Reverse knowledge transfer as a means to enhance postgraduate students' appreciation of 'real-world' sustainable environmental management

Ian Bailey

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Introduction

The Research-informed Teaching project to which this report relates was initiated in response to a call by the University of Plymouth's Faculty of Social Science and Business for proposals for innovative teaching and learning projects. The theme of the call was Reverse Knowledge Transfer, i.e. teaching and learning initiatives that promote interaction with external organisations in order to further students' understandings of subject areas beyond the 'abstract' knowledges that can be conveyed in traditional teaching and learning situations.

The focus of this particular project is the University of Plymouth's MRes/MSc Sustainable Environmental Management (SEM). SEM already supports various research-informed teaching and reverse-knowledge transfer activities through its taught modules and field-based activities, by involving professional and lay practitioners from national government, local authorities, industry, environmental agencies, charities and consultancies in interactive, discursive and problem-based educational sessions. However, the award of funds from the initiative was seen as a way of developing this important element of the course, enabling it to thrive in a highly competitive market, offer research-led and interactive teaching, and nurture continuing professional development for teaching staff.

In preparing the bid, we followed HEFCE's (2006: 6) statement that 'all students have a right to learn in an environment that provides the opportunity to fully develop their knowledge, understanding and skills. A learning environment informed by research provides learners with an understanding of knowledge creation (the research process and research methods) and its application (in economic, social, health and global contexts). It also stimulates key skills of critical analysis, respect for evidence and informed decision-making. We feel that a research-informed environment to stimulate the development of knowledge and skills is appropriate to all levels of student learning in higher education.'

The theme of call for proposals (reverse knowledge transfer) indicated a relatively broad interpretation of the term research-informed teaching. We interpreted this as including any teaching and learning technique that encouraged 'discovery-based' learning among students, and so developed a bid based around enabling students to interact with professionals in the environmental sector in field and class settings in order to enhance their appreciation of 'real-world' environmental management process and issues through a combination of practical experiences, discussion, and problem solving.

The purpose of this report is to report the schedule of activities organised as a result of the award and to evaluate its outcomes. Following this introduction, the remainder of this report is structured as follows. The next section summarises the aims of the project and acknowledges key contributors to the project. This is followed by a

description and justification of the course selected for the project and then a summary of the main reverse knowledge transfer activities undertaken. An evaluation of perceptions of the scheme, from the perspectives of students and staff, is then given, followed by some outline ideas for the continuation and dissemination of activities.

Aims of the Research-informed Teaching Project and Project Team

The general aim of the project, as noted above, was to assist students taking the University of Plymouth's MRes/MSc Sustainable Environmental Management to prepare for future careers in the environmental sector by promoting interaction with existing practitioners. The purpose of this was to complement conventional academic teaching methods and perspectives with those of professional and lay practitioners, in other words, to ensure students' knowledge and skills did remain abstract from the situations and issues they were likely to encounter in their careers. Specifically, these activities aimed to enhance students' understandings of:

- how environmental and sustainability issues are managed in the real world in terms of the roles of scientific evidence, stakeholder interests, power relations between stakeholders, and the processes by which differences of opinion and managed and decisions are made;
- current regulatory frameworks used to manage environmental problems and of best professional practice in the environmental sector;
- the use of discussion and questioning to probe the parameters of problems and their solution;
- different problem-solving techniques in the environmental sector;
- the networks of actors involved in managing environmental and sustainability issues.

The bid and project were coordinated by the two programme leaders of SEM, Dr Ian Bailey (programme manager) and Dr Andrew Williams (deputy). However, many excellent ideas and much assistance were given by other University staff, to whom we are greatly indebted, in particular:

- Dr Colin Trier (Earth, Ocean and Environmental Science), for coordinating the environmental management systems conferences and workshops;
- Prof. Geoff Wilson (Geography), for co-hosting two field weeks;
- Fumiyo Kagawa (Centre for Sustainable Futures), whose participation in a field week provided many of useful ideas for the project;
- Dr Stephen Sterling, Dr Jennie Winter, Sally Murrall, and Dr Martin Mowforth, for being stalwart supporters of the *Issues and Debates* seminar series.

