Linking discipline-based research with teaching to benefit student learning

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“No issue is more basic in modern higher education than the relationship between research and teaching” (Clark, 1997: 241)

"Involving students in inquiry - in research - is a way of improving their learning, motivating them more. After all, what motivates large numbers of academics is engaging in the excitement of research. Bringing research and teaching together is a way of enhancing the motivation of both academics and students" (Brew, in Jenkins et al, 2003)

“There was a time not so long ago when the great faculty divide was between faculty who performed research and faculty who did not. Now, however, with most faculty engaged in research, the new line of demarcation is instead between faculty who engage students in their research and those who do not" (Malachowski, 2006)

Structure
1. Different ways of linking research and teaching
2. Linking research and teaching: different views
3. Disciplinary perspectives
4. Institutional perspectives
5. Conclusion

Table 1: Different ways of linking research and teaching

- The content of courses is informed by staff research
- Students learn about research methods
- Teaching methods adopt a research-based approach, such as through inquiry-based learning
- Students undertake their own research projects, whether individually or in teams, and not just as part of their end of degree dissertations
- They assist staff with their research projects
- Students gain experience of applied research / consultancy through work-based learning
- Staff undertake pedagogic research which benefits the quality of their teaching
Table 2: Linking research and teaching: Different views

“Our view is that university research often detracts from the quality of teaching. We regret the continuing elevation of research and the systematic neglect of the quality of instruction.” (Pocklington and Tupper 2002, 7 – about Canada)

“Courses taught by those at the cutting edge of research will necessarily be of higher quality than those taught by those merely using the research results of others – whatever the apparent quality of their style of delivery. … Furthermore, if teaching is undertaken by researchers the linkage is automatic, even if, as is often the case they are not always teaching about their own narrow research specialism.” (Lee 2004, 9 – with particular reference to geography in UK)

The New Zealand Education Amendment Act (1990) defines a university as where “teaching and research are closely interdependent and most of their teaching is done by people who are active in advancing knowledge.” (That policy was audited in the late 1990s but has since received less emphasis).

In Scholarship Reconsidered Ernest Boyer (1990, xii) challenged US higher education to “break away out of the tired old teaching versus research debate.”

“The (UK) Government is not seeking an artificial divide between teaching and research. … Lecturers need to keep up to date with their field through engagement in some form of advanced scholarly activity. But this need not necessarily be through participation in … leading-edge research.” (Department for Education and Skills 2003)

“HEFCE Board announced … additional funding to support teaching informed by research, for 2006-07 and 2007-08, to be allocated in inverse proportion to an institution’s research funding” (Letter to HEFCE-funded institutions, 6 Oct 2005) (ie c£25m over two years)

“Why does every University, thirty-eight of them, public ones, why do they all have to be doing research, teaching and scholarship and struggling to do it in so many areas? Why can't we have Universities that make a conscious decision to specialise in outstanding teaching and scholarship but do very little research? Why can't we have formal affiliations, one specialising in teaching and another research, between our domestic Universities?” (Brendan Nelson, Minister for Education, Science and Training, Australia, April 2005)

“We are all researchers now … Teaching and research are becoming ever more intimately related … In a 'knowledge society' all students – certainly all graduates – have to be researchers. Not only are they engaged in the production of knowledge; they must also be educated to cope with the risks and uncertainties generated by the advance of science” (Scott 2002, 13)

“I propose that colleges and universities provide an opportunity for all undergraduates to conduct research — to create knowledge” (Ellis, 2006; Professor of chemistry at the University of Wisconsin at Madison, on detail as director of the National Science Foundation’s chemistry division through June 2006).
CASE STUDIES OF LINKING DISCIPLINE-BASED RESEARCH AND TEACHING IN DISCIPLINES, INSTITUTIONS AND NATIONAL SYSTEMS

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These cases of disciplines, institutions and national systems that have intervened to bring teaching and research together are drawn from Australia, Canada, Denmark, Ireland, Hong Kong, New Zealand, United Kingdom and United States. They focus on links between teaching and disciplinary research. With a few exceptions they exclude initiatives that encourage research into teaching and learning - although this is a critical and important way in which research and teaching may be linked, it is distinct from links with discipline-based research. In discussing teaching research relations and analysing these case studies, it is important to start from a research-based understanding of what we mean by 'linking teaching and research'; and then use this understanding to consider whether these international case studies fit your particular context at discipline, institutional and national levels. The paper is organised under eight main headings:

1 Contexts, Transferability and a Framework
2 Linking Research and Teaching in Disciplines
   2.1 Biosciences and Chemistry
   2.2 Social Sciences
   2.3 Law
   2.4 Geography and Environmental Studies
   2.5 Earth Sciences
   2.6 Arts, Humanities and Design Disciplines
   2.7 Education and Philosophy
3 Linking Research and Teaching in a Range of Institutions
   3.1 Europe
   3.2 Australia
   3.3 New Zealand
   3.4 United States
   3.5 Canada
4 Sources and Bibliography

Annex 1: Institutional strategies to link teaching and research: a framework
1. Contexts and Transferability

The value of case studies largely lies in the specific ideas they present for adapting elsewhere. We recognise that the form of, and the possibilities for, teaching-research connections will vary between disciplines / departments, institutions and nations. However, the particular forms of teaching-research connections are transferable and adaptable to other contexts. So when looking at the case studies below also consider how innovations in particular disciplines, institutions and countries can be adapted to your context.

We have found the framework developed Griffiths (2004) effective in supporting staff/faculty to examine both their current courses and institutional policies and practices and in adapting innovations from elsewhere. According to Griffiths teaching can be:

- Research-led: where students learn about research findings, the curriculum content is dominated by faculty research interests, and information transmission is the main teaching mode;
- Research-oriented: where students learn about research processes, the curriculum emphasises as much the processes by which knowledge is produced as learning knowledge that has been achieved, and faculty try to engender a research ethos through their teaching; or
- Research-based: where students learn as researchers, the curriculum is largely designed around inquiry-based activities, and the division of roles between teacher and student is minimised.

![Fig 1 Curriculum design and the research-teaching nexus](source: Healey (2005))

Healey (2005) has expressed these differences diagrammatically using two axes (Fig 1). One classifies approaches to linking teaching and research according to the extent to which they are...
teacher-focused and students are treated as the audience or student-focused and treat students as participants, while the second axes classifies the approach as emphasising research content or research processes and problems. He identifies a fourth category 'research tutored' where students learn in small group discussions with a teacher about research findings.

Another useful framework for analysing discipline variation is provided by Biglan (1973) identifies different discipline types. He distinguishes between disciplines which are predominantly 'pure' and those which are predominantly 'applied' and those which are predominantly 'hard' or predominantly 'soft'. The latter refers to the dominant paradigmatic approach whether e.g. quantitative scientific or qualitative interpretative. The opportunities and ease with which research and teaching may be linked varies according to these discipline types. Some differences in students’ experiences by discipline are shown below.

