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# Engaging students in research and inquiry

## Mick Healey

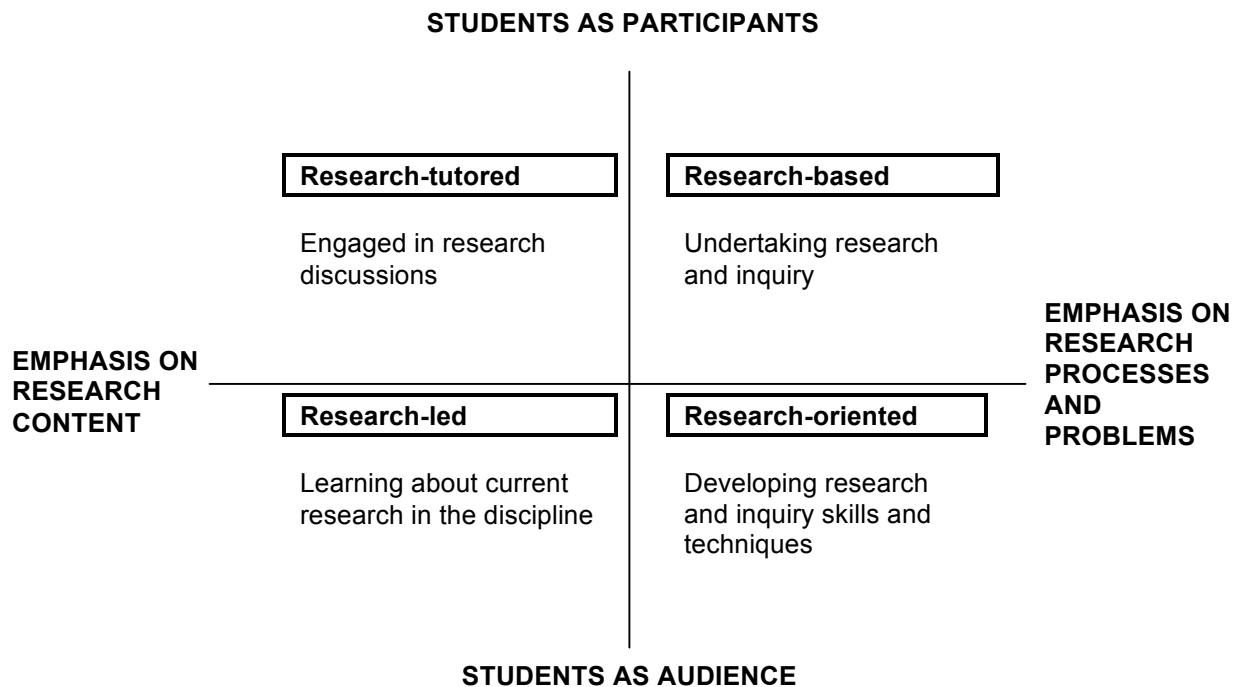
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The material in this handout has been developed over several years with Alan Jenkins, Professor Emeritus, Oxford Brookes University, UK; [alanjenkins@brookes.ac.uk](mailto:alanjenkins@brookes.ac.uk). Further and more detailed case studies, including institutional and national examples, references and a list of useful web sites may be found at: [www.mickhealey.co.uk/resources](http://www.mickhealey.co.uk/resources). Several of the following case studies are taken from Healey and Jenkins (2009) and Healey *et al.* (2013).

We have found the framework developed by 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:

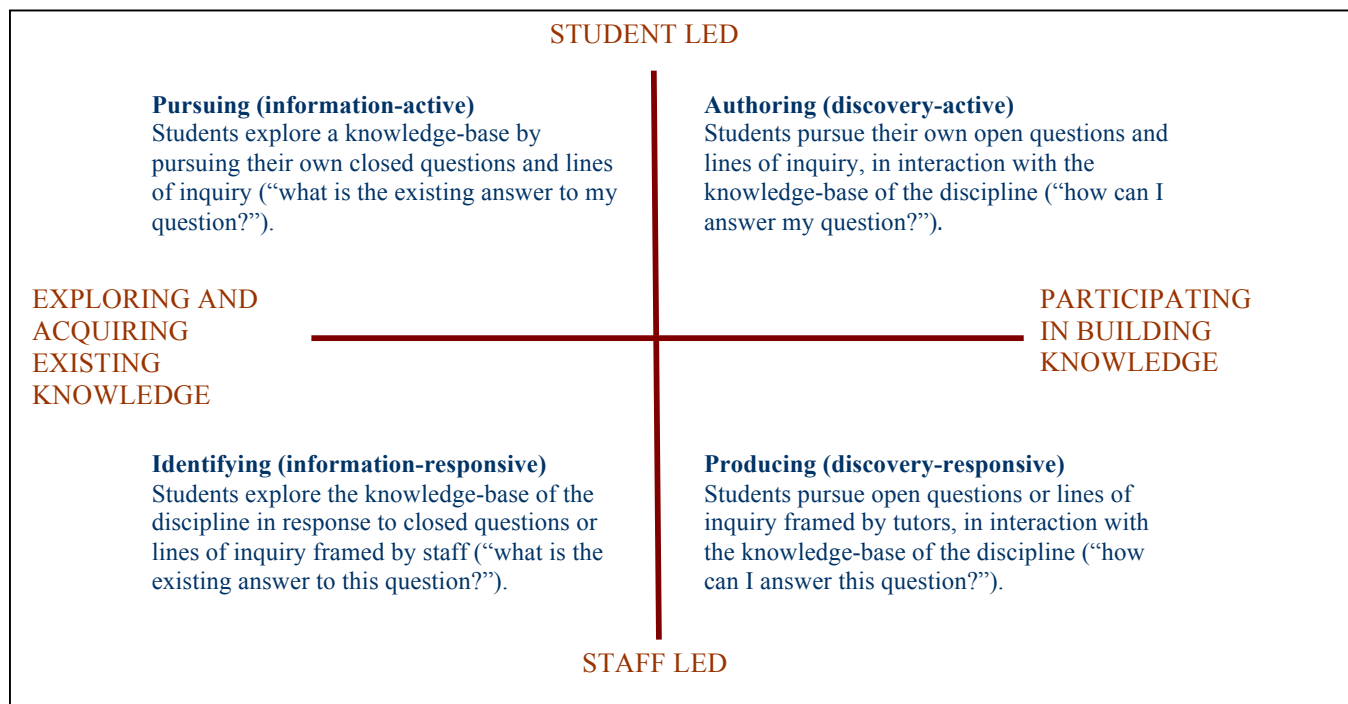
- **Research-led:** where students learn about research findings, the curriculum content is dominated by faculty research interests, and information transmission is the main teaching mode;
- **Research-oriented:** where students learn about research processes, the curriculum emphasises as much the processes 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 and Jenkins (2009, 7), based on Healey (2005, 70)

Fig 2 Inquiry-based learning: a conceptual framework



Based on Levy (2009)

**Table 1. Learning configurations**

Form	Linkages between	Titles
Duos	Research and Education	Research-based education (RBE); Research-based learning (RBL)
	Work and Education	Work integrated learning (WIL); Work-based learning (WBL)
	Community and Education	Community-based learning (WBL)
Trios	Research, Work and Education	Professional Learning Environments (PLEs)
	Research, Community and Education	Community Learning Environments (CLEs)
Quads	Research, Work, Community and Education	Professional and Community Learning Environments (PCLEs)

**Table 2 Engaging students in Boyer’s four scholarships**

Types of scholarship	Illustrative example of ways of engaging learners
Scholarship of discovery	Engage in inquiry-based learning; undergraduate research and consultancy projects; co-research projects with staff.
Scholarship of integration	Engage in integrating material from different sources, including across disciplines; integrate life and work experience with academic studies; reflect on implications of studies for personal development.
Scholarship of application/engagement	Engage with local, national, and international community service projects; volunteering; knowledge exchange projects; apply knowledge and skills in work-based placements.
Scholarship of teaching and learning	Engage in mentoring; peer support and assessment; collaborative group work; learners as explicit partners in educational development and inquiry.

Fig 3. Students as partners in learning and teaching in higher education: An overview model



Source: Healey, M., Flint, A. and Harrington, K. (2014) *Engagement through partnership: students as partners in learning and teaching in higher education*. York: Higher Education Academy based on p.25. © The Higher Education Academy. All rights reserved.