We would also like to acknowledge the many representatives of external organisations who gave time willingly to help broaden the students' appreciation of 'real world' sustainable environmental management through involvement in reverse knowledge transfer activities.

Case Study Selection and Justification

As stated in the introduction, the course selected for this reverse knowledge transfer project was the University of Plymouth's MRes/MSc Sustainable Environmental Management (SEM). The degree is one of several postgraduate courses that comprise the University's Environmental and Marine Sciences (EMS) programme and it acts, in general terms, as a training programme for postgraduate students wishing to pursue a professional career in the environmental sector. Students taking the course take a range of core modules spanning the natural and social science approaches to environmental management: *Sustainability Issues and Debates, Environmental Law and Ethics, International Environmental Policy-Making*, and *Environmental Assessment and Sustainability*. Students also take up to three option modules, plus a compulsory dissertation, that allow them to specialise with a review to increasing their employability in the environmental sector. These include: *Land Degradation and Management, Coastal Zone Management, Economics and the Environment, Remote Sensing and Geographical Information Systems, Biological Diversity*, *Marine Science and Regulation*, and *Work-based Learning in Environmental Management*. Finally, students are required to complete a linked *Research Skills and Methods* module that provides a basic induction to research design and execution in preparation for their dissertations.

SEM was considered to be a particularly apt candidate for reverse knowledge transfer activities because of the difficulties of providing students with first-hand experience of the issues and challenges involved in 'real-world' environmental management in class-based, laboratory, or even conventional fieldwork formats. Although some element of work experience is provided through the optional work-based learning module, most advertisements for environmental jobs specify minimum levels of experience and/or an appreciation of contemporary issues within the sector. This is a generic problem for one-year masters' programmes and the decision was taken to develop a programme of activities that encouraged SEM students to engage in direct dialogue with a variety of practitioners in the environmental sector in order to bolster their 'non-academic' understandings of key issues in topics covered by the course and, thus, to plug an element of the 'skills gap' that some students experience (particularly in the short term) when applying for jobs.

The relatively small class sizes (typically 12-18 students per year), above average levels of attainment, and general maturity of students taking SEM also lent themselves to experimentation with 'more risky' interactive teaching techniques and settings. Large class sizes in particular have been identified as a major constraint on the practice of innovative approaches to education for sustainable development advocated by (Bosselmann, 2001; Sterling, 2004; Cotton *et al.*, 2009). For a fuller review of barriers to pedagogical techniques to promote education for sustainable development in higher education, see Velaquex *et al.* (2005). Having provided the general rationale for making SEM the focus of reverse knowledge transfer activities, the next section provides a description of the main activities organised.

Reverse Knowledge Transfer Activities

Four main activities were specified in the RiT bid and formed the focus of activities over the two-year duration of the grant. It should be noted that some of these activities had already begun but on a relatively small scale as a result of budgetary constraints. The RiT grant enabled these to be expanded to a scale that better met the aims and objectives set for SEM.

SEM field week: organisation of a specialist four-day residential trip to West Cornwall analysing a range of generic and region-specific environmental management issues. The trip was run in this format over two years and including visits to a range of public and private sector organisations and individuals. Organisations participating in the project included: DEFRA, Natural England, Eden Project, Geevor World Heritage Site, Penwith District and Cornwall County Council, as well as a number of private sector organisations across a range of sectors (e.g. fishing, tourism, agriculture) that cannot be named for confidentiality reasons. The purpose of these visits was to engage students in active demonstrations of, and discussions on, a series of environmental management issues in order: (i) to expand their appreciation of the issues, stakeholders and viewpoints involved; and (ii) to build confidence in their interrogative and discursive abilities. An additional benefit from these visits was the establishment of a number of contacts for future student dissertation projects.

