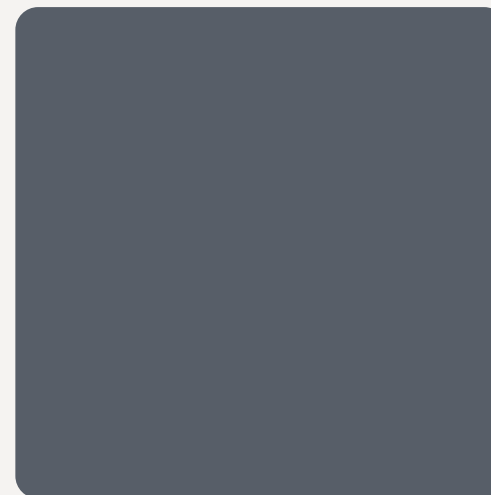


EIGHT PRINCIPLES FOR LINKING RESEARCH AND TEACHING

Department for Curriculum and Quality Enhancement
University of Portsmouth

Center for the Studies of Higher Education
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Why Link Research and Teaching?

The hallmark of university education is that it involves the production of knowledge rather than simply the communication of that knowledge. Knowledge can be communicated by good teachers who are not engaged in research, but the distinguishing feature of university education is that knowledge is communicated in an environment in which that knowledge is being produced.

Linking research and teaching also has a number of advantages in enhancing student learning. Students' knowledge about a subject can benefit from exposure to the cutting edge of a discipline. However, immersing students in the relevant disciplinary and departmental research cultures and the process of doing research and enquiry can be of wider benefit. Designing research strategies, collecting and analyzing data and discussing and presenting research findings provide vital transferable skills, which are useful for subsequent careers both inside and outside the academic environment.

On a more practical level, students who will be completing their own dissertations or research projects need to be introduced to the principles and practices of research throughout their time at university. There is also evidence to suggest that students who are actively involved in the process of research are more motivated and engaged (Baldwin, 2005); furthermore, this method is more effective in promoting deep rather than surface learning.

Researchers can also benefit from involving students in their research activities. Students may provide alternative perspectives that can provide a useful mechanism for feedback on research projects. Students may generate valuable research ideas and outputs through their work projects and dissertations. Finally, inspiring and enthusing students about research enhances capacity-building for the future.

How to Link Research and Teaching?

In most universities and in most subject areas, academic staff make reference to their own or other academic research in the course of their teaching; this is what Griffiths (2004) terms “research led teaching”. Other approaches involve students more actively in the process of creating and/or experimenting with knowledge. Teaching may focus on the processes through which knowledge is produced; place emphasis on developing skills of research and enquiry; and develop a research culture in which students are encouraged to think about how knowledge has been developed and how they themselves can engage in that process. The involvement of students in the research process can be taken a stage further by an inquiry-based curriculum in which students are involved as active partners in the learning process. This involves a more radical overhaul of the curriculum and a commitment to engaging students as learning partners.

The purpose of this guide is to supply examples, ideas and suggestions for how to link research and teaching in the mainstream curriculum and how to provide opportunities for all undergraduate students to be engaged in activities that connect research and teaching. Although we draw on the principles developed at the University of Melbourne on building the learning and teaching nexus (Baldwin, 2005) and on the work undertaken by Alan Jenkins and Mick Healey on linking research and teaching (Jenkins & Healey, 2005; Jenkins, Healey, & Zetter, 2007), this guide has been developed and contextualized through case studies from the University of Portsmouth and Nagoya University.

About This Guide

The UK government has actively promoted the concept of “research informed teaching” to ensure that all undergraduates benefit from learning in a higher education environment that is informed by research, and has provided funding to ensure that links between research and teaching are enhanced. In Japan, many institutions have introduced seminars for new undergraduate students with the aim of providing opportunities for them to understand research activities and to obtain study and research skills. Furthermore, development activities for academics have been promoted to improve the quality of undergraduate education.

This guide is one of the outputs from a collaborative project undertaken between the University of Portsmouth and Nagoya University on linking research and teaching. The collaboration provided an opportunity to compare strategies for linking research and teaching across different countries, disciplines and types of university. This guide draws on examples from both institutions to illustrate how learning and teaching can be enhanced through enabling students to learn about and participate in the research activities of their university.

COMMUNICATE THE EXCITEMENT OF DOING RESEARCH

Inquiry and research engage students' intellectual curiosity. Before students graduate from university, we should make them fully aware of the pleasure to be derived in creating knowledge. Appreciating the excitement of doing research can enhance students' motivation to learn.