# 1 Strategies for engaging students with research in disciplines

Here we use the four categories shown in Figure 1 as a framework for structuring the case studies. Each way of linking research and teaching is associated with a different way of engaging students with research:

- research-led: *learning about current research in the discipline*;
- research-oriented: *developing research skills and techniques*;
- research-based: *undertaking research and inquiry*; and
- research-tutored: *engaging in research discussions*.

Despite the extent to which students are participants being one of the dimensions of the model, the examples explored in this paper are primarily active and exciting experiences. Hence most belong in the top half of the model.

## 1.1 Research-led: learning about current research in the discipline

Students can be engaged with current research in the discipline in a variety of ways, including through lectures, academic staff-led seminars, laboratories and course work. The examples below focus on strategies that clearly put students in active mode as they encounter current research in their subject.

### **Biochemistry undergraduate students are helped to read research articles at the University of Leicester, UK**

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 initially impenetrable. In the Department of Biochemistry at the University of Leicester 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 a set of exercises has the 70 or so 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 information: Wilmott et al. (2003)*

### **Introducing students to academic staff research: Department of Geography, University College London (UCL), and Department of Mechanical Engineering, Imperial College London, UK**

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

- Each first year tutorial group is allocated a member of academic staff who is not their tutor.
- Tutorial groups are given three representative pieces of writing by the member of staff along with a copy of their CV, and a date is arranged 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; and c) how the interviewee's research relates to his or her teaching, other interests and geography as a whole.

In the first-year Mechanical Engineering course at Imperial College London in the 1990s:

- Engineering students were divided into 10 to 15 groups of four to five students in the January;
- each student group was given an engineering 'artefact', e.g. a safety razor; the bottom frame of a bicycle. In the next few weeks these student groups could knock on the doors of any of the department's research groups or

academic staff, and ask questions around the issue of ‘what research are you doing that might effect how this artefact will look like and function in about five years time?’;

- later all student groups presented a poster that provided a summary of their findings;
- the poster session was held in large public space in the department with some 700 attending; academic staff, support staff, postgraduates and first-year and other students.

*Further information:* Dwyer (2001)

### **Research emphasis days in Veterinary Medicine at the University of Edinburgh, UK and the University of Florida, US**

Each year the School of Veterinary Studies at the University of Edinburgh organises a ‘Research Emphasis Day’ where local researchers present current work to students of all years in a conference style format. In addition the School invites speakers from a variety of potential research employers to an event called VetChoice where students from any year are invited to learn about research opportunities for veterinary undergraduates and graduates. These range from talking about research opportunities within the Veterinary School to opportunities outside the School. The University of Florida College of Veterinary Medicine organises a similar event.

*Further information:* Struthers *et al.* (2008); <http://www.link.vet.ed.ac.uk/internal/red.htm>  
<http://www.wlcastleman.com/ufvetmed/phizeta07/index.htm>

### **1.2 Research-oriented: developing research skills and techniques**

Assisting undergraduates to develop research skills and techniques is a key aspect of the intellectual journey of students as they develop as researchers. It is rather worrying though, that in one study only between a quarter and a third of final-year students at both research-intensive and less research-intensive institutions report that they feel have developed these skills, despite most of them having undertaken compulsory courses in research techniques (Turner *et al.*, 2008). Course lectures, practical and laboratory classes and course work are common modes of teaching in which research skills and techniques are particularly emphasised. The examples that follow illustrate other ways in which they may be developed.

### **First year students pose questions through observation in biology at ANU, Canberra, Australia**

In groups of 12–20 students, students conduct this exercise while walking through the nearby Australian National Botanic Gardens with a demonstrator (TA) as part of the 350 student introductory class on Evolution, Ecology and Genetics. The exercise takes 2 to 3 hours, plus some time to write up afterwards. It gives first year students the liberty to start thinking like scientists, to stimulate their curiosity and to get them talking to their peers. Students are taken for a short walk through the gardens and encouraged to observe their surroundings. They then are sent off ‘solo’ for ~30 minutes to write down 10 questions (e.g. Why do eucalyptus leaves dangle?). Each student then reads one or more of their questions to the group and together the students and tutor restate the question as a hypothesis (e.g. eucalypt trees in arid environments have leaves that dangle at steeper angles than those in wet environments) and design an experiment to test that hypothesis. The exercise builds confidence and comfort with the experimental process, demonstrates what makes a ‘good hypothesis’, and begins to get students thinking about elements of experimental design.

*Further information:* Adrienne Nicotra ([adrienne.nicotra@anu.edu.au](mailto:adrienne.nicotra@anu.edu.au));

[http://biology.anu.edu.au/adrienne\\_nicotra/](http://biology.anu.edu.au/adrienne_nicotra/)

### **A guide for undergraduate dissertations in Sociology, Anthropology, Politics, Social Policy, Social Work and Criminology at Sheffield Hallam University, UK**

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 the 'student voice' should be especially valuable for new supervisors.

*Further information:* [www.socscidiss.bham.ac.uk/s1.html](http://www.socscidiss.bham.ac.uk/s1.html); Todd *et al.* (2004)

### **Embedding inquiry-based learning in a skills module concerned with sustainability at the University of Gloucestershire, UK**

'Skills 4 Sustainability' is a first-year course in which skills for inquiry-based learning is embedded in a module on sustainability. The module is delivered from weeks 1 to 12 of the first semester by a team of eight tutors to about 150 students with no formal lectures. Students are organised into tutor groups according to their subject specialism. Students inquire into and develop a proposal for improving the sustainability of the University, which they must research and present as a group. The students are prepared for their inquiry-based project by different activities in the preceding weeks. The best proposal from each tutor group goes forward to the *Green Dragons' Den* for consideration by an expert panel comprising the University Vice-Chancellor, the Director of Institute for Sustainability and a local business manager. Half the module marks are given for the creation of an individual e-portfolio, built up throughout the module, which requires students to reflect on sustainability issues, their own position and action they might take to improve their own sustainability, both environmentally and as a learner.

*Further information:* Swansborough *et al.* (2007)

### **Auditing and developing student research skills at the University of Adelaide, Australia and the University of Reading, UK**

Selected departments at the Universities of Adelaide and Reading have systematically audited department-based undergraduate and postgraduate programmes for the extent to which they develop student research 'skills'. The University of Adelaide has developed both a conceptual framework on student research development and based on this, a diagnostic tool to support interventions to strengthen student research skill development in courses. Thus two consecutive first-year courses in Medical Science have adapted their assessment tasks explicitly and systematically to develop student research skills in accordance with the Research Skill Development (RSD) framework. A broadened application of the framework is being trialled, including with laboratory-based and numeracy-rich research, as well as with other disciplines and departments, including Petroleum Engineering, Nursing and English.

The framework is publicly available for other institutions to adapt. Within departments methods to collect data on undergraduates' research skills teaching and learning can be time-consuming and ineffective. At the University of Reading a related electronic 'research skills audit tool' has been developed for academic staff to map systematically research skills teaching and assessment within their own modules.

*Further information:* Willison and O'Regan (2006, 2007); Fraser *et al.* (2007)

### **1.3 Research-based: undertaking research and inquiry**

Probably the most obvious way for undergraduate students to engage in research is to undertake final-year dissertation or capstone research and inquiry projects. In the examples below we look at other ways in which students may be involved in research projects from the first year onwards, both within the curriculum and outside it. We also give examples of ways that the outcomes of these research projects may be celebrated.

### **Introducing inquiry-based teaching methods in Literary Studies at University of Manchester, UK**

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 inquiry-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 divided into three groups. 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 subgroup to subgroup helping discussion to develop. 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 subgroup was 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 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 nuanced.

*Further information:* Hutchings and O'Rourke (2003)

### **Science undergraduates build on research of previous students at University College London, UK**

Students on a course on the History of Science 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. First developed in a final third-year course, the "course will now be open to second years which will enable interested students to continue their work as part of their dissertation, and to strengthen the diachronic community by having the previous year's students present when the next cohort take the course" (Chang 2007, 21).

*Further information:* Chang (2005, 2007); Chang and Jackson (2007); Ambrosio and Jackson (2011); <http://www.ucl.ac.uk/sts/study/hpsc/3007>

### **History students contribute research findings to a website at the University of Victoria, Canada**

In 2002, John Lutz taught, for the first time, History 481: Micro History and the Internet, a learner-centred and research-oriented subject in which the main activity was primary archival research on various aspects of life in Victoria, British Columbia from 1843 to 1900. Initial subject activities include orientation to the historical archives in Victoria and basic web-site creation skills. Students work in small groups on a research project and the final research 'product' of the subject is a web site, not a standard research paper. The subject has been developed with the support of local community groups and another university. It is one of the international innovative examples of digital history where the web is used as a research tool, a means of disseminating research and developing student web skills.