### Students’ experiences of learning in a research environment

<table>
<thead>
<tr>
<th></th>
<th>Physics</th>
<th>Geography</th>
<th>English</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What is research?</strong></td>
<td>Breaking new ground; moving forward; exploration and discovery</td>
<td>Gathering information in the world; answering a question</td>
<td>Looking into; gathering; putting it together; a focus of interest</td>
</tr>
<tr>
<td><strong>How visible is it?</strong></td>
<td>Laboratories and machinery (ie tools) but often behind closed doors</td>
<td>Most visible in the field</td>
<td>Not tangibly visible but apparent in the dialogue</td>
</tr>
<tr>
<td><strong>Where is it located?</strong></td>
<td>Out there; at a higher level</td>
<td>Out there in the field</td>
<td>In the library; in the head</td>
</tr>
<tr>
<td><strong>Who does it?</strong></td>
<td>Lecturers</td>
<td>Lecturers and (increasingly over time) students</td>
<td>Lecturers and students</td>
</tr>
</tbody>
</table>

Source: Robertson and Blackler (2005). Based on interviews with 36 students (first years to postgraduates) at Canterbury University, NZ

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### 2 Linking Research and Teaching in Disciplines

#### 2.1 Biosciences and Chemistry

*Origin*: publishing undergraduate research in an extra-curricula house journal  
Dr Jac Potter, Chester College of Higher Education

The Department of Biological Sciences operates an undergraduate journal, called *Origin*, to publish research work completed by students. *Origin* was devised to offer a genuine experience of research publication to students in response to a perceived need as a significant proportion of students go on to further discipline-specific study or research when their degree is completed. Publication does not accrue academic credit. The benefits of publication to the student are considered to be the genuine experience of completing the full research cycle and the end product, a professionally produced article, which student authors can include with their curriculum vitae. Feedback from student authors also indicates that they gain a great deal of personal satisfaction and learn a great deal about scientific writing and the research and publication process.

Source: The Higher Education Academy Centre for Bioscience  
[http://www.bioscience.heacademy.ac.uk/projects/tdf/potter.htm](http://www.bioscience.heacademy.ac.uk/projects/tdf/potter.htm)
The Stanford Research Communication programme: a case study of better integrating research in the teaching environment
Carolyn Gale, Stanford University, USA

Many researchers have problems communicating their ideas to non-specialized audiences. When researchers cannot successfully communicate the purpose and significance of their research, the results are:

- Reduced exchange of new concepts, methods, and findings among academic disciplines and subdisciplines
- Lack of appreciation and knowledge by lay persons of the purposes and achievements of academic research
- Underutilization of research findings for policy- and decision-making

Individual researchers who are unable to clearly express their ideas in ways comprehensible to non-specialists experience problems during job-talks, when writing proposals or communicating with the media, and in other professional and personal situations. I-RITE and I-SPEAK (http://www.stanford.edu/group/i-rite/) provide faculty, postdoctoral scholars, and advanced graduate students with time-efficient, intense training in effectively communicating their ideas to a broader audience. Participants work on crafting a written statement that describes their research in understandable and compelling ways to high school seniors or university undergraduates.


Asking questions in plant biology at Australian National University

A practical exercise designed for a Level 2 course involves students: making observations in a botanical garden; coming up with 10 questions each (e.g. why do eucalypt leaves dangle?); sharing one of these questions with a group of other students; coming up as a group with hypotheses based on the question (e.g. Eucalypt trees in arid environments have leaves that dangle at steeper angles than those in wet environments); thinking of ways of testing the hypothesis(es); and writing up individually their 10 questions and one hypothesis as a 750 word mini-proposal for a research project.


At Cornell University (USA) all first year biologists have research experiences

The ‘Explorations Program’ introduces biology first-year undergraduates to research by Cornell staff, in the context of a course of 700-900 students. Large-scale funding has created 100-120 ‘experiences’, each of approximately 3-4 hours, for groups of 6-8 students. Most are designed to introduce students to the kinds of research problems on which the academic staff member works. Programmes take place both in research labs on campus and at field sites near campus. The programme is structured so that each student is required to participate in one ‘Exploration’ per semester.


At University College London chemistry undergraduates build on research of previous students

Chemists at UCL are involved in an ongoing pilot project aimed at a full integration of teaching and research at the undergraduate level. The chief innovation is the mechanism of inheritance: each year students receive a body of work produced by the previous group of students and make improvements and additions to it; this process can be repeated until publishable materials are
produced. This is part of a system of learning that enables students to function as a real and evolving community of researchers.

Source: Chang (2005)

At Leicester University biochemistry undergraduate students are helped to read research articles
Chris Wilmot, University of Leicester

The expectation that students in the latter stages of an honours degree will be keeping abreast of developments in a particular field of knowledge requires them to become conversant with research articles. Yet the content of such papers is frequently jargon-rich and impenetrable. In the department of Biochemistry at Leicester University some final third year modules are in effect journal reading clubs around particular research themes. Key components of the first year programme are explicitly structured to introduce them to reading and to writing as researchers. In particular as part of a year long scientific skills module (c70 students) a set of exercises has students first consider the structure of a scientific report and read and evaluate a given research paper. Subsequently, students are asked to imagine themselves as scientific investigators interested in a specific problem. In tutor-led group discussion, they design an experiment to investigate the problem and then individually write a report based on provided data.

Further details at:
http://www.bioscience.heacademy.ac.uk/journal/vol1/beej-1-10.htm
ftp://www.bioscience.heacademy.ac.uk/events/york05/willmott.pdf

2.2 Social Sciences

Inquiry-based learning introductory course for social sciences has a significant impact on students subsequent performance at McMaster University, Canada

McMaster University has been running a first year course for social sciences based on inquiry (Inquiry 1SS3) since the late 1990s. This case study discusses this award-winning course as it evolved over the first five years (see Justice et al. 2002; in press a), since then other instructors have taken on the course and is taught to reflect their interests. It was typically taught in sections of no more than twenty-five students assigned to an instructor. All of the sections had the same curriculum, reading material, process of assessment, and goals that were outlined in a detailed compendium. The classes met for twelve three-hour concurrent sessions. Class time consisted of a combination of exercises and tasks for building the students’ critical abilities and time for students to share ideas about their individual inquiries with other students. Much of class time involved groups of four or five students assisting each other in such things as clarifying understandings or planning research strategies.

All students investigated aspects of a broad social science theme, such as ‘self identity’ and addressed a common inquiry question, such as: ‘Why do images of ethnicity, race, gender, sexuality, age, class, or abilities help to create aspects of personal and community identity?’ Students had to propose their own inquiry question, such as: ‘Why do some children apparently become violent after watching violent cartoons while others seem to be unaffected?’ They had to justify why the question was important in relation to existing literature. They then investigated the question through a process which involved developing and testing hypotheses using secondary sources. The course emphasized the development of skills, including critical reading and thinking,
independent and collaborative learning, information searching and evaluation, analysis and synthesis, oral and written communication, and self and peer evaluation.

Analysis of five years of data (Justice et al. in press b), comparing students who took the Inquiry course with comparable students who did not, shows that it has had a significant impact on how well students perform during their academic careers. The findings allow for initial differences between the two samples. Taking the Inquiry course is associated with statistically significant positive differences in obtaining passing grades, achieving Honours, staying on the Dean's honour list, and remaining in university.