Environmental Assessment and Sustainability: This module provides students with an introduction to a range of environmental assessment and management techniques. The specific activity organised under the auspices of the RiT project was the convening of a one-day mini-conference and workshop involving a series of speakers from the Environment Agency, sustainability charities, environmental consultancies and the private sector, to discuss the strengths and weaknesses of different environmental assessment techniques and to provide 'hands-on' experience (via afternoon workshops) with problem solving within the ISO14001 environmental management system structure.

Sustainability: Issues and Debates: This term-one module seeks to introduce students to the contested nature of sustainability and sustainable development, linking theory to practice and bridging the divide between natural- and social-science perspectives on environmental policy and management. RiT funding enabled a series of guest-speaker sessions (e.g. Department for International Development and Institute for Environmental Management and Assessment), again based around the introductory context-setting and problem-solving model adopted for the Environmental Assessment and Sustainability module. Topics covered in this module included: education for sustainable development, international free trade and tourism in developing regions, energy security and renewable energy, risk identification and management, and the role of avoided deforestation in climate and sustainable-development policy).

Institute of Environmental Management and Assessment (IEMA): IEMA is the UK's main coordinating body for current and future professionals in the environmental sector. The original intention had been to fund student attendance at a couple of IEMA national and regional information/briefing events. However, this proved to be

impractical due to timetabling constraints and it was more economic to include IEMA briefings as part of the Sustainability Issues and Debates module. It was decided that a more productive approach would be to apply for SEM to be accredited as an IEMA Approved Trainer in order to ingrain IEMA best practice more thoroughly into the main content of the SEM programme. The accreditation process was led by Dr Andrew Williams, deputy programme manager for SEM, and accreditation was achieved in October 2008. The main benefits of accreditation are seen in terms of: the redesign of part of the course to meet IEMA professional standards; the ability to market the course as IEMA accredited; and the opportunity for SEM students to become IEMA students and to receive IEMA publications providing briefings on latest best practice and experience within the sector.

Evaluation of Outcomes

Formal evaluative 'research' on the outcomes produced by the Reverse Knowledge Transfer project has not been conducted yet for four main reasons:

- It is rather early to obtain reliable data on the employment impacts of the scheme, since only one year's worth of students have completed the course since the RiT funding ended. Outcomes in terms of improved employability and career progression would, therefore, be speculative this stage, although the 2007-8 SEM cohort has performed very strongly in a difficult job market. SEM students from that year are now pursuing successful careers with the Environment Agency, the South West Climate Change Impacts Partnership, Plymouth City Council, the Biological Association, and various consultancies and other private-sector organisations;

- A systematic data collection exercise is complicated by the fact that students tend to disperse very soon after completion of the taught components of the degree for exams and dissertation projects. The ideal would be to conduct focus groups or semi-structured interviews, but these would most likely only capture a minority of views. Contact is maintained with some alumni but, again, these are not necessarily representative of the wider student group in terms of academic attainment and employment destination.

- Any evaluation would, to an extent, be counterfactual, since the students that have benefitted from the project would be unable to compare it directly with delivery of the course without these activities. A general indication of the benefits of this approach, specifically in relation to SEM, can be found in Kagawa *et al.* (2006), who conducted pilot research for the Centres for Sustainable Futures on the relative merits and demerits of transmissive and discursive/interactive learning techniques in education for sustainable development during a previous SEM field week.

- Avoiding deception at the learning/pedagogical research interface. Any form of post hoc evaluation may have been construed by students as deception in their learning experience while, conversely, *ex ante* highlighting of certain activities may have artificially altered students' responses to the reverse knowledge transfer activities undertaken.

Instead, the evaluation was based on the following data: (i) comments by students during termly SEM staff-student liaison meetings and via student perception questionnaires; (ii) findings from Kagawa *et al.* (2006); and (iii) personal reflections by the two course leaders on the strengths and limitations of the interactive pedagogies implemented as a result of the RiT project. All student comments are paraphrased and anonymised and the analysis is grouped by key themes.