- ⇒ Talk about your motivation for doing research
- ⇒ Communicate the enjoyment of doing research in your field
- ⇒ Share the excitement of producing knowledge
- ⇒ Explain why research skills are important for students
- ⇒ Explain how research outcomes make a difference to students' daily lives
- ⇒ Engage students through interesting demonstrations and examples

The Weight of a Large Balloon

Scientific experiments incorporated into regular curricula are usually conducted according to strict instructions. Recently, a new type of experiment has been introduced as part of a course for first-year students in the School of Science: students must themselves design experimental methods in order to answer a given question, namely "How much does one of these large balloons weigh?" Of course, this question does not refer to the weight of the rubber from which the balloon has been made. Rather, the students must figure out how to measure, in the atmosphere, the weight of the air contained in a balloon, and execute their ideas. They are provided with a spring balance, a scale, a stopwatch, strings, a basketball, and other materials. The students, who have just entered the University, are divided into groups of seven to eight members to tackle the question.

The balloons in question are each about one metre in diameter. Some groups of students spend the first several minutes of the session playing with the unusually big balloon. This behaviour is tolerated since the session is also viewed as a time for first-year students to get to know each other and make new friends. Sooner or later the students begin to discuss their task and they try out various ideas. Some students assume it is good enough to find just one answer, so the professor continues to animate the class, encouraging the groups to look for a new method once they have succeeded in weighing the balloon by one method.

This approach to experiment gives students a taste of scientific research and helps them to depart from high school-style learning and assimilate more proactive university-style learning.

DRAW ON YOUR OWN RESEARCH EXPERIENCES

The best way to help students understand what research is like is to use actual examples, and the most effective examples are your own. Students are fascinated to learn how their instructor is actually carrying out research.

- ⇒ Inform students about your research interests
- ⇒ Talk briefly about your history as a researcher
- ⇒ Explain how you have tackled problems in your research
- ⇒ Explain why you became a researcher
- ⇒ Set up a website about your research
- ⇒ Use your papers and publications in your teaching

Research Skills for Criminology

A number of distance learning courses run by the Institute of Criminal Justice Studies are aimed at students who are already working in the area of criminal justice, but are seeking an academic qualification to develop their understanding of the subject or to enhance their career prospects. The distance learning materials that support the Introduction to Research Skills unit were designed to engage students in the current research interests of the department by explaining the different methods that members of staff use to research criminal justice issues.

The section on questionnaires, for example, includes extracts from three different questionnaires developed by members of staff, which provide useful insights into the range of techniques and types of question that can be used to gather information from respondents.

The section on observation includes an extract from an ethnographic study undertaken by a member of staff as part of his doctoral work and is followed by a series of questions that invites students to identify the strategies used by the author to integrate academic arguments with his own observations; to consider their own personal characteristics and biography; and how these might impact on a similar research situation.

The materials also include practical advice and suggestions on handling data and these are illustrated with examples of how research texts prepared by staff have used quotations from interviews to ensure that the text has an authentic feel and avoid misinterpreting views.

Using material in this way fulfils a number of objectives which enhance the relationship between research and teaching. It makes students aware of the research experiences of staff and provides students with an insight into the practical issues involved in designing and developing effective research projects. It also brings the teaching materials to life and makes them more interesting and engaging.

EMPHASIZE THE PROCESS OF KNOWLEDGE PRODUCTION

Communicating the results of research is important in university education, but it is equally important to teach the process of knowledge creation. Try to get students to understand the dynamic process by which knowledge progresses.

- ⇒ Explain how researchers do their research in your field
- ⇒ Categorize the major research methods in your field
- ⇒ Relate the history of research in your field
- ⇒ Tell the story of how researchers overcame problems in their field
- ⇒ Use examples to show how the discipline is dynamic and evolving
- ⇒ Explain the different approaches to knowledge production among disciplines

Diffraction

The following example describes how diffraction is taught in a course on crystallography. In preparation, the instructor obtains a roll of organdy (thin and coarse fabric with a plain weave), cuts it into 15 cm x 15 cm pieces, and finds a safe source of light (both monochromatic and white). In class, the instructor gives one piece of cloth to each of the students, holds the source of light and tells the students to look at it through the cloth. Students often express surprise at the clarity of the diffraction pattern with/without colour spectrum they see. Then comes their assignment: "Draw what you saw and explain why it looks that way," and "Draw diagrams of the diffraction patterns you see when you stretch or fold the piece of cloth, and explain why they appear that way." In this manner, the students experience the process of developing logical explanations for the different examples and cases that they have encountered.

Toy glasses are also used in these classes, an idea suggested by a fellow researcher. Such glasses often generate student interest because they provide unusual patterns according to the principles of diffraction the class has already studied. The students are then asked to explain how these images can be produced scientifically. The answer is provided in the subsequent class.