Current research is investigating in what way(s) Inquiry 1SS3 students changed that might explain their long-term enhanced performance at university. A quasi-experimental study (Justice et al., 2005) compares a randomly selected group of 54 students who took Inquiry 1SS3 in their first semester with 71 comparable students who did not. The research goes beyond self-reports of learning and directly measures abilities and performance. Though not yet published, it seems taking Inquiry 1SS3 is associated with meaningfully higher scores in actual performance tests of many intellectual and academic skills and that often the magnitude and significance of the difference between groups is comparable to that between upper- and lower-level students (~2 years of university).

Sources: See Justice et al. (2002, 2005, in press a and b)
http://socserv2.mcmaster.ca/Inquiry/CourseOutline.htm
http://www.socsci.mcmaster.ca/socsci_inquiry.cfm

A guide for Undergraduate dissertations in Sociology, Anthropology, Politics, Social Policy, Social Work and Criminology

This web-resource was prepared to provide support and guidance for students writing dissertations in the social sciences, but it offers useful guidance for any students carrying out research. It deals with some of the common questions, concerns and practical issues that undergraduate students face when planning a piece of social research – such as research design, ethics, access, and writing styles. The resource also provides some useful information for academic staff who are supervising undergraduate dissertations. It provides case studies of dissertation supervision issues and examples of the students’ experiences of completing a project and it is hoped that this ‘student voice’ will be especially valuable for the 'new' supervisor.

The content for the site was written by academic and support staff who have a particular interest in this area and have a great deal of experience in supervising undergraduate dissertations in the fields of sociology, anthropology, politics, criminology, social policy and social work. They have not produced this resource with the aim of providing a set of definitive answers; instead they recognise that there are many ways in which the 'journey' through the process can be completed. The notes included here draw on the experiences of dissertation supervisors, academic research into the student and staff experiences of study and supervision, and examples of good practice.

Contact Malcolm Todd m.j.todd@shu.ac.uk
www.socscidiss.bham.ac.uk/s1.html
Using undergraduates to evaluate student experiences of teaching and learning (Sociology: University of Warwick)

In this project, second and third year Sociology students led an evaluation of their peer’s experiences of teaching and learning. Students were asked to design a short research proposal, and the winning applications – judged according to criteria of both feasibility and innovation - were given a bursary by staff to put the proposals into practice. Five undergraduate students were chosen to lead the project, and they used a variety of social research methods – including focus groups, interviews and participant observation – to explore the learning experiences of their peers. The results were widely discussed within the department, and at a department away-day, and have led to students being more involved in academic debates.

In a second stage of the project, a number of staff designed new course modules which sought to create a ‘pedagogic space’ that transferred some of the responsibilities for content and learning outcomes to the students. The student researchers interviewed the staff about their experiences of running the modules. The courses aimed to give students more control over the forms and outcomes of their learning. However, this ideal was sometimes limited by the time and commitment of students willing to contribute to the blogs and web-spaces envisaged as part of this more decentred process of learning.

There is no doubt that the organization of this project brought direct benefits to project team members. Students working on the project as student researchers have greatly enhanced their research, political, inter-personal and communication skills. Staff members have developed greater expertise in working with students as co-producers of knowledge. In this regard, the aim of integrating responsibilities for teaching and research is evidenced in the conduct of the project itself.

Project led by Dr Christina Hughes. Christina.Hughes@warwick.ac.uk
www.c-sap.bham.ac.uk/resources/project_reports/findings/ShowFinding.asp?id=139

2.3 Law

Research on a prescribed case study LLB module, School of Law, University of Birmingham

Building on modules studied at stages 1 and 2, seminars examine the nature of legal scholarship and methods for designing a research project. Working with primary and secondary material arising from a case study of a multi-faceted legal, social and political episode, each student then:

- devises a project design
- receives formative peer assessment on the project design
- provides formative peer assessment to another student’s design

Each student individually carries out their research project and writes an essay and reflective account of the process by which the project was formulated and an assessment of the extent to which the project has met its objectives. Each student is expected to work independently with a high degree of learner autonomy. In the final phase of the project, students are required to work collaboratively as a team to devise a strategy for disseminating some or all of their research output during the module in a format appropriate for a non-academic audience (for example policy makers in government, members of the general public or a professional group). The group produces a document explaining the strategy and may annex to it any actual or proposed output (for example a briefing document, letter to the press, draft article for a magazine or newspaper, plans for a website etc).
Students participate in a research project on Criminal Justice linked to staff interests at Australian National University

Students at ANU have the opportunity to participate in a research project based on current research being conducted by members of the Faculty of Law, the Australian Institute of Criminology and Research School of Social Science. **Criminal Justice** is an advanced law elective which critically examines the principal institutions, processes and legal rules relating to the administration of criminal justice. The iLearning project is an assessable option that allows students to devise a research projects which have both academic value and practical outcomes.

2.4 Geography and Environmental Studies

Geography students at Glasgow Caledonian University submit reviews for publication made available to the local community

Practising Geography, the second year undergraduate Human Geography module, offers individual students the option of submitting coursework in the form of a briefing paper based on a small-scale, fieldwork-based research project that they themselves have designed and executed. On completion of the module, students can then elect to have their paper refereed by an independent expert (generally a local resident from the field locality or a member of one of the Royal Scottish Geographical Society’s Regional Centres). Publication on the project website is conditional on an acceptable referee’s report.

Source: McKendrick *et al.* (2003) [http://www.gees.ac.uk/linktr/McKendrick1.htm](http://www.gees.ac.uk/linktr/McKendrick1.htm)

Geography students at University College London interview staff about their research

All year one students to do an assignment in term one, in which students interview a member of staff about their research.

- Each first year tutorial group is allocated a member of staff who is not their tutor.
- Tutorial groups are given by that member of staff three pieces of writing which are representative of their work, their CV and arrange a date for the interview.
- Before the interview students read these materials and develop an interview schedule.
- On the basis of their reading and the interview, each student individually writes a 1,500 word report on a) the objectives of the interviewee's research; b) how that research relates to their earlier studies c) *how the interviewee’s research relates to his or her teaching*, other interests and geography as a whole (emphasis added).

Source: Dwyer (2001)

Students across all three years of an environmental studies degree course at Sunderland University work together on local sustainability projects

Students on an Environmental Studies degree at the University of Sunderland undertake local sustainability projects, which brings levels 1, 2 and 3 students together in small research groups to work in collaboration with Sunderland City Council's Local Agenda 21 personnel, and other local environment and development agencies.

Source: Hughes *et al.* (2001)
Centre for Active Learning (CeAL) in Geography, Environment and Related Disciplines
University of Gloucestershire, A HEFCE funded CETL

The Centre for Active Learning (CeAL) will be an international centre of excellence reviewing, developing, promoting and embedding inclusive and exemplary active learning for students in geography, environment and related disciplines, including landscape architecture, community development and heritage management. It will build on our nationally and internationally-recognised record of excellence in active learning. Active learning focuses on inquiry in the field, studio, laboratory and classroom using real sites, community-related and employer-linked activities. More than simply 'learning by doing', our approach enables students to construct theoretical understanding through reflection on practical activities. It is particularly effective with the School’s diverse student body, including disabled students, mature students and distance learners. CeAL will be developed around communities of active learners where students and staff inquire together. A key innovative feature is joint student projects with related Schools in the University, and initially thirteen HEIs in England and ten universities overseas. The Centre will make important contributions to the development of evidence-based active learning practices, including through research undertaken by Graduate Teaching Assistants registered for part-time pedagogic research degrees. The University of Gloucestershire is committed to pursuing active learning across all undergraduate/postgraduate curricula, with CeAL as the laboratory for innovation, experimentation and evaluation.