*Further information:* <http://www.victoriasvictoria.ca/>; [http://en.wikipedia.org/wiki/Digital\\_history](http://en.wikipedia.org/wiki/Digital_history); <http://web.uvic.ca/~jlutz/courses/hist481/index.html>

#### **1.4 Research-tutored: engaging in research discussions**

Engaging in discussion is a key way to develop understanding. Traditionally in higher education this takes place through staff-led academic tutorials and seminars. Here we consider other ways in which undergraduates may engage with research through discussion.

### **Involving first-year English students in the international research community at University of Gloucestershire, UK**

At the University of Gloucestershire, Arran Stibbe allows students to take on the identity of a researcher from the start of their time at university. In the *EZ102 Language & Ecology* module the students have an opportunity to share their insights with the wider research community. The research community in turn has something to gain from student contributions because students can critically analyse aspects of their language and culture that others have

yet to examine. The students are encouraged to take part in the international research community through working with the *Language & Ecology Research Forum* – the main international forum for research in ecolinguistics. The Forum links together a network of scholars, has an online journal, a range of resources and a dedicated section for the *EZ102* module. The approach works best when students are becoming critically aware of texts that they are familiar with, rather than struggling to understand new genres understood better by the lecturer than by the students.

*Further information:* [www.ecoling.net/courses.html](http://www.ecoling.net/courses.html);  
[resources.glos.ac.uk/ceal/resources/casestudiesactivelearning/activelearningcasestudies/index.cfm](http://resources.glos.ac.uk/ceal/resources/casestudiesactivelearning/activelearningcasestudies/index.cfm)

### **Student group work assignments based on analysis of current Geoscience discipline journal article analyses at the University of Adelaide, Australia**

This Do-It-Yourself (DIY) Interactive Multimedia (IMM) project is an exercise in knowledge engineering that has been used in a final-year undergraduate Structural Geology course since 1996. Two or three students work collaboratively on the development of a multimedia-based analysis of one international journal article, interrogate and summarise the text, but also become familiar with the figures, diagrams, plates, tables and these days often simulations and animations that 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. Authors generally reply positively to the questions 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.

*Further information:* James (2003)

### **Students across all three years of an Environmental Studies degree course worked together on local sustainability projects at the University of Sunderland, UK**

Students on an Environmental Studies degree at the University of Sunderland undertook local sustainability projects, which brought 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.

*Further information:* Hughes *et al.* (2001)

This framework provides a useful way to talk about the nature of undergraduate research and inquiry in different disciplines, because it is inclusive of different pedagogies for engaging students. Some individuals, course teams, departments and even whole institutions have used the framework to audit their practice to see if they have, what they consider in their context to be, an appropriate balance of activities.

## **2: Engaging students in research and inquiry at the beginning of their academic studies**

### **2.1 Undergraduate research at the University of Gloucestershire, UK begins at induction**

In 2007, over 650 students in the Faculty of Education, Humanities and Science undertook discipline-based inquiry projects during induction week. This involved them working in small groups to collect information from the library and in the field, analyse it, present it to tutors in novel ways and receive formative feedback. For example, the human geographers and the sociologists researched the experience of Gloucester residents of 'the Great Flood of 2007'. The biologists and the psychologists investigated primate behaviour at Bristol Zoo. Other faculties in the University are developing their own versions of undergraduate research as part of induction. It has also proved a significant staff development activity both for the many academic tutors involved in designing inquiry-led activities and for the library staff who changed their approach to library induction to support the specific student research projects.

*Further information* <http://insight.glos.ac.uk/tli/resources/toolkit/wal/sustainable/Documents/Induction.pdf>



## **2.2 Inquiry-based learning introductory course for Social Sciences had 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 since the late 1990s. It is typically taught in groups of no more than 25 students assigned to an instructor, who are subdivided into groups of four or five students. All of the groups have the same curriculum, reading material, process of assessment and goals that are outlined in a detailed compendium. The classes meet for 12 three-hour concurrent sessions. Class time consists 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. Students investigate aspects of a broad social science theme, such as 'self-identity', and address 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 have 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 have to justify why the question was important in relation to existing literature. They then investigate the question through a process that involves developing and testing hypotheses using secondary sources. There is strong research evidence of the positive impact of this inquiry course on the subsequent performances of students at McMaster University.

### *Further information*

Justice *et al.* (2002, 2007a, 2007b, 2009); [socserv2.mcmaster.ca/Inquiry/CourseOutline.htm](http://socserv2.mcmaster.ca/Inquiry/CourseOutline.htm); For more recent versions of the course see: [http://www.youtube.com/watch?v=i9idE\\_uClpc](http://www.youtube.com/watch?v=i9idE_uClpc); [http://cte.uwaterloo.ca/research\\_on\\_teaching\\_and\\_learning/TBRG/OND/2011/Presentations/Vine.pdf](http://cte.uwaterloo.ca/research_on_teaching_and_learning/TBRG/OND/2011/Presentations/Vine.pdf)

## **2.3 Introduction to writing research and contemporary cultures at Miami University, Ohio, US**

Students in the first-year core course in 'Writing and Cultures' investigate how the forms of writing, and the methodologies for researching writing and culture, are being transformed through web-based communication. Through this reading and writing intensive seminar, students investigate how digitised technologies are transforming the forms of writing and communication. The course culminates in a group assignment where students, using secondary and primary sources, investigate an aspect of contemporary culture (e.g. dating, shopping) and how the forms of communication are being reshaped by the internet. They produce a multimodal website that includes text, digital images, audio and video. The course fulfils institutional requirements for the liberal education goal of critical thinking.

### *Further information*

[www.users.muohio.edu/mckeeha/h101-09](http://www.users.muohio.edu/mckeeha/h101-09); [www.users.muohio.edu/mckeeha/h101-09/final\\_project.html](http://www.users.muohio.edu/mckeeha/h101-09/final_project.html);

## **2.4 Linking first and second-year assessment strategies through researching the need for a local sports development project in a work based learning module at West Herts College, UK**

In the second semester of year one Foundation Degree in Sport Studies (FDSS) students develop a project proposal focused on researching the need for a local sports development project. Students complete a project proposal form which is then presented to a panel for assessment.

In year two students are encouraged to approach employers with their year one sports development project proposals, to fulfil the requirements of their double semester work-based learning (WBL) module. On average seven out of ten students use this opportunity with others seeking projects linked with marketing and management. Within WBL, students are required to network with employers to find a niche in the employers' market. Students develop, implement, analyse and reflect on their implemented project proposals and this forms the basis for a 5,000 word mini final project.

The nature of the inquiry-based project in year one enables learners to thoroughly research and investigate their potential projects prior to implementation in year two, clearly showing study progression and academic skill development. Examples include: a proposal to increase female sports participation which resulted in a cricket enrichment programme at a local secondary school for year eight female pupils and an employment opportunity for

the FDSS student; a proposal to increase Sikh community sports opportunities which resulted in a varied sports enrichment programme at a local primary school within a Sikh community.

### **2.5 Sitting in the 'hot seat': supporting students on foundation degrees to read critically at East Durham College, UK**

This initiative began in years one and two of two Foundation Degrees (Early Years and later Education and Care) at East Durham College, a college franchise with the University of Sunderland. To help the students make the transition to higher-level reading we adapted the approach of Ginnis (2001) where the teacher sits in the 'hot seat' of the classroom and students interrogate the teacher about their reading and understanding of an academic text. They now model on a single occasion, the original strategy of Ginnis and in subsequent weeks reverse the strategy by asking students to seek out, and locate literature of their choice, week-by-week, reducing the level of guidance and enabling them to gain increasing independence, and autonomy in learning. When in class, they are asked to take a two to five minute slot, actively participating by being on the 'hot seat'. When seated, they begin to share their critique of literature, they isolate key themes and dominant ideas, attempt to make sense of what is written and not written explicitly. This is shared in class with their peers and lecturer.

### **2.6 Library staff support students to find key information and explore research questions at the University of Sunderland**

University of Sunderland library staff collaborated with a college lecturer at Bishop Auckland College, a franchise college, to pilot two online workshops with foundation degree students taking courses in Education and Health and Health and Social Care. Using Vyew – the online collaborative web conferencing tool – online rooms were created to embed problem-based activities which would align with the curriculum. The features of Vyew encourage active learning and participation by providing an interactive whiteboard, editing tools, instant chat and virtual sticky notes which can be used to provide instant feedback. The rooms remained available following the live session for reference and to promote further learning.

