outcomes of the Fellowship it seems likely that, provided momentum can be maintained, it will prove to have been an important catalyst for change. The large number of on-going activities, including accepted conference and journal papers, and invitations to Professor Brew to contribute to future events and projects, demonstrates the positive response to the Fellowship nationally and internationally and provides healthy signs of continuing momentum. It is extremely encouraging that Macquarie University is committed to supporting aspects of this work into the future (i.e. through website hosting). Nevertheless, serious consideration needs to be given to the question of wide-scale embedding and sustainability at a national level. Cultural change of the kind and scale envisaged by the Fellowship is necessarily slow and requires facilitation and resourcing.

Processes and process deliverables

Resources and website

13. The Fellowship was effective in collecting a wide range of relevant resources and links and in making these available via a new website hosted at Macquarie University (<http://www.undergraduateresearchaustralia.com>). The website is well-developed, provides a detailed overview of the Fellowship itself, is easy to search, and provides appropriate attributions for all sources. Continued development of the resource-base, including the editorial work required to maintain quality, is assured in the short to medium term by Professor Brew. The paper-based manual (lodged at Macquarie's Teaching and Learning Centre) offers a resource for follow-up workshop events. Although it did not prove possible within the timescale of the Fellowship to trial the transferability-in-practice of resources across institutions, as originally intended, feedback on their value is encouraging. It would be useful, somewhat downstream of the Fellowship, to conduct an impact evaluation of the website resources in terms of uptake and repurposing.

Research report

14. It is anticipated that Evan Jewell's report on undergraduate research schemes in Australia will prove to be an especially important outcome of the Fellowship, serving to highlight much hitherto 'invisible' activity. It could be a useful spur for benchmarking across institutions and for more strategic and co-ordinated action at institutional level.

Regional roundtables and national summit

15. Roundtables and the summit proved to be successful strategies for stimulating awareness-raising, engagement and new lines of thinking among those who attended, as well as providing a mechanism to explore national needs and resulting in a collectively-developed Communiqué for wide distribution. The events attracted senior managers and institutional leaders although a number of universities were not represented and the summit did not attract representatives of all organisations targeted (including NH&MRC). It will be important to disseminate Fellowship reports to these universities and research organisations and to seek further follow-up.

Further activities

16. Profile-building and dissemination was a major focus of the Fellowship and the amount of activity (meetings, seminars, presentations etc) is impressive. Invitations extended to Professor Brew to speak at a wide range of institutions provide evidence of the topicality of the Fellowship internationally as well as nationally. An unanticipated aspect of the Fellowship was the level of institutional engagement at Macquarie and the ability to make strong connections with other institutional initiatives, with impact reflected in moves towards policy development based on the Fellowship's work.

Enabling factors

17. A number of factors emerged as especially important to the successful achievement of Fellowship deliverables, as follows: the excellent institutional support provided by Macquarie and specifically by its Learning and Teaching Centre staff; the opportunity to build a small, highly-motivated Fellowship team; the inclusion of an undergraduate researcher in the Fellowship; the study trip allowing comparison of international trends and leading to further insights and connections that have been disseminated; the large number of informal opportunities for engagement and dissemination in the form of conversations including those at Macquarie as well as across the wider sector.

Challenges and constraints

18. The Fellowship experienced some challenges and constraints. Much was achieved in one year but inevitably the timescale created pressures. For example, it was challenging to organise an international summit within 10 months. Achievement of some original objectives proved to be over-optimistic in the timescale and so adjustments were made.

19. It proved difficult to network across the teaching-research boundary; stronger links between ALTC and research bodies might have been helpful here and for future projects on this theme ALTC may be able to play a more proactive role in facilitating boundary-crossing in this respect.

20. The media communication strategy was only partly successful; while the Fellowship disseminated in a number of ways it was not taken up by the media to the extent hoped.

21. Support for ALTC was helpful in a range of areas; however some aspects of anticipated support from ALTC were not provided, including access to media, help setting up events, and communicating with stakeholders. Generic mailing lists often were out of date necessitating additional work by the Fellowship.