2.5 Earth Sciences

Using independent, investigative learning in environmental geology

The assignment is run as part of a Level 3 (Honours Year) full credit module entitled 'Environmental Geology' The approach uses 3-stage individual mini-projects where students are allocated a specific environmental geophysics problem and required to design a solution, interpret field data and present their findings in technical report and verbal format. Each student is given an environmental problem and is put into the scenario of being a consultant recruited to address this problem for a client. The client is either the local authority or a private land owner. Either way, the client demands a professional approach and prompt, concisely-presented results. The assignment is in three parts:

(a) Desk study.

Students, after receiving their mini-project brief, have three weeks to conduct appropriate research and produce a 500 word report (plus diagrams) detailing their proposed strategy for addressing their problem. They are given the following headings to guide report preparation:
- Project objectives;
- Proposed geophysical survey plan (technique(s) and field layout);
- Logistics (costs, staffing etc.) of the field survey (bearing in mind the constraints given in the brief);
- Data requirements from the field workers.

During this stage, four hours are timetabled in the module for research and consultancy with tutor. Students are informed that they have a maximum of five minutes per consultancy session and must have specific questions to ask, indicating that they have performed some preliminary research before coming to the tutor. "What techniques should I use?" or "How do I start this?" are not valid questions!

(b) Data interpretation & final report

Students are given their datasets, along with marked desk study reports and feedback sheets. Note that if a student makes an inappropriate request for data in their desk study, they are informed of
this but still given the correct data set. There is no cumulative penalty for this mistake. Students have a further 2 weeks (including 2 timetabled hours) to interpret their data and produce and submit a full technical report to the client. Again, guidance is given on the required report structure.  

(c) Open meeting presentation

Students are required to prepare and deliver a solo presentation to an open public meeting (20 minute session, including 5 minutes for fielding questions) describing their problem outline, methodology, data interpretation and recommendations. The audience includes Councillors (soon up for re-election) and members of the lay public (staff members and other students) who have a vested interest in the environmental issues of each project. A disruptive group of 'eco-warriors' (usually noisy postgraduate students…type casting at its best!!) also makes an appearance! During their presentations, students must show appropriate local and environmental considerations and effective handling of heckling from concerned local residences and the 'eco-warrior' group.


Do-It-Yourself (DIY) Interactive Multimedia (IMM) - Student groupwork assignments based on analysis of current (Geoscience) discipline journal article analyses

This DIYIMM project at the University of Adelaide is an exercise in knowledge engineering that has been used in a final year undergraduate structural geology course continually since 1996. In that year a simple student research assignment essay, comprising 25% of the marks for the course, was replaced by the DIYIMM exercise. The exercise was also changed to a group learning exercise, with groups of 2 or 3 students working jointly and collaboratively on development of the multimedia assignment and on the seminar. Students are given an introductory and explanatory contact lesson describing the aims, objectives, tools and methods, together with a short hands-on practical class on how to use the available multimedia authoring system (eg Hyperstudio) and how to access the array of digital resources which might be needed to carry out the assignment.

The exercise clearly provides a close link to the teaching of structural geology in this course and the most current research being carried out in the discipline. Students not only have to read and understand one international journal article (which is now available on line before even the hard copy journal arrives in the library), but they must also search through the bibliography of that article for a number of relevant papers. They must interrogate and summarise not only the text, but also become familiar with the figures, diagrams, plates, tables and these days often simulations and animations which may be available on the author's website.

One very important key to the research/teaching link is when the students have to devise a question to the author(s) and to email that question. Receiving a reply (which does not always happen), is most exciting to the students and is a critical point in the realisation that the author is a real person and is carrying out their research usually in a similar institution (University). Authors generally reply positively to the questions (it at least shows that someone is reading and interested? in their own research), and occasionally a general dialogue occurs. The exercise has now been running continuously for eight years and has been carried out by about 400 students. This has left a legacy of about 150 IMM modules providing interesting summaries of much of the last eight years of cutting edge research in structural geology.

Source: James (2003)
Digital Structural Mapping of the Moine Thrust foreland at Loch Assynt, Scotland: Introduction of a 3D visualization system into a Level 2 field trip

This exercise from the University of Durham develops student appreciation of research and brings data/findings from staff research into the curriculum.

Digital structural mapping (DSM) methods involve the acquisition of field data on hand-held computers operating Geographical Information Systems (GIS) software. By connecting to a GPS receiver, geospatial control on observations is automatically provided. With technology advancing rapidly, driven by applications in the engineering, construction and environmental monitoring industries, digital field mapping systems are now becoming affordable and can attain equivalent or better positional performance than is routinely achieved by traditional methods (compass clinometer, etc). For the field geologist there are a number of obvious advantages. Powerful multi-attribute mapping and high-resolution spatial analysis can be carried out during fieldwork. The ability to view and analyze data collected at each stage allows an iterative approach to be taken to field problem solving. Data may be directly imported to 3-D visualization, analysis and 4-D modeling packages, which can provide further constraints on the viability of the interpretation. Digital formats ensure that the 'field to report' process is more streamlined.

We have recognised that during mapping training, some students have less developed 3-D spatial awareness than others. It is essential that geologists can build up a 3-D mental picture of their surroundings in order to solve geometrical problems commonly confronted in the field. This ability is very difficult to teach in the laboratory and it consistently remains an aspect of fieldcraft that students either ‘get’ immediately or struggle with for long periods of time. In order to aid those students who have difficulty with their 3-D visualization, we have developed a series of computer models which allow the students to view the sites they where at during the preceding day, to see a virtual 3-D representation of the geology and its larger-scale context. They can then use this visualization to reinforce and enhance their own observations, interpretations and mental picture of the geology.

The 3-D model was progressively revealed to students in conjunction with their own mapping of the area, on a laptop available during their evenings work periods. They were able to rotate the model; fly around their virtual mapping area and zoom in to places they have been, allowing them to revisit their observations and interpretations. The students were directed by staff to think about the geometry of the major structures and how this results in the observed rock outcrop patterns. The students could also see how their small piece of work fits into the larger picture of the geology of NW Scotland.