The first workshop focused on in-depth exploration of research topics and finding relevant information sources. Three activities were designed, the first of which used a mind-mapping tool to help identify keywords and themes in chosen topics. The second activity involved the identification of appropriate tools to find sources and then searching for literature in four key areas of theory, professional practice, academic research and legislation/policy. The focus of the second workshop was on how the information sources could be effectively used in assignments. Initial feedback has led to adoption of the workshops for the 2013-14 academic year by all partnership FECs who run one of the two programmes.

### **2.7 Developing a research orientation in undergraduate creative arts in the Bachelor of Illustration at Northern Melbourne Institute of TAFE, Australia**

Two large mural projects have been introduced in the first year of the three-year program to establish a 'research sensibility'. These projects provide industry-based opportunities for first-year students to research and engage in an enterprise that has a clearly defined product at completion. The initial investigative research aims to encourage exploration and broad enquiry, through the use of the library to develop information and academic literacies through the creation of relevant reference lists, bibliographies as well as accessing and compiling community resources relevant to the particular project.

During the early phase of the research there are factors for consideration that may involve the specific communities living within the intended locations of the artwork. In the mural projects example, the students' investigative research directed their attention to the need to become aware of sensitive cultural, political and religious requirements for appropriate imagery for public display within a diverse ethnic mix.

## 2.8 1,000 biology students are involved in research at University of Sydney, Australia

First year Biology students at the University of Sydney contribute to the understanding of the prevalence of asthma in Sydney. Each student learns to pour an agar plate which they take home and expose in their back yard over a 10 minute period, to collect a sample of airborne fungal spores in the atmosphere. There are 1000 students in the class and they live all over the Sydney metropolitan area. Once the fungi collected have grown into colonies, students learn to use a key to identify the fungi, and the class results are converted into maps showing the distribution of the different species. This generates new knowledge, which they discuss online with an international expert, and which is fed into research programs on allergens. The students involved reported a better awareness of research, and their involvement in it, than students involved in a practical course which had a traditional textbook demonstration practical exercise. Dr Charlotte Taylor describes a thousand students as an 'ideal' size of research team for carrying out research of this nature.

*Further information:* Taylor and Green (2007); [http://www.mq.edu.au/lrc/altc/ug\\_research/research\\_curriculum.htm](http://www.mq.edu.au/lrc/altc/ug_research/research_curriculum.htm)

## 2.9 Introducing students to academic staff research: Department of Geography, University College London (UCL)

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

- Each first year tutorial group is allocated a member of academic staff who is not their tutor.
- Tutorial groups are given three representative pieces of writing by the member of staff along with a copy of their CV, and a date is arranged for the interview.
- Before the interview, students read these materials and develop an interview schedule.
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*Further information:* Dwyer (2001)

## 2.10 Involving first-year English students in the international research community at University of Gloucestershire, UK

At the University of Gloucestershire, Arran Stibbe allows students to take on the identity of a researcher from the start of their time at university. In the *EZ102 Language & Ecology* module the students have an opportunity to share their insights with the wider research community. The research community in turn has something to gain from student contributions because students can critically analyse aspects of their language and culture that others have yet to examine. The students are encouraged to take part in the international research community through working with the *Language & Ecology Research Forum* – the main international forum for research in ecolinguistics. The Forum links together a network of scholars, has an online journal, a range of resources and a dedicated section for the *EZ102* module. The approach works best when students are becoming critically aware of texts that they are familiar with, rather than struggling to understand new genres understood better by the lecturer than by the students. In 2012 the process was simplified and applied to the successor first year module *HM4202 Sociolinguistics and Ecolinguistics*. Instead of a dedicated student section and a journal, the website now contains a mixed collection of articles, some of which are by students and some by researchers. These articles can be found at [www.ecoling.net/articles](http://www.ecoling.net/articles).

*Further information:*

<http://www.english.heacademy.ac.uk/explore/publications/casestudies/sustain/ecolinguistics.php>

<http://resources.glos.ac.uk/ceal/resources/casestudiesactivelearning/activelearningcasestudies/index.cfm>

### **2.11 Scientific Communications 101: A student organised science conference at Curtin University, Australia**

Students in an introductory year one course with a linked focus on physics and science communication were required to plan and present a one-day Physics conference. The context was an institutional requirement that employment focused communication skills be integrated into disciplinary programmes. The idea of a student-organised science conference, publication of the proceedings, and the reasons for the approach were explained to students in the first Physics class. For the following week, students were asked to decide on a Physics topic they were interested in presenting at the conference, the overall theme for the conference, and how all the students would contribute to the organisation of the conference and the publication. Later in the term the conference took place over a day and staff and students from the department and local high school students and their teachers attended. In the years that the course ran it succeeded in helping students develop more effective communication skills linked to their discipline, introduced them to research debates and helped them begin to think and communicate like physicists.

*Further information:* Zadnick and Radloff (1995)

### **2.12 Year one poster presentation conference in engineering at Newcastle College, UK**

In May 2013, the School of Engineering and Science organised a first-year poster presentation conference. This provided an opportunity for students to disseminate the findings of their work-based learning (WBL) projects. WBL projects require first-year students to identify and research an issue in the workplace relevant to their engineering discipline. Part of the assessment process includes a poster and a verbal presentation on their findings delivered to a general audience.

The event was hosted by students, with lecturers providing assistance and assessing their work. Posters were displayed on walls around the venue, with students presenting their aims, methodology and findings to visitors. Some of the students also displayed creative products developed in response to their findings. The conference was advertised widely across the institution. The event was aligned with the monthly information, advice and guidance event which attracts prospective FE and HE students, some attending with their parents. The event contributed to the developing community of staff and student research within the school and it is hoped that the conference will become an annual feature in the academic calendar, and will be emulated in other areas of our HE provision.

### **2.13 Grand Challenges 2013: a researcher led programme for first year undergraduates at University of Exeter, UK**

This programme provides first year students with a researcher led 11 day educational experience at the end of the academic year. Students produce solutions and ideas to tackle some of the key dilemmas of the 21st Century, like climate change, ageing, ethical banking, child health and international security. The programme includes a cultural, social and sporting festival on campus during the middle weekend.

Central to the programme are twelve interdisciplinary 21st century dilemmas. Students work in cross-disciplinary groups to address significant cultural, social, economic and/or environmental issues. Divided into small groups facilitated by a postgraduate (PG) inquiry group facilitator, students research key questions and produce negotiated outputs which are communicated to wider audiences. Examples include writing a policy paper, U-tube videos, debates, awareness campaigns, myth buster pamphlets, social media discussions and dramatic presentations.

Four key principles which relate to research informed education underpin the dilemmas:

#### **Research led**

Exeter has a tradition of introducing undergraduates to research skills and ideas and this is embedded in the [Strategy for research led education](#). The 21st century dilemmas provide a powerful focus for teaching and learning through research. Senior Academic Champions with a national or international research profile take the lead and recruit well known external champions to work with them. Together with other academics and PG students they ensure the rigour and research relevance of the work.

### **Interdisciplinarity**

Each dilemma builds on interdisciplinary research being undertaken at the University. Students are given insights into this research and use concepts and approaches to develop skills which transcend disciplinary boundaries. They should be able to transfer some of their new research knowledge and skills into their University programme during subsequent years.

### **Inquiry based learning**

Ensuring that students have an intrinsic motivation to engage is a challenge at the end of the summer term; consequently dilemmas are designed around active approaches used by researchers. With support, students:

- actively set their own goals;
- take part in research like activities to gain knowledge and skills; and
- are responsible for communicating high quality outputs at the end of the dilemma.

### **Education for employability**

Employability related master classes and research-like employability related skills are embedded into the programme. Opportunities to reflect on these are integral. A significant link has been made with the [Exeter Award](#) and several employer led events take place. Students who show the greatest commitment and innovative thinking are awarded places at the [Battle of Ideas 2013](#) and, for a select few, a chance to attend the [One Young World Summit 2013](#). At both of these events they will have opportunities to work with internationally renowned thinkers and researchers.

