

Improving balance and mobility through problem-based learning

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Abstract

The paper describes the transformation of a traditionally delivered, interdisciplinary module on environmental liabilities into an IT format in a problem-based learning module. The drivers for this development were quality improvement, internationalisation and accessibility. The outcomes raise questions relating to skills development, deep learning and time allocation to academics for management of distance learning projects.

Keywords

contamination, environmental liability, interdisciplinary project, problem-based learning

Introduction

Problem-based learning (PBL) is an instructional method that challenges students to “learn to learn”, working cooperatively in groups to seek solutions to real world problems (Duch, 2005). Effective design of PBL material is important (Koschmann et al., 1994) but whilst design and implementation are resource intensive, delivery may also place heavy demands on academic time. Increasing the mobility of students and courses through electronic delivery has balance implications for university work planning. These issues are addressed through the medium of a case study. The paper traces the development of a module from its conception as the keystone course in a newly developed, UK based Masters in Environmental Management, to an internationally applicable, problem-based learning project, available in electronic format. The subject of the project is a highly topical liability problem in western democracies, namely, the issue of land contamination. Thousands of hectares of land have been damaged by industrial activity in the past. Issues of hazard risk assessment, redevelopment potential and value as well as financial responsibility for cleanup, are all pertinent. Solutions involve input from a range of disciplines and rely on both a variety of available data and evidence but also require assumptions to be made where information is lacking. In essence it is a complex problem solving exercise to which there is more than one credible solution and certainly no single “right answer”. This challenging problem, which began life as a conventional piece of assessment, now forms the centrepiece of an electronic learning resource, which has been developed for an international audience. The initial resource investment was large. The design team now faces issues in respect of delivery and ongoing management.

Development

The module as originally constructed was fairly conventional in form consisting of a series of lectures and workshop activities spread over the 12 weeks of one semester. The learning outcomes were defined so that at the end of the module the student should be able to:

- Identify important environmental liabilities that may threaten a business.
- Recognise the need for a coherent and co-ordinated approach to containing the problem of environmental liabilities.
- Operate effectively within a team and practice project management in addressing the problems of environmental liabilities.
- Demonstrate basic understanding of current legislation as it applies to environmental liabilities.
- Apply the principles of risk assessment and management to environmental liabilities.
- Demonstrate a basic understanding of asset valuation and the measurement and role of environmental impairment in it.

A key aspect of the module is its interdisciplinary nature and the need for the acquisition by students of both a diverse body of knowledge and a range of research, analysis and presentation skills. A project was designed for assessment purposes. Small groups of 4 to 6 students were tasked with preparing a strategy for the owners of a designated contaminated site in the United Kingdom (UK) and preparing a written and oral presentation, setting out their analysis of the nature and extent of the liability arising from the contamination and putting

forward a strategy to manage the resulting risks along with, where relevant, a development scheme. Following the conclusion of this process the student group was taken on an international field study week where they were expected to apply the skills developed in the UK to a contaminated site liability problem in an unfamiliar environment. Over a number of years, sites in Polish and Canadian cities were used for this exercise.

A number of specific issues relating to the overall course design became apparent from both staff experience and student feedback:

- The assessment task was extremely challenging, not least because much of the information and many of the skills required to complete the project were only made available sequentially. An understanding of diverse aspects was required at the outset to get to grips with the entirety of the problem, but with the original design this was simply not possible.
- The liability problem could be analysed and addressed from a number of perspectives. A framework for action was required to provide guidance.
- The issue of contaminated land liability is international in nature, in that solutions are required for sites in many countries. The skills required to address these are transferable.

Equally, a number of broader issues were raised namely:

- Students wished to study this material in non-standard modes, for example outside conventional classroom hours because of work commitments, or as a Continuing Professional Development (CPD) module rather than as part of a Masters program.
- The teaching team felt the module had international appeal since it represents cutting edge approaches to a significant environmental problem.
- University policy was to expand markets, especially internationally and increase student numbers generally.