2.6 Arts, Humanities and Design Disciplines

Arts of Citizenship Program at the University of Michigan

In this program students combine learning and research with practical projects that enhance community life. Each year Arts of Citizenship directly sponsor eight to twelve projects, and we award grants for another eight to twelve projects. Our community partners have included Mosaic Youth Theatre of Detroit, the African American Cultural and Historical Museum of Washtenaw County, Michigan Radio, the City of Ann Arbor, the Ann Arbor District Library, Heritage Battle Creek, Detroit’s Matrix Theatre Company, the Arab Community Center for Economic and Social
Services in Dearborn, and public schools in Ann Arbor, Ypsilanti, and Detroit. Our projects in the arts, the humanities, and design are wide-ranging:

- Students on Site is our major collaboration with the Ann Arbor and Ypsilanti Public Schools. Through field trips, hands-on classroom work, and an online archive, third- and fourth-graders learn to investigate the history of their communities. See the website at www.artsofcitizenship.umich.edu/sos.
- Another K-12 project is Telling It, which features afterschool literacy playshops for homeless children in Washtenaw County. UM students devise multi-arts activities that stimulate writing projects by the children.
- In the Underground Railroad project, Arts of Citizenship has collaborated with the African American Cultural and Historical Museum of Washtenaw County to research nineteenth-century antislavery activism and African American community life in the area. We’ve displayed our youth-oriented historical exhibit, Midnight Journey, to over 20,000 people at schools, libraries, and museums in Michigan and Ontario.
- The Broadway Park Design project (a collaboration with the Ann Arbor Department of Parks and Recreation) proposes designs for public art, public history, and cultural amenities in this historic park on the Huron riverfront. Our website on Broadway Park is at www.artsofcitizenship.umich.edu/broadway.
- Partnering with Detroit’s Mosaic Youth Theatre, Arts of Citizenship teams used oral history and archival research to help create 2001 Hastings Street, a nationally touring musical drama about coming of age in 1940s Detroit. The production and an accompanying exhibit were part of the celebration of the Detroit’s three hundredth anniversary in 2001.
- The Homelands project, with Matrix Theatre of Detroit, produced an original dramatic piece, Homelands, set in the Michigan Central Railroad Depot. The play and its lobby exhibit of historic photos debuted in spring 2002, and UM faculty have produced a multimedia sourcebook as a guide for other groups.
- In partnership with UM’s School of Art and Design, UM students in Arts of Citizenship’s Detroit Connections serve as mentors for afterschool art workshops in Detroit elementary schools. By using art to reinforce math and science concepts, this project aims to improve overall educational outcomes. See www.umich.edu/~janiep for photos of the children.
- Arts of Citizenship has collaborated with Michigan Radio on a series of student-created radio documentaries, including award-winning pieces on the 1967 Detroit riots and on Arab-American youth. The latter has a companion website at www.artsofcitizenship.umich.edu/listen. Plans are underway for additional documentaries on citizenship, youth, and diversity.
- In west Michigan, we’re cosponsoring the Heritage Battle Creek Field School each summer, to train community historians in researching African American local history of the twentieth century with a goal of creating museum exhibits.


History students in British Columbia contribute research findings to a Web site

In 2002, John Lutz implemented History 481: Micro History and the Internet, a learner-centred and research-oriented course in which the main activity was primary archival research on various aspects of life in Victoria, British Columbia from 1843 to 1900. Students worked in small groups to conduct the research and eventually to publish their findings on the website called “Victoria’s Victoria”. John reports that "The feedback I get often says, that if they remember only one course from university, this (course) will be it ... some alumni contact me to say that the web skills have
landed them a job.” John notes that the grades in Micro History 481 were approximately 8% higher that the grades that these same students received in other senior history courses that they take from him.


The MA in Shakespeare Studies: Text and Playhouse run jointly by the English Department at King’s College, University of London and the Globe Theatre

The aim of this initiative is to indicate the integral nature of the links between research and teaching through this very practical example. The Text and Playhouse MA concentrates on Shakespeare’s dramatic texts, and the manner of their performance in the Globe theatre. This MA is heavily informed by two forms of scholarly research, textual studies and performance practice. The students are encouraged to conduct their own primary research using the resources of the Globe theatre. Similarly the lecturers at Kings, who are involved in this programme, have taken the opportunity to test their own textual theories on the Globe stage. Both Professor Ann Thompson and Dr. Gordon McMullan, who run the course for King’s, have used elements of the performance aspects of the course in editing editions of the New Arden Shakespeare. This programme is not unique in its partnership with a theatre company, but is distinctive in that the theatre company has employed a full-time academic (Dr Gabriel Egan) partly to run the course.

Source: English Subject Centre Linking teaching and research http://www.english.ltsn.ac.uk/explore/resources/linking/index.php

Introducing enquiry-based teaching methods in literary studies

The traditional form of Literary Studies teaching in HE is tutor-centred. In this case study a group of second year students studying Eighteenth Century Literature are introduced to enquiry-based learning in the first week of the first semester. The course consists of a weekly lecture and a weekly seminar. The latter consists of 15 students who are divided into three groups of five sitting round a small round table. During the seminars the tutor acts as a task-giver and thereafter as both an information resource, responding to student requests and as a facilitator moving from sub-group to sub-group helping discussion to develop where needed. For example, in week 1 the students were given a poem by Samuel Johnson, ‘On the death of Dr Robert Levet’. The poem was issued to students without annotations or supporting detailed biographical information. Each sub-group were asked to address two questions: ‘What kind of language does the poem use?’ and ‘What belief system, if any, does the poem imply?’ Most groups responded to this task actively by exploring and considering the possibilities from a range of perspectives, establishing and pooling any existing knowledge base and assessing its applicability to the task in hand. By emphasising the need to seek other sources to contextualise their answers the facilitator began to establish the research element crucial to moving from ‘problem solving’ to something more active.

2.7 Education and Philosophy

**Students in pre-service teacher education for university lecturers at Otago, New Zealand undertake ‘authentic enquiry’ using portfolios**

Students used portfolios to provide space for ‘authentic enquiry’ that focused on student self-determination and the process, rather than the outcomes, of learning. The rationale behind the portfolio involved reflections on practice as the curriculum developed during the research cycle. Initially, portfolios were evaluated formatively during supervisory meetings and each student decided what part of their portfolio should remain private and what the tutor might read and comment on. In the second phase of development, formative judgements about work were no longer made and portfolios became private documents. Challenges for student teachers were associated with the novelty of the experience, the time taken for reflection to develop and the individualistic nature of the task. This presents challenges for the supervisor centred on new methods of supervision and trying to live up to the explicit values that informed the curriculum.

*Source: Harland (2005)*

**Learning to think like a philosopher: developing students’ research skills in a history of philosophy course, University of Leeds, UK**

One aim of most degree courses, at least if they are in a single discipline, is to help students think like, for example, historians, chemists, or planners. Traditionally in philosophy this is attempted by ‘sitting at the feet’ of experienced philosophers and ploughing through long reading lists. Research into philosophy is seen as something largely reserved for postgraduate study. At the University of Leeds, George MacDonald Ross has developed a more active approach in a final year module, which engages his students directly with a philosophical text – Kant’s *Critique of Pure Reason* – and helps them develop key research skills.

He teaches the course by running interactive seminars, rather than lectures, at which students are forbidden to take notes, except for a secretary, who posts minutes on a website within 24 hours. This has the advantage that students focus more on discussion during seminars, and that they treat the minutes as secondary literature, rather than their own intellectual property to be used without acknowledgment. Most of the time is spent discussing the interpretation of key passages projected on a screen. However, most of the students’ learning time is taken up by reading the text in conjunction with George’s running commentary; preparing short answers to interpretative questions, some of which will form the basis of the following seminar; and writing essays. Researching and writing essays is a small-scale version of what historians of philosophy do as researchers, and it is central to the module. Apart from one final essay, students write three two-page essays during the year. They are given the assessment criteria (presentation, referencing, accuracy, clarity, argumentation, independence, other strengths and weaknesses) before hand and have to self-assess their attempt against them. He does not put the mark on the essay, instead he tells them to guess the mark in the light of his comments, and sign up for a 15-minute individual tutorial at which he reveals the mark, and advises them on how to improve their performance next time.