Sources: Correspondence with Sue Burkill ([Sue.Burkill@exeter.ac.uk](mailto:Sue.Burkill@exeter.ac.uk)); <http://www.exeter.ac.uk/grandchallenges/aboutgrandchallenges/>; Kay, J (2013)

## **2.14 A first-semester experience exploring the history of science through one-act plays at Concordia College, USA**

All first-year students are required to enrol in a one-semester inquiry course that is discussion based and writing intensive. Topics for these courses are driven by faculty interest and expertise and are offered by departments across campus. All Inquiry courses share common learning outcomes that include explaining the value of intellectual investigation and demonstrating the ability to conduct an intellectual investigation by gathering data for well-reasoned arguments and cogent conclusions. For example, in 'Unravelling the Mysteries: Sheldon Cooper and Other Great Scientists through the Ages', students read historical and contemporary texts, lead class discussions on course readings, write a traditional dissertation on an argument they have chosen and developed, and perform 30-minute one-act plays with scientific demonstrations.

The central text for the course is *The Scientists* by John Gribbin who takes the reader on a journey of science through the lives of the most influential Western scholars from the Renaissance through the turn of the millennium. Students are assigned into working groups of three or four students. In the first half of the semester, each group is responsible for leading the discussion on one chapter (time period) and is expected to include independent research that enriches the context and content for the scene beyond the 'who did what when' to include the influence of politics, health, religion, communication and culture, to name a few. Each group also performs a 30-minute one-act play around a central character or characters from their assigned time period. Their plays must include a 10-minute demonstration of a key scientific principle, discovery or invention developed by their character(s). Students are shuffled into new groups for the second half of the semester, facilitate another discussion and perform a second one-act. Just before the mid-semester point, pairs of students interview a teacher-scholar in the division of science and mathematics at our institution. The course culminates with the students writing about the scientific journey of their interviewee with the intention of informing a lay audience about the research activities and interests of their faculty and students.

Sources: Correspondence with Krys Strand ([strand@cord.edu](mailto:strand@cord.edu)); <http://www.concordiacollege.edu/about/concordia-at-a-glance/>; <http://www.concordiacollege.edu/student-life/first-year-experience/>; <http://www.concordiacollege.edu/student-life/first-year-experience/inquiry-seminars/>

### **2.15 Students hold a Green Week at Dun Laoghaire Institute of Art, Design & Technology, Ireland**

First year students, initially in management and marketing but now working across faculties and disciplines investigate issues with respect to the question *How green/sustainable is our campus?*. They are supported by academic staff and the Estates department. Students start defining group topics in September, consider how to examine and analyse local data, and in March, for one week, examine the issue in depth and present their results and recommendations in a campus-wide event attended by senior management.

Source: Correspondence with Jenny Haughton ([jenny.haughton@iadt.ie](mailto:jenny.haughton@iadt.ie));  
<https://www.facebook.com/pages/IADT-Dun-Laoghaire-Green-Week-2013/329029953874904>  
<http://www.iadt.ie/en/>

### **2.16 Year one concentrated activities in mechanical and automotive engineering, civil engineering and computing at Coventry University, UK**

These three programmes start with intensive c6 weeks of guided activities. In mechanical engineering there are six week long activities all of which include 2 or 3 hours of key note presentations, 14 or 15 hours of facilitated activity and 1 hour of assessment. Each week students are given their mark and feedback before departing for the weekend. In civil engineering, year 1 students start realistic group project work in the first weeks of their course. In recent years topics have included a footbridge in a park, and a cycleway connecting tourist attractions. The project is revisited later in the year for an intensive one-week activity culminating in presentations to an audience of local employers. Integrated project work runs through the three year programme. The final year integrating project includes all students of the Department working in multi-disciplinary teams (civil engineers, building services engineers, construction managers, architectural technologists, building surveyors and quantity surveyors) working on a real brief, supported by inputs from practitioners. In computing, in their first six weeks students undertake a set of week-long tasks that build into a single project-for example to develop an MP3 player.

Source: <http://www.coventry.ac.uk/research/research-directory/higher-education/activity-led-learning/activity-led-learning-case-studies/>

### **2.17 Changing how first year students view experimental physics as a learning experience: The ‘Secret Objective’ at University College London, UK**

One of the problems that 1<sup>st</sup> Year, undergraduate experimental physics courses have is the way that students approach the discipline. Often their previous experiences have been limited to directed demonstrations rather than experimentation. It is not unusual for students to view physics experiments to be a recipe that they follow to get a ‘correct’ answer. Indeed, some students have said that, in the past, they were quite happy to make up results so that they matched their expectations regarding the successful experimental outcome. This is not what we want physicists to do.

Consequently, a new teaching concept was introduced at University College London’s 1<sup>st</sup> Year practical physics courses: The ‘Secret Objective’. Students are encouraged to believe that not all of the scripted experiments were as straightforward as they seem. Doubt is placed in the minds of the students about the validity of their preconceptions regarding the outcomes of experiments. They are told that some experiments have been modified so that they will not behave as expected. This can range from the theory in the script not being sufficient to explain the data, to anomalies in the experimental system that cause interesting problems. Indeed, some experiments can have multiple Secret Objectives. Therefore, the students are trained to look for anomalies in the practicals that might have been placed there by the experiment creator. Breakout sessions are used to discuss what they think the ‘Secret Objective’ was so that a discussion can take place regarding how career physicists approach experimental challenges and unexpected findings. Consequently, they actually analyse their experiments rather than purely copying values in their laboratory notebooks without any critical thought. They actively observe in a way that is quite new to them. Indeed, they often find Secret Objectives that are not placed there by the experiment creator but are there as a result of the real physics. That is what we need them to do and ‘Secret Objectives’ are a means to do this. It is habit forming.

Further information: Paul Bartlett ([paul.bartlett@ucl.ac.uk](mailto:paul.bartlett@ucl.ac.uk))

### **3. Final year and capstone projects**

See also: 2013 *Developing and enhancing undergraduate final year projects and dissertations*. York: HE Academy. (Healey M, Lannin L, Stibbe A and Derounian J) 93pp  
[http://www.heacademy.ac.uk/projects/detail/ntfs/ntfsproject\\_Gloucestershire10](http://www.heacademy.ac.uk/projects/detail/ntfs/ntfsproject_Gloucestershire10)

#### **3.1 Engaging students in applied research through a community sports development consultancy project at University of Central Lancashire, UK**

The final year Community Sports Development module acts as a capstone module for Sports Coaching students. This module is an optional module which is taken in addition to the honours dissertation. Students work as a project team through a consultancy brief with a partner agency and recommend strategies that can be employed to support community development through community sport and coaching initiatives. There are normally 8-12 consultancy briefs divided up among the 40-50 students, with students creating their own consultancy teams. Examples of consultancy projects include: a) A “health check” of football refereeing in Blackburn; b) Community Sport and Crime Reduction; and c) Community Sport (“Street Dance”). The emphasis is upon the students creating professional working relationships with the client organisations in order to carry out primary research that is directed by the clients and supported by the Academic staff at the University. Students are expected to hold regular review meetings with the clients, carry out interviews with relevant stakeholders; use secondary research to help analyse their findings; and present their work and recommendations to the organisation through the staging of a mini-conference, where all the partner groups are invited. Representatives from agencies provide the feedback on students’ work, judging on the content, feasibility of solutions, and competency in conducting research.

Source: [//resources.glos.ac.uk/ceal/resources/casestudiesactivelearning/undergraduate/index.cfm](http://resources.glos.ac.uk/ceal/resources/casestudiesactivelearning/undergraduate/index.cfm)

#### **3.2 Modelling the research experience: Tourism students' virtual conference at Universities of Lincoln and Wolverhampton, UK**

In May every year, final-year Tourism students at the Universities of Lincoln and Wolverhampton participate together in a live virtual conference, as part of their final-level assessment. A conference is a useful vehicle for extending insight into the process and practice of knowledge creation and dissemination and for students to participate as, in effect, research disseminators. Information technology has made it possible: during the specified time frame of one week, students across two campuses can come together at times of their choosing to participate in a joint effort to disseminate research findings and engage in dialogue about their research. Feedback from them has been very positive and encouraging. Two qualified web designers built the site and have been on hand to deal with technical issues. Teaching staff have provided support for the conference throughout. Students submit a full conference paper, but it is only a summary discussion paper that appears on the conference website. Each student is also required to post a comment on another conference paper, in true conference dialogue tradition.