General points for consideration by ALTC

22. There is growing recognition of the different forms that 'staff-student partnership' in learning and teaching enhancement can take, and of the benefits of this approach. The involvement of an undergraduate student researcher in this program was consistent with its values and purposes, and was enormously successful in terms of contribution to its outcomes. It is suggested that this approach could serve as a model for other ALTC projects which incorporate an element of research.

23. Based on the experience of this Fellowship some suggestions are offered about ALTC resources/enablers that might be of general value for Fellowship projects: an induction pack with all generic information (up-to-date contacts, suggestions for where to hold events around the country); regular 'for attention' communications to PVCs drawing attention to up-coming project events; specialist assistance with media strategy and proactive networking especially in relation to policy-makers and media; a system of mentoring for new Fellows to ensure that practical knowledge about national change facilitation does not 'leak away' when projects finish; a 'period of residency' at ALTC as suggested but not in this case followed through; a source of funding to which Fellows (or others) could apply for specific follow-up work to projects, with embedding and sustainability in mind.

Conclusion

24. The Fellowship has made a very significant contribution to moving the undergraduate research agenda forward at a national level in Australia and to making the benefits of strong links between research and teaching better understood. A number of its change-facilitation strategies could serve as exemplars for similar Fellowships. However, a one-year project is necessarily limited in terms of what can be achieved. Given that the theme of undergraduate research and inquiry is expected to continue to grow in global significance, it will be important to capitalise on the Fellowship's achievements through further investment in support for development in this area.

Philippa Levy, 25 April 2011

Current situation

What is the current situation (at start of project)? Describe it and list the drivers for change.

Summary of current situation and drivers for change:

Research policy-makers and leaders/managers less engaged with UGR than teaching community

See also project proposal

Enabling Factors/Resources

What is needed to do the activities leading to the desired outcomes for the project?

People resources

Appropriate researcher expertise and administrative support.

Active national team and international team.

Impact evaluation support.

Logistical resources

Time, funding, appropriate meeting spaces, website creation etc.

Institutional and ALTC resources

Institutional support (Macquarie)

ALTC support

Stakeholder group analysis and engagement strategies

Academics, institutional and national policy-makers (R as well as L&T), students...

Identify appropriate communication and engagement approaches for different audiences (including research policy-makers and managers), students, academic staff etc.

Processes/Activities

What activities are required to achieve the desired outcomes for the project?

Consultation and Participation Activities

Conduct meetings and events designed to stimulate wide engagement, participation and input to project: Meetings; Roundtables; Summit...

Research Activities

Identify national needs relating to moving forward thinking, practice and policy on UGR.

Collect resources and protocols from relevant initiatives; repack and create new resources where appropriate.

Develop and make public a more holistic conceptual framework relating to UGR.

Capture 'process knowledge' on how to engage R, L & T communities with UGR issues.

Publicity and Dissemination Activities

Publicise project (press promotions; via networks etc).

Establish website; disseminate resources, protocols and other research and reflection outcomes to relevant stakeholder groups.

Reflection Activities

Reflect on, and document, AB's learning about a) UGR; b) how to engage different audiences about UGR.

Evaluation Activities

Establish project 'Theory of Change' and evaluation plan; conduct evaluation ;write key indicators.

Desired Outcomes

What will the outcomes of the project be for stakeholders?

Engagement Outcomes

Stakeholder groups' thinking and debates on UGR will have changed and developed (members of national team; members of national team's extended networks; managers and policy-makers at institutional and national levels; students).

Action Planning Outcomes

Plans for continued dissemination of project outcomes will have been established.

Foundation and, ideally, concrete plan for creation of national centre for the integration of research, learning and teaching will have been established.

Impact Evaluation Outcomes

The project's 'theory of change' will have been reviewed and the short-term impact of the project will have been assessed (including identification of unanticipated outcomes).

Longer-term impact

What long-term changes will your project achieve?

Summary of desired impact

Enhanced learning engagement of undergraduates (see also project plan)