George has also attempted, though so far with only limited success, to establish ‘buddy groups’ to mimic the informal networking found in research communities. This means trying to shift a culture of competition in assessment to one of co-operation in research. He has also been given a grant by his university to devise multiple-choice questions (MCQs) which will develop the ability of students to consider reasons for and against different possible interpretations of key texts, and for and against the validity of the ideas and arguments as so interpreted. They won’t be told whether they
are right or wrong, but they will be forced to think argumentatively about the text they are reading; and the change in activity from mere reading and note-taking to active engagement with an MCQ should improve their motivation. More importantly, the sort of thinking they will be engaged in will be precisely the sort of thinking that is characteristic of the mature historian of philosophy.

Source: Based on a draft case study by George MacDonald Ross, January 2006. The final version will be available on The Higher Education Academy’s Subject Centre for Philosophical and Religious Studies http://www.prs.heacademy.ac.uk/

3. Linking Research and Teaching in a Range of Institutions

3.1 Europe

The University of Warwick Undergraduate Research Scholarship Scheme (URSS)
http://www2.warwick.ac.uk/services/cap/curriculum/rbl/urss/
http://www2.warwick.ac.uk/fac/soc/pais/currentstudents/urss/
This scheme, based on US experience, enables some 10-15 second-year students per year to take part in independent research guided by staff. A limited number of bursaries are available for students to carry these out either full-time during the vacation or part-time during term or vacation. This scheme will now be significantly expanded and become a significant feature of Reinvention Centre for Undergraduate Research at the Universities of Warwick and Oxford Brookes (see 2.3). See also Imperial College http://www.imperial.ac.uk/urop/ and MIT case study below.

Southampton Solent University: Advanced scholarship strategy
(http://www.solent.ac.uk/sihandbook/Personnel/default.asp?level1id=3713&level2id=4799&level3id=4808)
In 2000 the institution had a special meeting of its then two totally separate committees for teaching and research. The meeting was solely concerned with teaching-research relations at the institution. A ‘full and frank discussion’ ensued, but from it emerged greater understanding of the issues and the development of a set of ‘horizontal strategies’ at institutional and faculty levels to bring teaching, research and scholarship together, including the Advanced Scholarship Strategy. This requires and supports all staff to be involved in work that directly focuses their scholarly and research time on scholarship supporting student learning. Such work varies by disciplinary groups across the institution, but has to result in a visible output in the public domain, carry peer esteem and contain an aspect of originality (Brown, 2003).

University of Sunderland: An integrated strategy

In 2004 the University of Sunderland introduced a single integrated academic strategy for teaching, research and reach-out activities. It followed a year’s debate within the institution. Its implementation is supported by an action plan which includes institution-wide personal development actions.

The Strategy states that the aim of the integration agenda is “to provide an academic environment which encourages and draws together research, learning and teaching and reach-out in order to
underpin high quality academic provision” (University of Sunderland: Academic Strategy 2004/05 – 2009/10 ‘Enabling, Enhancing and Supporting our Learning Community’, 2004, p. 3). All three facets are the responsibility of the Deputy Vice Chancellor.

The implementation has included new reward processes and changes in university structure and processes. For example, a restructuring of central services has brought together the previously separate Graduate Research School and Industry Centre to give fully integrated research and reach-out support. Teaching and learning as yet remains separate. As for promotion of academic staff the revised process “requires applicants to evidence appropriate levels of attainment in each of research, teaching and reach-out and their integration. Conferment of Professorial title for example is made on the basis of outstanding achievement in any of research, teaching or reach-out but also demands demonstration of particular required levels of attainment in each of the other 2 facets” (Brown, 2005, p.3). Integration helps academic staff to “avoid the destructive competition” (p.1) that can occur when the different facets are viewed separately. However, reporting to the Funding Council still has to be separate.

Source: Brown (2005)

University of Roskilde (Denmark): Half of the work of all students is spent undertaking projects
(www.ruc.dk/ruc_en/about/)
At least 50% of student time in the assessed curriculum in five years from BA to MA is taught through project work. The projects involve students working in groups guided by staff. ‘Problem-orientated project work ... [is] participant directed indicating that it is the group members that collectively ... take the responsibility for the project. ... The result is a body of knowledge owned for the most part by the students that produced it and not borrowed from the teachers who taught it’ (Legge, 1997, p.5). The first two years are interdisciplinary group projects, later projects tend to be within one discipline and sometimes may be undertaken individually.

3.2 Australia

Australian National University: Introduction to Inquiry
The University aims to ensure that ALL their undergraduate students are introduced to inquiry learning from the beginning of their program of study. An inquiry-based approach to learning involves students directing their learning by formulating questions, defining problems and investigating issues relevant to their future roles as researchers and professionals. Examples are presented from courses on The Big Questions in Physics; Human Biology; Resources, Environment and Society; Money, Power, War; Science and Public Awareness; and Introduction to Psychology. The site also includes two examples of inquiry-based learning in more advanced courses.

Monash University and University of Sydney: Teaching and Research Nexus Benchmarking Project
In 2004 a benchmarking process based investigation between these two research-intensive universities concluded: “The teaching-research nexus is clearly identified in strategic plans in both universities, but both could benefit from a more integrated approach. The nexus is also reflected in
Learning and Teaching Plans, but does not necessarily cascade into all plans.” The aim of the Benchmarking project was to analyse methods of implementing the teaching-research nexus, and compare performance in nominated areas. A six-stage process was developed:

- establishing the partnership;
- setting the framework (areas of comparison and matrix);
- securing a Memorandum of Understanding between the two institutions;
- applying the framework;
- benchmarking, self evaluating; and
- generating recommendations.

The investigation involved senior staff working in their respective institutions with a limited cross over membership steering the cross institution process. While performance indicators were developed and used in this study, the central view was that the key value of benchmarking was examining and improving policies and processes within the two institutions. The ‘other institution’ and what was seen internationally as ‘best practice’ in effectively linking teaching and research, served as mirrors to examine and to improve each institution’s practices and policies.

Dr Jennifer Weir Centre for Higher Education Quality, Monash University (now at Murdoch University)

Dr Angela Brew, Institute for Learning and Teaching, University of Sydney

University of Sydney: Strategic use of performance indicators to stimulate linkage (http://www.itl.usyd.edu.au/rt/usydproject/performance.htm)

The purpose of the Performance indicators is to provide a mechanism for auditing progress towards reaching the university’s strategic goals for strengthening the relationship between teaching and research, and to encourage the development of research-enhanced teaching.

Key criteria for judging research-led teaching:

- Student awareness of and active engagement with research
- Academic staff capacity to integrate research and teaching
- Curriculum designed to engage students in a variety of research-based activities, induct them into the research community and develop their awareness of research
- Departmental encouragement for aligning research and teaching
- Faculty support and encouragement for strengthening the nexus between research and teaching
- College recognition and support for the development of the links between research and teaching
- University commitment to the development of strong relationships between teaching and research

These key criteria derive from the scholarly literature on research-led teaching. The indicators are designed to focus on aspects that can be demonstrated and that would clearly distinguish good practice in research-led teaching. The table shows indicators of these criteria, and whose responsibility it would be for gathering and providing the information. It also suggests indicative audit requirements.