Sources: [www.tsvc.lincoln.ac.uk](http://www.tsvc.lincoln.ac.uk);

#### **3.3 Language students work in teams on international market research projects at Leeds Metropolitan University, UK**

For almost 15 years all the final-year undergraduates on language degrees at Leeds Metropolitan University work in teams of four over a full year to undertake international market research projects on behalf of local businesses, following project briefs prepared for them by the managers in those businesses. The students practise the whole range of skills they have developed on their course (applied languages, team-working, time management, research, project management, data analysis, report-writing, presenting recommendations and so on) in a real-world environment based on genuine commercial needs and products. The students appreciate that they are not working on a case study but with actual products and professionals who teach them about expectations in a professional environment. Over the years, those products have included fashion jewellery, specialist woven fabrics, language services, bathroom equipment and even high-speed, crash-proof shutter doors. Students are particularly fascinated by the company or factory tours as, for many of them, it will be the first time they have ever seen behind the facade of a

business. The employers also prize the experience as they get valuable research undertaken that can assist them with their strategic development of international markets.

Sources: Webb (2008; 2012)

### **3.4 Giving students first-hand experience of research-based consultancy in environmental management at University of Queensland, Australia**

Team-based problem-based learning is used in the final year capstone course for the Environmental Management, Rural Management Environmental Tourism and Tropical Forestry degrees at the University of Queensland's Faculty of Natural Resources, Agriculture and Veterinary Science to give students experience of research-based consultancy. It is a year-long course, team taught by an interdisciplinary staff (in recent years, a social scientist and an ecologist for the internal students, a multi-skilled environmental manager taking the external students). The staff solicit suitable 'problems' and clients among their contacts, for instance from government agencies, non-governmental organisations, or land care groups, or the private sector. The staff may help the client mould the topic to achieve appropriate degrees of difficulty, and equity in workload and difficulty across the student groups. The students work like consultants to their client, coping if the client changes the brief during the year (as many do a couple of times). They work in groups of about six students. The clients come to campus at least three times, for an initial briefing to their students, and presentations at the ends of first and second semester. They liaise with the students all year, usually off campus at their offices, and by phone and email. The staff give a flexible program of lectures in first semester, to prepare the students with skills they need towards each forthcoming step of their tasks, and in group processes. At the end of the year their report is 'published' (printed and bound) for the clients. Peer and self-assessment are used to distribute group marks among the contributors.

Source: Correspondence with Helen Ross, 2006

### **3.5 Biology start up business final year project, University of Durham, UK**

Biology Enterprise is a collaborative venture between Durham Business School and the School of Biological and Biomedical Sciences. This elective module for final year undergraduate students in the School of Biological and Biomedical Sciences aims to introduce science students to the key processes of business start-up and enhance their enterprising skills and behaviours. The module is project-orientated with self-selecting groups of students who generate an idea for a business opportunity that is based on a scientific discovery. Students use their knowledge and understanding of science to develop and research their idea into a technology that can be readily commercialised e.g. a diabetes breath tester, a biodegradable chewing gum. In parallel, the Business School teaches students the necessary skills and knowledge required to develop their idea into a successful business. This course offers science undergraduates an alternative to the traditional laboratory-based project and is useful for those seeking employment in business and commerce.

Sources: <http://www.bioscience.heacademy.ac.uk/events/dur05.aspx>  
[http://www.dur.ac.uk/biosciences/undergraduate/courses/content/level3/lab\\_project\\_enterprise\\_schools/](http://www.dur.ac.uk/biosciences/undergraduate/courses/content/level3/lab_project_enterprise_schools/);  
<http://www.bioscience.heacademy.ac.uk/journal/vol11/beej-11-r2.aspx>  
<http://www.bioscience.heacademy.ac.uk/ftp/events/york05/cowie.pdf>

### **3.6 Senior Capstone at Portland State University, US**

During the final year each undergraduate student is required to participate in a Senior Capstone, the culmination of the University Studies program. The Senior Capstone is a community-based learning experience that:

- Provides an opportunity for students to apply the expertise they have learned in their major to real issues and problems in the community;
- Enhances students ability to work in a team context necessitating collaboration with persons from different fields of specialization;
- Encourages students to become actively involved in this community.

Each student works with a team of students and faculty. Each Senior Capstone must result in some form of summation, closing project, or final product that puts closure to the students' experience. Senior Capstones vary in length ranging from one term to three terms, depending on the specific nature of the Capstone.



Sources: [www.pdx.edu/unst/senior-capstone](http://www.pdx.edu/unst/senior-capstone);  
[www.oirp.pdx.edu/portweb/published\\_pages/prototype/themes/cp/capstone/](http://www.oirp.pdx.edu/portweb/published_pages/prototype/themes/cp/capstone/)

### **3.7 Students undertake a vocational research project in the Foundation Degree Public Services – Policing Studies at Sheffield College, UK**

Students are required to complete a research module in year two (level 5). This is of particular importance to those wishing to progress to the next year where they will be required to complete a dissertation. The topic or issue is usually drawn from the student's work-based learning placement. Examples from the current cohort are:

1. a special constable conducting research into the views of police colleagues towards the quality of personal protection equipment;
2. a student working with youths on the edges of criminality conducting research into the attitudes of young people in relation to stop and search.

Learners are expected to formulate specific, measurable aims, carry out a literature review, examine and employ appropriate research methods and collect and analyse findings. Overall, it is critical that consideration is given to research in methodological and 'real world' crime contexts. The assessed piece consists of a 4,000-word report and students are encouraged to discuss their findings and recommendations with their WBL employer and future potential employers.

### **3.8 Giving students alternative assessment options for undertaking a product design project at Nottingham Trent University, UK**

The course offers several possible routes. Assessment is based on a learning contract negotiated and agreed between the tutors and student. This contract stipulates the content of work, enabling students to complete one of the following options:

1. a 10,000-word dissertation and students produce a poster that summarises their work;
2. a 5,000-word conference paper with a supporting presentation delivered to peers and tutors;
3. a conceptual project with a 5,000-word critical justification. As well as a written outcome students are required to produce illustrations or simulations.

Prior to students undertaking their chosen assignment, there is a three-week intensive period when students complete a learning contract. The contract identifies what option the student will complete, what they hope to learn and how that learning will be demonstrated. The module involves students using a wide range of primary and secondary research skills.

### **3.9 Involving Students in Interdisciplinary Interactive Media Consultancy Projects at Miami University, Ohio, US**

Interactive Media Studies at Miami University is an interdisciplinary programme (including Computer Science, Engineering, MIS, English, Marketing, Graphic Design, Education, etc.) that brings together students and faculty to investigate how interactive media informs and transforms their disciplinary perspective. The programme has been running since 1996 and uses problem-based learning and team-oriented projects to help students to learn how to apply their theoretical knowledge to innovative digital solutions for a paying client. About 100 students a year take the programme. The students work in groups of up to 20. The students themselves decide how to divide up tasks; typically there are groups undertaking development, design and marketing. The programmes are team taught with the last two weeks spent on de-briefing and talking about what they've learnt. The students are typically in class four hours a week, but spend many more hours, for example visiting clients, undertaking research or doing user testing. They make a presentation to their client at the end of the project. Commercial companies are charged \$20,000 per project paid on delivery; non-profit organisations and charities are typically charged c\$5,000. They found the client did not take it as seriously when no charge was made. From the client's perspective, they get out of the box thinking that they would never obtain from a consultant firm. The clients typically end up with something that far exceeds their expectations. The students find it surprising and challenging to manage the changes which commonly occur during the development stage of the project.

Sources: Interview with Glenn Platt 14 November 2007; <http://student.sba.muohio.edu/ims/>

### 3.10 Alternative Final Year projects in the Biosciences at the University of Leeds, UK

Final year students within the Biomedical Sciences group of programmes (Human Physiology, Medical Sciences, Neuroscience, Pharmacology) have the opportunity to undertake one of the seven types of research project. Each project is of 8 weeks duration, with students expected to commit 3.5 days per week to their project. Students are provided with a list of projects (with project descriptors) in March of the year preceding their final year and invited to choose, in rank order, 10 projects they would like to be considered for. Projects are then allocated based on student choice and ranking within the year group; with projects starting in the January of their Final Year.

The assessments for all project types are similar. Students are required to write a 25-30 page dissertation and deliver an oral presentation. Students undertaking critical review projects also have to submit a 5 page grant proposal linked to their review. There is also a supervisor allocated “productivity” mark.

*i. Individual laboratory projects*

Students undertake an individual programme of research in the laboratory of their project supervisor, often contributing to ongoing research within that laboratory.

*ii. Group laboratory projects*

Students work collaboratively, a team of 3-4, to undertake a programme of research; based either in their supervisor’s laboratory or in the teaching laboratories.