Overview

Students generally responded very positively to the use of interactive teaching and learning techniques. Their *a priori* expectation of postgraduate education was that it would contain large elements of discursive learning and some expressed disappointment, particularly during early parts of the course, that many modules adopted a transmissive approach. The *Sustainability Issues and Debates* module was described by one mature student as a 'weekly sanctuary', where they were encouraged to express their ideas rather than being told things.

It's very important to get your ideas out into the open, even if you weren't confident about the topic, it's a process of developing thoughts, and by feedback and communication with a lot of other people and a lot of links. I found it very useful.

They also appreciated the opportunity to 'ground truth' concepts that they were introduced to in other modules and the 'de-jargonisation' of sustainability issues that took place during discussions with representatives from external organisations (Wals and Jickling, 2002).

The contested nature of 'real world' sustainable environmental management

One key benefit of reverse knowledge transfer activities identified by SEM students was that it helped them to understand the contested nature of sustainable development (see also Cotton *et al.*, 2007; 2009). Most had come to the course with a fairly narrow view of sustainable development and on the relationship between environmental science, policy and management. In particular, the *Issues and Debates* module and fieldweek proved useful in clarifying why 'good' environmental science do not always translate into 'good' sustainability decision-making and, thus, the need to understand the complex range of stakeholder priorities and interactions that mediate the production, interpretation and use of environmental science in policy and planning (Kagawa *et al.*, 2006). This could be argued to be an especially useful 'lesson' for trainee environmental professional (particularly those from a natural science background) in terms of understanding the contingent nature of environmental science and impediments to its applications that exist from the local to international scales (Schneider, 2002; Wilson and Bryant, 1997; Wilson and Hart, 2000). The specific pedagogical benefit in this instance, therefore, lies in encouraging students to develop broader perspectives on contestable topics while also honing their discursive skills.

Skills and knowledge updating

A second major benefit well illustrated in the Environmental Assessment and Sustainability module, as well as via IEMA accreditation and membership, was the enhancement and updating of knowledge on keynote environmental management concepts and techniques. For example, by becoming student IEMA members, students receive copies of the IEMA newsletter and *Best Practice Series* (e.g. IEMA, 2006). This was valued highly by students (and staff involved) because environmental law is one of the fastest changing elements of European Union and UK law. Keeping abreast of latest developments and how their implications are interpreted by professional bodies is an essential part of professional practice, and it becomes increasingly difficult for formal lectures to keep pace with all developments while still providing foundational knowledge. Reverse knowledge transfer by this means provides an excellent way of bridging this gap provided students maintain their registration beyond their degree.

Practising problem-solving

The RiT activities in the *Environmental Assessment and Sustainability* and *Issues and Debates* modules were also welcomed by students as providing opportunities for practical problem solving. While this is a fairly generic skill that higher education aims to instil in graduates, added value is gained from discipline-specific problem solving. One particular example highlighted by the students was environmental management systems workshops run by representatives from a local authority, an environmental consultancy and a third-sector sustainability organisation. For this, students were required to develop a 'legal compliance risk' and 'continuous improvement' priority list in line with ISO14001 requirements based on briefings given the three representatives. They were then required to develop action plans to achieve the top three objectives identified for presentation to the 'board of directors' for the company. Similarly, students were required to develop an environmental impact statement for a proposed development that met the requirements of the EU Environmental Impact Assessment directive. Practising problem-solving techniques and producing reports to professional standards was seen as significantly more valuable than generic problem-solving exercises that are high on generality but short on the specific competencies demanded by their chosen profession.

Networking opportunities

Because of the career-oriented nature of SEM as a degree, students are naturally eager to establish contacts within the environmental sector as a means of securing future employment. This has always been an important aspect of the course, which places strong emphasis on dissertation project conducted in collaboration with external organisations and, more recently via the *Work-based Learning* module. The reverse knowledge transfer project, however, provided new opportunities to create links between students and external organisations at an early stage. This has, on occasions led to a cascade effect and snowball networking, where work-based learning placements evolved into dissertation projects, and further contacts made through this led ultimately to employment. In other situations, meetings with external organisations during the field week and *Issues and Debates* module led to volunteering opportunities and work placements.