Examples of performance indicators

- Student awareness of and active engagement with research
- Undergraduate and postgraduate student awareness of the research culture of the university and the research being done in their school/department/faculty
- Academic staff capacity to integrate research and teaching
- Proportion of senior and active researchers engaged in first and second year undergraduate teaching
- Proportion of teaching staff with PhD or research record
Curriculum designed to engage students in a variety of research-based activities, induct them into the research community and develop their awareness of research
• Proportion of units where students engage in research-based activities
• Research and scholarship on teaching and learning is demonstrably used in designing new curricula and monitored by Academic Board Committees
• Departmental encouragement for aligning research and teaching
• Proportion of disciplinary research-active staff and pedagogically research-active staff vis à vis total staff numbers
• Existence of an advertised student research seminar program or evidence of engagement of undergraduate students in departmental seminars
• Faculty support and encouragement for strengthening the nexus between research and teaching
• The links between research and teaching are explicitly encouraged in Faculty Strategic Plans
• The existence of funding allocated to pedagogical research grants
• College recognition and support for the development of the links between research and teaching
• Strategic plans refer to the links between teaching and research
• University commitment to the development of strong relationships between teaching and research
• University Strategic Plan explicitly states that the links are important
• Appointment, promotion, probation and tenure criteria all explicitly require the teaching/research link to be addressed
• The University’s teaching evaluation and quality assurance and enhancement processes are research-based
• Teaching, Learning and Assessment Policies and Research Policies stress the importance of linking teaching and research
• Audit of research-led teaching carried out on a triennial basis and benchmarked with other Universities

A selection of these measures is then used in determining an element of a department’s budget; thus better ensuring implementation (Brew and Prosser, 2003).

3.3 New Zealand

University of Victoria, Wellington
(http://www.utdc.vuw.ac.nz/excellence/awards2005/)
Teaching Awards are ‘awarded to applicants who demonstrate excellence in integrating their academic research effectively in their teaching, engaging undergraduate students in research, and or carrying out research on teaching and learning in their disciplines’ (Angelo and Azmar, 2005).

Auckland University of Technology: Excellence in Teaching and Research Awards
(http://www.aut.ac.nz/staff/office_of_the_vice-chancellor/awards.htm)
These are intended to recognise and reward excellence in both teaching and research, recognising the dynamic interaction of the teaching/research nexus. The Academic Audit process highlights the need for universities to demonstrate the interactive nature of the teaching/research nexus, and in fact this element represents one of the key categories for quality audit. Having such an award will encourage AUT staff to reflect on and enact this link.
3.4 United States

Massachusetts Institute of Technology: Undergraduate Research Opportunities Program
(http://mit.edu/urop/)
The Undergraduate Research Opportunities Program (UROP) supports research partnerships between MIT undergraduates and academic staff. Formed in 1969, it is one of the earliest such programmes. “UROP projects take place during the academic year, as well as over the summer, and research can be done in any academic department or interdisciplinary laboratory. Projects can last for an entire semester, and many continue for a year or more. UROP students receive academic credit, pay, or work on a voluntary basis.” MIT is now working with the department of engineering at Cambridge University (UK) to develop an undergraduate research programme there (http://www.cambridge-mit.org/cgi-bin/default.pl?SID=6&SSSID=495&NewsID=161; http://www.eng.cam.ac.uk/teaching/urops/). MIT conducts an audit of UROP participation among graduating seniors each year. For the class of 2004, 82 per cent of graduating seniors had participated in UROP at least once during their undergraduate careers (personal communication, 2005).

Hampshire College: Linking research and teaching is key element of the college’s mission
(http://www.hampshire.edu/flash/index.php)
Hampshire is a small private liberal arts US college focused on self-initiated, individual research programs of study negotiated by students with academic staff. More specifically:

**Beginning and Division 1 Requirements**: ‘Students must formulate substantive questions on a range of specific subjects and then reflect critically on the implications of the analytical frameworks and methods they used in pursuing the questions’ (Prince and Kelly, 1997, p.7).

**Division 2 Requirements**: ‘Working with at least two or three faculty, students … define a substantive area of study and then specify key questions that will serve as general guides through the concentration… In the second step … the student designs a program of study, including … independent study’ (ibid., p.8).

**Division Three and Capstone Requirements**: This is ‘primarily devoted to a … thesis or artistic project’ (ibid., p.9).

Southern Illinois University: Paul Simon Award
http://www.siue.edu/ORP/FACFUND/psa.html
The Paul Simon Outstanding Scholar award is presented to an SIUE faculty member in order to recognize the role of research and creative activities in excellence in teaching. The Award confirms SIUE's belief that an individual must be a good scholar to be a good teacher. A plaque and a $5,000 award, routed through the payroll system, is presented to the honoree. The Simon Award will not be given automatically each year; it will only be awarded when a nominee of superior merit is selected. Only one Award will be given annually. The Simon Awardee will be expected to make a presentation for graduate students and faculty about integrating research into teaching activities during the Graduate School Research Symposium.

3.5 Canada

University of British Columbia: University-wide research-based learning experience
TREK 2000, 2010 and the University Academic Plan state undergraduate students who choose to attend UBC should have the opportunity to benefit from attending a major research institution. Every student should have the opportunity to engage in research and experience the excitement of discovery should they desire. In order to support this type of learning experience, the Undergraduate Research Committee out of the VP Research Office developed the Multidisciplinary Undergraduate Research Program (MURP) in 2004. Supported by a Teaching and Learning Enhancement Fund Grant (TLEF), MURP’s goal is to develop a cohesive undergraduate research program at UBC that will support the enhancement of research experiences for our undergraduate students.

Undergraduate students are selected from all possible disciplines to participate in this novel and exciting program. Students who participate have the opportunity to develop skills to support a research project they are involved in within their discipline (be it through directed studies, honours programs, volunteer work or research assistantships). In this way, we hope to bring together the wide variety of research avenues students can take part in, demystify the research process, and helping students to get the most out of their research experience.

University of Alberta: Institution-Wide Project ‘Research Makes Sense to Students’ (http://www.uofaweb.ualberta.ca/researchandstudents/)
The University of Alberta has introduced a "Research Makes Sense for Students" initiative under the Office of the VP (Research). Some of the activities undertaken through this initiative have been an ‘Integrating Teaching and Research Awareness Week’ aimed at faculty and graduate students, promotion of undergraduate research linked to the student orientation week organised in conjunction with the Student Guild, a university-wide environmental scan of teaching-research linkages, and specific policy and funding proposals to strengthen teaching / research connections.

McMaster University: Inquiry-based courses available across the curriculum (http://www.mcmaster.ca/cll/inquiry/index.htm)
The University has a tradition of innovative problem-based learning in medicine and engineering. In 1998 it launched an initiative to develop an inquiry-based approach across the whole curriculum, starting initially in selected courses in years one and two. “Inquiry courses are skill-driven rather than content-driven, focusing on the skills required to perform effectively at university and well beyond university. These generalizable skills help students hone skills equally useful for advanced levels of academic research.” This is supported through the teaching development unit and through programme leadership responsibilities for senior staff. Teaching is done in teams of generally research active, tenure stream staff, with a three-year rotation, reflecting the commitment needed to teach such courses, but also better ensuring that the skills of inquiry teaching are disseminated across the university.