The experiment with pieces of cloth originates from a personal experience of instructor, who is a crystallographer. Once, with new curtains, he saw the blurred light of a street lamp through the thin curtain. Looking carefully, he observed the diffraction of the light and a colour spectrum. After some playful experimentation involving twisting the curtain and watching the light through layers of cloth, he decided to have his students do the same. Demonstrations on diffraction using a piece of cloth may not be unique, but lessons based on ideas that researchers have generated personally have particular efficacy.

INCLUDE CURRENT RESEARCH FINDINGS AND ISSUES IN YOUR TEACHING

Introducing students to the latest research findings and issues is one of the essential features of university education. Some research results, however, are still in the hypothetical stage and have not yet become established as solid knowledge. Therefore, it is necessary to present research findings in context.

- ⇒ Regularly update the syllabus to include cutting edge research
- ⇒ Identify the current state of knowledge and areas where research is ongoing
- ⇒ Identify the key questions being explored by current research in the field
- ⇒ Include the most current research findings in the field
- ⇒ Introduce discussion on current research
- ⇒ Provide references to current academic papers

Learning From Research

Learning From Research is a new unit that enables students to work with staff on research projects for academic credit. Students can participate in a range of research experiences including: working on experiments; developing questionnaires or other research instruments; recruiting participants to a study; organizing and participating in focus groups; setting up or participating in interviews; collating, entering or transcribing data; and/or disseminating project findings. The level and extent of students' participation in research activities depends on the nature of the project and the level of their own expertise, but they all have the opportunity to be included in ongoing research, often at the cutting edge of the discipline. Examples of some of the projects currently on offer include: investigating the use and impact of social networking activity; patterns of mobile phone use; local approaches to social inclusion; intellectual leadership; women's liberation in Britain 1968–82; evaluation of a novel approach to navigation in a virtual world; comparison of two different computer-based input devices for evaluation of Bradykinesia in Parkinson's disease; and foreign languages and translation in film.

To pass the unit, students must complete a research placement, attend two workshops and complete a research report that includes a reflection on the learning they have achieved through the research experience. Students may also submit a poster presentation that provides information about the project and evaluates their contribution to it. The flexible nature of the unit provides the opportunity for staff to involve students directly in their current research activities but also enables students to experience the process of knowledge development. This gives students a valuable insight into academic research for those considering research as a career, but also provides them with excellent experience and skills that will be useful to them later in their course.

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PROVIDE OPPORTUNITIES TO ACQUIRE RESEARCH METHODS AND SKILLS

Research requires various methods and skills, which can be acquired only through actual application. Instructors are expected to give students such opportunities through class activities.

- ⇒ Teach students how to use research tools
- ⇒ Show examples of how different research methods/skills are used
- ⇒ Tell students to conduct a small-scale literature review
- ⇒ Build small-scale research activities into group work
- ⇒ Tell students to analyze research data from existing 'real world' projects
- ⇒ Introduce problem based learning

Portsmouth Case Study

Freshwater Ecosystems in Environmental Science

This is a new unit in which students will be taught about an array of freshwater ecosystems, such as rivers/streams, ponds, wetland and estuaries. The course will also teach students how to design field investigations and undertake research-based activities. As part of the unit assessment, the students will carry out a piece of field-based research at a stream, which they will have designed and undertaken themselves. The write-up for this piece of work will be in the style of a journal paper (and will require the students to have undertaken a literature review, laboratory analysis of water samples, macro-invertebrate species identification and data analysis).

Portsmouth Case Study

Global Environmental Issues and Concerns in Economics

Each student is required to identify both an environmental theme (e.g illegal logging, the toxic trade, the case against waste incinerators) – either at the local or global level – and an NGO with its organizational focus upon that theme. Working closely with the unit coordinator, each student then undertakes individually directed research using the appropriate research tools/methodologies with a view to producing a briefing paper upon the theme – and in a style appropriate to the organization and its objectives. In those instances where the final report is deemed to be of a sufficiently high quality, it is submitted (by the unit coordinator) to the NGO for consideration – with a view to the report being placed on the NGO's own website.

INVOLVE STUDENTS IN VARIOUS RESEARCH ACTIVITIES IN YOUR INSTITUTION

Universities carry out a wide range of research, and participating in real research activities is a rewarding experience for undergraduate students. Students will be stimulated by observing a research project first hand and in assisting in carrying out research.