Conclusions and caveats

From the preliminary evaluations presented in this report, the development of a research-informed teaching project based around the concept of reverse knowledge transfer has provided a small group of postgraduate students with a range of subject-specific and generic skills and knowledges that are difficult to provide through traditional lecturer-student interactions. The key benefits identified in this report include: encouraging a more discursive and critical thinking approach; challenging preconceptions; skills and knowledge updating; practising problem-solving; and developing contacts within the environmental sector. Although it is premature to draw conclusions about the effects on student employability (the key measure for this project because of the main ambition causing students to take this course), early indications are that SEM students are gaining good posts, relevant to their career aspirations, in a difficult job market.

While the general indications are that the RiT project has been a worthwhile exercise, some caveats should also be noted. First, not all students adapted equally well to the interactive learning techniques employed, particularly students that had arrived directly after undergraduate degrees with large student numbers and a generally transmissive approach. This led to some adopting a 'passive engagement' approach, listening to representatives from external organisations and taking notes rather than making the most of the opportunity to engage in critical discussion. Second, linked to this, a significant number of students had not yet developed their interrogative skills sufficiently, or did not appear to realise the value of this approach enough, during RiT events, which sometimes led to superficial questioning or non-engagement. A case in point was one Environmental Assessment and Sustainability conference, where students were invited to attend a free lunch with the guest speakers but, disappointingly considering this was masters' level teaching, most opted to leave after eating rather than taking the opportunity to discuss themes covered in the morning conference. Breaking the passive mindset of some students remains a challenge for future reverse knowledge transfer activities of this nature. Both problems may be more pronounced for undergraduate students who perhaps have less commitment to the course and are at an earlier stage in their educational development.

Finally, the inclusion of interactive teaching and learning techniques raised the expectations of some students that this would be standard fare for all modules and led to a sense of disappointment where this was not the case (Kagawa *et al.,* 2006). This is in part a function of the fact that SEM is an inter-disciplinary and inter-faculty programme where developing a consistent approach can be problematic. Improved coordination and dissemination of good practice are, nevertheless, challenges which should not be ducked, though it should also be said that not all subjects lend themselves equally to discursive approaches. This is especially true of more technical disciplines, where students need requisite knowledge to discuss themes (e.g. *Environmental Law and Ethics, Economics and the Environment, International Environmental Policy-making*). The lesson here is to avoid a doctrinaire approach, as this may lead to discursive teaching being applied inappropriately and fairly superficial learning. This was observed in a few of the *Issues and Debates* classes

where students were requested to reflect on issues about which they had insufficient knowledge to make more than shallow contributions. As with many things in education, the trick is to achieve a judicious balance through careful reflection on the learning outcomes sought.

Continuation and dissemination plans

These provisos notwithstanding, plans are well advanced for the continuation of reverse knowledge transfer activities for SEM. This was, in fact, always a key aspiration of the degree, but it was one which had been stifled slightly by lack of a formal budget. Funding RiT activities thus required programme managers to devise ways of leveraging funds on an *ad hoc* basis, and the RiT project provided an opportunity to develop a more systematic and ambitious programme for the duration of the grant. As part of a University reorganisation and in recognition of the benefits gained from the current programme, a budget has now been allocated for the forthcoming academic year and the hope is that this will become permanent. Some aspects of the RiT project have *de facto* become permanent, particularly IEMA accreditation, as this is more straightforward to justify in terms of potential additional recruitment to the course.

The findings presented in this report are based on fairly limited data and more extensive research over a longer time period would be required to obtain reliable trends. However, the results confirm some of the benefits and drawbacks of interactive learning techniques discussed in the pedagogical literature (Wals and Jickling, 2002; Healey, 2005; Healey and Jenkins, 2005), so may be suitable for dissemination via the University's annual Teaching and Learning Conference. Options will also be explored to combine these results with those from cognate projects run at the University for presentation at national and international pedagogical research conferences.

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