*iii. Computer simulation project*

Students investigate the function of biological systems using established computer models (e.g. human cardiac myocytes).

*iv. Critical review projects (with linked grant proposal)*

Students undertake a hypothesis driven critical review of the literature in a specific area/topic within the biosciences.

*v. Survey projects*

Students undertake a public health survey under the general theme of “Healthy Lifestyles”.

*vi. Science and Society projects*

Students undertaking science and society projects create, deliver and evaluate an interactive, curriculum enhancing teaching in local primary (students aged 7-11 ) and secondary (students aged 13-18) schools.

*vii. Educational development projects*

Students undertaking educational development projects develop and evaluate learning resources for use in undergraduate teaching. Working either individually or in small teams, students develop learning resources or new teaching methods (e.g. social media) to support ongoing teaching.

### 3.11 Developing of a creative research culture for fine art students through providing a choice of dissertations at Somerset College of Art, Taunton, UK

NAIT’s applied research program gives students the opportunity to put their learning to work in an applied, real-world project. They work with faculty, industry, and community partners to investigate problems and opportunities proposed by our partners or sponsors.

BA Fine Art students have a choice of three forms of dissertation:

1. the traditional 5,000–8,000 word Thesis module.
2. a 5,000–8,000 word Critical Commentary. This research form explores the students’ work and ideas about their own Fine Art practice.
3. a Special Project that requires a 3,000–5,000 word research document and the production of three pieces of studio work.

All three options have consistently proved popular.

The diversity of research options empowers and motivates the students; emphasises active learning; facilitates learning through the production of artefacts; and encourages reflective practice and first-person enquiry. A sense of discovery, exploration and provisionality are therefore integrated into the research culture. Assuring standards across different forms requires careful discussion of marking criteria by staff. Students are placed in peer learning groups to support one another and, early on, to help discuss the relative merits of each of the research forms. A bridging module is also in place towards the end of the second year to help students get started on their third year so that the summer vacation can be used for primary and secondary research.

## Table 1: Alternative possibilities for dissertations and capstone projects

Case studies referred to below are to those on the project website:

(<http://insight.glos.ac.uk/tli/activities/ntf/creativehops/pages/default.aspx>). Recently added brief case studies are included in the Final year projects and dissertation handout available from:

<http://www.mickhealey.co.uk/resources>.

Common features	Alternative possibilities
Individual work	Teamwork and group-work at some stage in the process; from workshops, mini-conferences and peer evaluation to entirely collaborative projects. Case study 1.4 is an example of a teamwork project.
The output is a research report	The output consists of a research report as well as a product or artefact that has been created through practical application of the research findings. Case study 1.8 gives examples of artefacts that students include in their dissertation.
Disciplinary focus	Interdisciplinary and/or practice focused, where the dissertation can link to career, employability and/or citizenship agendas. Case study 3.5 is an example of an interdisciplinary approach.
Detached observation	Engagement and intervention in the real world and 'live' issues; personal reflection. Case study 4.1 is based on reflection in the real world context of the workplace.
Use of scholarly literature	Using scholarly literature, but also drawing on a wider range of practice and other sources; for example, high quality new media sources or oral testimony. Case study 1.3 demonstrates using a scholarly approach to develop a visual artefact.
Consideration of the ethics of the research process in terms of not harming subjects	Deeper consideration of the ethics of the research in terms of the potential benefits or detriments to society arising from the type of research conducted. Case study 1.9 includes reflection on ethical issues.
Emphasising in-depth analysis	Emphasising the integration of analytical skills with other skills. In Case study 5.6 students are required to use and demonstrate a wide range of skills.
Writing style derived from subject textbooks and journal articles	Appreciation of the wide range of scholarly writing that takes place in a subject area, including creative approaches. Using a mixture of writing styles; for example, a research section written in an academic style and an artefact produced in a business or public-facing style for a target audience. Case study 1.12 describes a range of creative scholarly writing styles in which dissertations could be written.
A written and bound thesis (c.5-12,000 words dependent on credit rating)	A written thesis for the main part of the dissertation, together with one or more artefacts derived from the research such as: project reports, reflective writing, conference presentations, business plans, software packages or visual artefacts such as DVD documentaries, sculptures or websites. Case study 4.5 illustrates how a written and bound thesis can be enhanced through the student presenting at an undergraduate conference.
Self-contained and completed	Part of a larger project. Case study 5.18 inherits and builds on work of previous cohort of students.
Campus based	Work-based, problem-based, or community-based research, consultancy, event planning and so on. Case study 2.14 describes work-based projects.
Aimed at preparation for a career as an academic researcher	Aimed at students' preferred career, whether as an academic researcher or a wide range of other possible careers, agendas and priorities. Case study 5.11 prepares students for a particular career path.
Reproduction of the traditions of the discipline	Creative extension of the discipline, or combining disciplines into an interdisciplinary project. Case study 3.7 shows how an interdisciplinary approach can achieve a tangible useful output.
Individual supervision	Group and/or peer advice and support. Case study 4.4 is a group-based project, where only one member of the team is required to be at the weekly meeting, giving responsibility to students to divide up tasks and communicate information effectively to other group members.
Assessed by academics	Assessed by peers or professionals in addition to academics. In Case study 2.4 35% of the assessment is marked by the client.

Source: Healey *et al.* (2013, 30)

## 4. Departmental and course team strategies to mainstream undergraduate research and inquiry

### 4.1 Co-ordinated interventions in Zoology at University of Tasmania, Australia

The department has developed a set of linked strategies/interventions including:

#### **Year one** (approximately 200 students)

- Workshop on the use of animals in research: students put in the position of researcher, considering experimental design and animal ethics to complete an animal ethics application.
- Throughout the year, students encouraged to interact with a web portal ([www.zoo.utas.edu.au/rir/rir.htm](http://www.zoo.utas.edu.au/rir/rir.htm)) with links to 'Hot Topics' in Zoology related to lecture material.

#### **Year two**

- An assessed task over several weeks, in which real, experimental data is given to the students for guided analysis and preparation as a manuscript for publication.

#### **Year three**

- Courses include group research projects, critical reviews of current literature, writing research grant applications, lectures from scientists outside the school and training in scientific communication.
- In the Zoology Research Unit individual students are matched with an academic supervisor to complete a semester-long research project.
- Selected students work with academic staff to prepare a research paper for *Nexus Journal of Undergraduate Science, Engineering and Technology* ([www.utas.edu.au/scieng/nexus/](http://www.utas.edu.au/scieng/nexus/)).

#### **Years two and three**

- All invited to participate in Student Research Volunteers programme ([www.zoo.utas.edu.au/volunteers/summvolunteer3.htm](http://www.zoo.utas.edu.au/volunteers/summvolunteer3.htm)). Volunteers are matched with mentors, usually postgraduate or Honours students in the School, for short-term, in-house research placements that may offer either laboratory or field experiences.

#### **Years one, two and three**

- 'Reach into Research' seminars held several times each semester ([www.zoo.utas.edu.au/rir/rir2&3.htm](http://www.zoo.utas.edu.au/rir/rir2&3.htm)). Speakers from industry, collaborating institutions and School PhD students present their research, and then all non-undergraduate audience members, except the facilitator, leave the room.

*Further information:* Edwards *et al.* (2007); <http://www.utas.edu.au/zoology/>

### 4.2 Research active curriculum at University of Sunderland, UK

Since 2010 the University of Sunderland has been revising its institutional teaching and quality assurance processes to deliver a curriculum that is 'research active'. The undergraduate curriculum is being redesigned to promote progressive development of graduate research attributes fostered through increasing student engagement in enquiry and understanding of research in a structured way through all levels. Final-year programmes are being designed to ensure that students experience a suitable synoptic activity which helps them bring together their understanding of their discipline and professional area, and prepare them for their subsequent employment and civic engagement. Implementation of this broad framework is at faculty level. In the Business School the programmes are being redesigned to offer a common first-year comprising an 80-credit 'super module' in which students will work in multi-disciplinary teams to research and design a business start-up; a 20-credit 'Contemporary debates in ...' module, where experts from the various disciplines of business and management will lead debates on topical and controversial issues in their subject area to raise student awareness of the uncertainty, subjectivity and the dynamic nature of knowledge. The research active curriculum is now also being developed in the community colleges linked to the University.