- ⇒ Give undergraduates opportunities to observe graduate classes
- ⇒ Provide opportunities for students to act as research assistants
- ⇒ Organize site visits to research centres
- ⇒ Inform students about the research interests and strengths of staff in your institution
- ⇒ Encourage students to attend research seminars by visiting scholars
- ⇒ Encourage students to apply for essay and research competitions

Academic Essay Contest

Every year, the University holds an internal academic essay contest for undergraduate students. While students are free to submit their essays independently, some participate as part of a course they are taking, as in the case of the First-Year Seminar, which incorporates the essay contest into its course.

The First-Year Seminar is for first-year students who undergo the actual process of study and research to acquire basic skills for scholarship in a small class. Students taking the First-Year Seminar are required to summarize in an essay the results of a small research project they pursue throughout a semester. In addition to submitting their work to their instructor, students also enter the essay contest. They also attend the essay writing seminar offered by the contest organizer.

There are a number of positive effects of incorporating the essay contest into the regular program of a course. First, participation in the contest motivates students to work toward a higher goal. On the contest website, students can consult guidelines on essay writing, including format and material presentation, as well as previously awarded essays. Such information provides students with useful pointers for academic writing in general. Secondly, the essay contest offers the opportunity to obtain positive feedback. An essay by a first-year student may receive an award, in which case the author is profiled in the University's newsletter with his or her photo. Thirdly, ensuring that the essay contest is part of the regular curriculum can involve students who would not otherwise volunteer themselves. In other words, "ordinary" students participate in the contest, alongside those self-confident students who are naturally attracted by such a challenge.

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CREATE SHOWCASES OF UNDERGRADUATE RESEARCH

One effective way to improve the quality of student research is to share outstanding results. Making such research results widely known serves not only as positive reinforcement for the students but also as good examples for others.

- ⇒ Provide opportunities for students to give presentations about their research
- ⇒ Publish student work in departmental newsletters or in-house journals
- ⇒ Put student work on websites
- ⇒ Use previous student work as models for students
- ⇒ Exhibit student work at conferences or university events
- ⇒ Organize contests or prizes for the best student work

Portsmouth Case Study

Criminology Journal

The assessment for one of the Criminology units calls for students to familiarize themselves with the format of academic journals in the discipline and asks that they then produce an article based around one of four topics. Students are provided with the criteria for publication, asked to submit their title (as part of the assessment) and offered tutorial support. Approximately 10% of the assessments are selected and presented at an editorial board, made up of staff and students. Work that meets the appropriate standard is published in an in-house departmental journal, along with the work of academic staff.

Portsmouth Case Study

User Research for Product Design

In the unit User Research for Product Design students undertake a small-scale empirical study comprising user observations and interviews in order to design an innovative product. One recent project was to redesign crutches; students interviewed users and employed other methods such as observation and survey research to identify problems and to suggest possible solutions. The unit coordinator organizes a poster presentation day at the end of the academic year at which students exhibit their projects. The presentation day is attended by a large audience comprising visitors from local industry, local schools and colleges, and other students.

INTRODUCE STUDENTS TO THE LIVES AND VALUES OF RESEARCHERS

Over many years, researchers come to develop and share certain ideas and values, such as academic freedom, intellectual integrity and respect for diversity. It is important to convey to students not only research methods but also researchers' ways of life and values.

- ⇒ Encourage students to have and to ask questions
- ⇒ Encourage skepticism about received theories
- ⇒ Explain how to think like researchers
- ⇒ Encourage students to understand and aspire to researchers' values and ethics
- ⇒ Explain the system of peer review in academic journals
- ⇒ Explain how to become a researcher in your field

Egg Dropping

This event is organized as part of the Mechanical Design and Creation course for third-year students. Participating students must drop raw eggs from the 10th floor of a University building without breaking them. To protect the eggs, the students are allowed to use only cardboard and one tube of woodwork glue. They have one week to prepare their project. While actually dropping the eggs, students are often confronted with factors unanticipated during the preparation, which enables them to understand the importance of extensive preparation. They also learn to recognize positive traits in their classmates' projects not found in their own (aesthetic appeal, low cost, ease of use, etc.). In a pre-event report, students must communicate the concept of their project to the reader in a clear manner, while, in the post-event report, the feasibility of their concept and possible solutions to problems encountered during the event must be discussed. The Egg Dropping experiment may seem simple, but it contains a variety of elements that must be taken into account in an engineering process.

The Innocence Project

The Innocence Project is a scheme whereby students work on alleged miscarriage of justice cases, to find out whether there are any grounds of appeal for prisoners or others who believe they have been wrongly convicted. Currently this project is an extra-curricula activity for students, but it is intended to incorporate the project into the curricula as a pathway in the Reflective Practitioner elective unit. Under this project students develop legal and factual research skills because they will have to find fresh evidence in order to challenge the conviction, or seek to undermine the credibility of evidence presented at trial by the prosecution.

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