Some 20% of students in year one and two take at least one inquiry-based course and the research evidence is that such students generally achieve well in subsequent courses. The institution is now faced with the challenge of scaling this innovation across the whole institution or keeping it for those students who select these perhaps more demanding courses (Elliot, 2005; Sutherland, 2005).

University of Toronto: Awards for Linking Teaching and Research
(http://www.alumni.utoronto.ca/events/awards/frye.htm)
The Northrop Frye Awards are co-sponsored by the University of Toronto Alumni Association and
the provost of the university. Annually one individual faculty member and one department or
division are recognized with the award for demonstrating exemplary and innovative ways of linking
teaching and research.

McMaster University: Petro-Canada Young Innovator Award
http://www.mcmaster.ca/cll/awards.and.recognition/petro.canada/index.htm
The Petro-Canada Young Innovator Award is a program that provides the opportunity for McMaster
to build on this connection and engage undergraduates in faculty research to deliver greater
benefits for undergraduate education. Campus-wide recognition for innovative research
achievement by a young faculty member. $25,000 support for a candidate designed project to
make this research accessible to undergraduate students. Under normal circumstances, the project
needs to be completed in the year following receipt of the Award.

University of Calgary: Student inquiry strategy
(http://commons.ucalgary.ca/inquiry/; http://www.communitiesofinquiry.com/sub/coi_model.html)
The University has an institutional strategy that sees student inquiry as ‘core to a research-intensive
university’. The e-learning strategy has been reshaped to directly support student inquiry with a
focus on developing ‘communities of inquiry’ using computer conferencing.

Malaspina University-College: Building design to link research and teaching
(http://research.mala.bc.ca/centers/index.asp?document=ScienceCtr)
The institution is in the initial stages for planning for a new Integrated Science Centre. This
provides the Faculty of Science and Technology with the opportunity to link research and teaching
into the design of the facilities. Students will take specific courses with a strong research
component, often requiring extended use of laboratory spaces instead of the traditional three-hour
classroom sessions. New lab spaces will be designed to accommodate this. Faculty research areas
will be places where students will engage in research with their teachers using an apprenticeship
model combined with problem-based teaching. The new building will also contain many spaces
where students can work in groups, with each other and with academic staff, on research projects,
both inside and outside the laboratories.

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http://www.uofaweb.ualberta.ca/researchandstudents/nav03.cfm?nav03=37560&nav02=37557&nav01=32191


Hong Kong University Grants Committee Research Assessment Exercises


http://www.heacademy.ac.uk/profdev/case_study6.pdf

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http://www.gees.ac.uk/projtheme/linktr/James.htm


http://www.heacademy.ac.uk/resources.asp?process=full_record&section=generic&id=585


http://www.qaa.ac.uk/academicinfrastructure/benchmark/honours/english.pdf
http://www.uofaweb.ualberta.ca/researchandstudents/nav03.cfm?nav03=37560&nav02=37557&nav01=32191


University of Alberta (2005) Canadian Summit on the Integration of Teaching and Research, 3-5 August http://www.ualberta.ca/summit


4.2 Further reading

For those requiring shortish executive summaries of many of the arguments about linking teaching and research see particularly: Brown (2003; 2004); Healey and Jenkins (2005); Hoddinott and Wuetherick (2006); Jenkins (2004c); Rameley (2004); Scott (2002); and Woodhouse (2001). The single most comprehensive text on the teaching-research nexus is Jenkins et al. (2003).

For over 200 references and a list of useful Web sites see: Healey, M Linking Research and Teaching: A selected bibliography http://www.glos.ac.uk/ceal/resources/litreview.cfm.


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### 4.3 Useful web sites

Canadian Summit on the Integration of Teaching and Research http://www.ualberta.ca/summit

Council on Undergraduate Research (CUR) http://www.cur.org/

FDTL Project LINK http://www.brookes.ac.uk/schools/planning/LTRC/index.html

Higher Education Academy http://www.heacademy.ac.uk

Research and Scholarship

http://www.heacademy.ac.uk/resources.asp?section=generic&process=filter_fields&type=all&id=20&history=

Subject Network http://www.heacademy.ac.uk/474.htm; covers every subject in 24 centres

Linking research and teaching http://www.heacademy.ac.uk/850.htm

Higher Education Funding Council for England Centres for Excellence in Teaching and Learning http://www.hefce.ac.uk/cefl

Hong Kong University Grants Committee Research Assessment Exercises http://www.ugc.edu.hk/eng/ugc/publication/prog/rae/rae.htm

Linking Teaching and Research in the Disciplines http://www.brookes.ac.uk/genericlink/ (though a little dated now there are a wealth of resources on this site including a section on Canadian Web sites)

McMaster University Centre for Leadership in Learning, Inquiry-based learning resources www.mcmaster.ca/cll/inquiry/inquiry.resources.htm


Reinvention Center at Stony Brook, New York http://www.sunysb.edu/Reinventioncenter/index.html

University of Gloucestershire Centre for Active Learning in Geography, Environment and Related Disciplines (CeAL) http://www.glos.ac.uk/ceal

University of New South Wales Research-Teaching Nexus http://www.ltu.unsw.edu.au/ref6_research_teaching.cfm
University of Sydney, Institute for Teaching and Learning, Research-led teaching and the scholarship of teaching http://www.itl.usyd.edu.au/RLT/
UREKA (Undergraduate Research Experience & Knowledge Award)
http://www.sfi.ie/content/print_friendly.asp?section_id=448&language_id=1
Annex 1: Institutional strategies to link teaching and research: a framework

Developing institutional awareness and institutional mission
Strategy 1: State linking teaching and research as central to the institutional mission and formulate strategies and plans to support the nexus
Strategy 2: Make it the mission and deliver it
Strategy 3: Organise events, research studies and publications to raise institutional awareness
Strategy 4: Develop institutional conceptions and strategies to effect teaching-research links
Strategy 5: Explain and involve students and parents in your institutional conception of teaching-research relations

Developing pedagogy and curricula to support the nexus
Strategy 6: Develop and audit teaching policies and practices and implement strategies to strengthen the teaching-research nexus
Strategy 7: Use strategic and operational planning and institutional audit to strengthen the nexus
Strategy 8: Develop curriculum requirements
Strategy 9: Review the timetable
Strategy 10: Develop special programmes and structures

Developing research policies and strategies to support the nexus
Strategy 11: Develop and audit research policies and implement strategies to strengthen the teaching-research nexus
Strategy 12: Ensure links between research centres and the curriculum and between student learning and staff scholarship

Developing staff and university structures to support the nexus
Strategy 13: Ensure the nexus is central to policies on inducting and developing new staff and for strategies to support the professional development of established staff
Strategy 14: Ensure teaching-research links are central to policies on promotion and reward
Strategy 15: Ensure effective synergies between units, committees and structures for teaching and research
Strategy 16: Link with related university strategies
Strategy 17: Participate in national programmes
Strategy 18: Support implementation at department level

Other strategies you consider appropriate

Source: Jenkins and Healey (2005)