### **4.3 Using undergraduates to evaluate student experiences of teaching and learning in the Sociology Department, University of Warwick, UK**

In the Department of Sociology at the University of Warwick, selected second- and third-year Sociology students led an evaluation of their peers' experiences of teaching and learning. 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 department academic debates. Clearly it is more transferable to those departments and disciplines such as Sociology, Education, Psychology and Management, where students developing research skills 'match' the research focus.

*Further information:* Hughes (2005)

### **4.4 A Curriculum Designed to Facilitate a Student's Journey toward Self-Authorship, Samford University, US**

The geography department at Samford University recently redesigned their department's curriculum guided by goals of increasing student engagement with the discipline, improving their practical skills, and enhancing their ability to solve complex problems and engage in critical thinking. Core modules provide basic instruction, but these introductory modules incorporate case studies, problem-solving, and active engagement with the subject matter. Students then proceed through a series of elective courses and finally to a series of courses called "Geography in Practice". Here students have the option of doing a supervised externship, acting as a teaching assistant for an introductory class, or doing an independent research project.

These experiences provide students with an opportunity to link their prior coursework with practical workforce skills. Finally all students complete a capstone experience where they may either undertake a client-based project, or may elect to do a traditional research paper. With the client-based projects, students work in teams with an outside client to define a problem, devise a work plan and create some distinct output. As examples, students have produced a series of maps for a local bicycle club, worked with the university's disability services on an accessibility map of campus, and collaborated with an environmental agency to study sedimentation in a river.

All capstone students are assessed on a range of skills, as well as informational and quantitative literacy. As students progress through the curriculum they are expected to take increased responsibility for their own learning and to develop the intellectual skills necessary to move beyond the campus and into society.

*Sources and further information:* Moore *et al.* (2011); <http://howard.samford.edu/geography/>

### **4.5 Auditing and developing student research skills at the University of Adelaide, Australia and the University of Reading, UK**

Selected departments at the Universities of Adelaide and Reading have systematically audited department-based undergraduate and postgraduate programmes for the extent to which they develop student research 'skills'. The University of Adelaide has developed both a conceptual framework on student research development and based on this, a diagnostic tool to support interventions to strengthen student research skill development in courses. Thus two consecutive first-year courses in Medical Science have adapted their assessment tasks explicitly and systematically to develop student research skills in accordance with the Research Skill Development (RSD) framework. A broadened application of the framework is being trialled, including with laboratory-based and numeracy-rich research, as well as with other disciplines and departments, including Petroleum Engineering, Nursing and English.

The framework is publicly available for other institutions to adapt. Within departments methods to collect data on undergraduates' research skills teaching and learning can be time-consuming and ineffective. At the University of Reading a related electronic 'research skills audit tool' has been developed for academic staff to map systematically research skills teaching and assessment within their own modules.

*Further information:* Willison and O'Regan (2006, 2007); Fraser *et al.* (2007)

#### **4.6 Students across all three years of an Environmental Studies degree course worked together on local sustainability projects at the University of Sunderland, UK**

Students on an Environmental Studies degree at the University of Sunderland undertook local sustainability projects, which brought 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.

*Further information:* Hughes *et al.* (2001)

#### **4.7 Students run the *Journal of Non-Significant Differences* at Grand Canyon University, USA**

The *Journal of Non-Significant Findings* is a student-run, peer-reviewed journal designed to provide learners with a comprehensive understanding of the research cycle and the publication process. It started as a university-wide initiative in the doctoral college, but now includes students at all levels (undergraduate, masters, doctoral) in both the process of managing the journal as well as in the paper submissions. In 2013 the journal was re-launched and submissions are open to students from any university or college. Central to the journal is an understanding that research does not have to be significant to provide valuable insight into scholarship. As such, articles are evaluated according to the soundness of the research process and the ability to contextualize the importance of non-significant findings.

*Source:* Correspondence with Jean Mandernach ([jean.mandernach@gcu.edu](mailto:jean.mandernach@gcu.edu)); <http://cirt.gcu.edu/research/nonsignificant>

#### **4.8 Preparation for the dissertation begins in year 1 of the Childhood Studies degree at Nottingham Trent University, UK**

In year 1 of the Childhood Studies degree course, students are introduced to inquiry based learning approaches in a module called 'Becoming an Active Learner', where they reflect on their own learning through a number of individual and collaborative reflective tasks. During the summer break, before the students enter year 2, the students are required to do directed readings to support their knowledge and understanding of research. In year 2 they take a 'Becoming an Active Researcher' module. For the first few weeks of the year 2 module they take dedicated seminars relating to research methods and ethics. All student groups are required to complete a research proposal and an ethics form before they embark on an inquiry in small research groups.

Working with academics in a range of disciplines, the groups of students follow a rigorous ten-week schedule where they undertake the research inquiry, write a research report and present their findings at a student-led conference. Students complete the module with a reflective account of the research process and what they have learned about becoming a researcher. Some students go on to present at conferences and to managers in relevant organisations.

As a result of the modules the students are prepared well for their final year independent dissertations through improving their confidence and ability to undertake collaborative and independent research. Engaging students in research inquiry, both strengthens communities of practice in higher education and the transference of skills and knowledge to professional working environments.

*Sources:* Ovens *et al.* (2011); [http://www.ntu.ac.uk/apps/pss/course\\_finder/113014-1/7/ba\\_\(hons\)\\_childhood\\_studies.aspx](http://www.ntu.ac.uk/apps/pss/course_finder/113014-1/7/ba_(hons)_childhood_studies.aspx); [Cyndy.hawkins@ntu.ac.uk](mailto:Cyndy.hawkins@ntu.ac.uk)

#### **4.9 Building a research identity in the Bachelor of Education (Early Years) at Northern Melbourne Institute of TAFE, Australia**

The Bachelor of Education (Early Years) is a four-year undergraduate degree that prepares pre-service early years and primary school teachers. The program attracts students from diverse backgrounds, many of whom are not well prepared for tertiary study. The program is committed to developing in students a 'research identity' from the outset as developing scholarship and a scholarly mindset is crucial for professional teachers in practice. Students are introduced to research skills in year one. Subsequently, students are required to participate in critical reading and discussion of research literature in order to understand research structures broadly and the impact of research on the field of education.

In the third year of the program, research-based activity is introduced to students as they develop and implement a self-reflective action-oriented research project based on their allocated teaching practice placements. In the fourth year of the program, students then plan and implement a research project in an educational setting. This activity occurs in a subject dedicated to the development of students' research proposals and related activity. Students are supervised to develop a research question in an area that interests them, they submit an ethics application and design their methodology accordingly. Students conduct this project in an educational setting and prepare a research report discussing the processes used and their findings.

#### **4.10 Engaging students in research into teaching and learning at the University of Western Australia and University of Exeter**

**The Undergraduate Learning and Teaching Research Internship Scheme (ULTRIS) was conceived at The University of Western Australia (UWA)** to introduce undergraduate students to authentic research outside their chosen discipline. By focusing their research on a teaching and learning issue of identified priority for the University, students are able to make significant contributions to the understanding of the problem and provide insights to inform future changes in policy and practice. Beyond the benefits to the institution and the individual students, this model of undergraduate research heralds an opportunity for research into teaching and learning to gain acceptance and interest amongst a new and previously uninvolved cohort of investigators.

At the **University of Exeter** students are engaged as partners in shaping and leading their own educational experiences through their '**students as change agents**' initiative. The key concept is that students themselves take responsibility for bringing about change, based on their own research on aspects of learning and teaching. The approach enables students to be actively engaged with the processes of change, often taking on a leadership role. They are engaged deeply with the institution and their subject areas, and the focus and direction is, to a greater extent, decided by students. The most important aspect is the focus on research, and building change on evidence-based foundations.

Students from across the university have contributed to this initiative, carrying out a series of research projects on their learning and teaching environment, selecting concerns raised through student-staff liaison committees (SSLCs), and providing recommendations and solutions to improve their experience. A small amount of funding was made available from the University's learning and teaching budget to support this initiative. Students worked as apprentice researchers; their research methods included focus groups, informal interviews and questionnaire surveys. Outcomes were presented at a student-staff conference, which resulted in institutional engagement with key research findings. Each small project has also been captured through a case study. Student research has driven organisational change, contributed to student engagement in shifts of policy and practice within the University, and supported students' graduate skills in the areas of research, project management and presentation of outcomes, leadership and understanding organisational development.

*Further information:* Partridge and Sandover (2010); Kay *et al.* (2010); Dunne and Zandstra (2011)

For many more case studies of students as change agents see: [www.mickhealey.co.uk/resources](http://www.mickhealey.co.uk/resources)