IT based project and learning material

In order to address these issues the team decided to move to electronic delivery. This was seen as a way of providing greater market flexibility, particularly in respect of students who were unable to attend university during conventional daytime teaching periods. It was also seen as a means of opening up potential for international students to undertake the entire suite of Masters modules at a distance. These considerations represent important market drivers of critical importance to university management. The transition was underpinned by a belief that it was a means of improving the student experience on the module. In the late 1990s the literature on PBL was expanding (Koschmann et al., 1996; White, 1996; Glasgow, 1997). The nature of the liability problem as originally defined, closely mirrors Dennen's description of PBL as a scenario which:

“assesses student performance on tasks that go beyond requiring just knowledge, comprehension, and application, and that involve demonstration of analysis, synthesis, and evaluation, all of which are more complex abilities. Students must define these problems before they may solve them, and typically there is no set solution.” (Dennen, 2000)

Structuring the module around the project and making the learning contingent on it appeared a logical step, which was supported by the work of a number of PBL developers (Rhem, 1998; Barrows, 2000). A design based on a series of goals, derived from analysis of previous educational practice, reflects the theoretical development framework set out by Koschmann et al (1994). Whilst the educational goals or outcomes remained as originally expressed, the design specification changed to:

- Give central place to the problem as opposed to the support materials.
- Package the problem and support resources in an attractive manner in order to engage interest.
- Allow students to address the problem from a variety of standpoints, moving away from sequential delivery, which was seen as a major constraint.
- Provide students with a flexible framework for analysis of the problem.
- Make the learning experience internationally relevant.
- Provide resources and information about the problem in a “real world” format.

The project is provided as an attractive simulation, almost like a computer game, based on the participant(s) occupying and exploring a virtual office that contains a range of resources for their use. These include the project brief, a computer to access the Internet, a filing cabinet of project related materials, relevant background material on video, and a virtual site visit with expert commentary. This base is sufficient to allow the learner to explore problem-based solutions and, in the process, acquire skills and knowledge in respect of

contaminated land liabilities. The visually appealing nature of the simulation represents an explicit attempt to foster a deep learning experience (Marton & Säljö, 1976) by encouraging repeated office visits.

To support the project and provide the required framework for analysis ten learning units were provided covering discreet topics such as *Project Management*, *Legal Issues*, *Site Investigation*, *Risk Management* and *Contaminated Land Valuation*. On the basis of past experience with aspects which students found hard to conceptualise or understand, video excerpts were used to illustrate certain points. Readings were also provided for reference. This reading material was supported by multiple-choice tests as a back up for learners to reassure them that they had understood key points.

A key decision by the teaching team relates to issues of portability, access, equity, technology and maintenance. Studying at a distance, perhaps internationally, students may not possess the latest computer hardware and software and may have unreliable links to the Internet. The IT package was therefore designed to run successfully at varying screen resolutions; it incorporated software requirements such as *QuickTime* and was placed on a Compact Disk (CD) rather than on a web server to facilitate access and minimise time spent on line. The intention of designing the CD to have a life of three years before requiring updating demanded a careful analysis of which material was relatively stable and could be committed to CD and which was volatile or liable to require change. In the latter category website references and multiple choice tests needed to be kept on a server where they could be easily updated and, in the case of tests, automatically marked, to allow rapid feedback to students. Links to the web site, available via Blackboard, were built into the CD, thus facilitating access, whilst the CD format did not require constant connection to the Internet by students, thus reducing costs and maximising utility. A further major advantage of electronic delivery is that it allows students to access not only materials, but tutor support at any stage in the sequence. E-mail correspondence with the tutor allows students to overcome the problems of accessibility and sequencing which occurred in earlier modes of delivery. Students can work individually or in small virtual teams to solve the problem. A key aspect of the original design, namely the international field study week, was maintained. Following successful conclusion of the problem solving stage, the virtual community of students becomes a real community by meeting in an unfamiliar location to tackle a live problem of a similar nature, employing skills developed in the previous stage.

Discussion

In summary, the approach is designed to focus student learning on a practical, real world problem and to use this experience to develop problem solving strategies and skills rather than simply provide a body of knowledge. The template is crafted to be internationally applicable, both by including examples of international practice in the unit materials and by focusing students' attention on the method and approach rather than on details of rules and regulations. The need to understand the importance of law and practice and how it might impinge on development, land values and legal liabilities is more important than retaining details of legislation. Thus the module reflects the belief that recognising what is important and how to access relevant material is more important than assimilating large quantities of data. The team take the view that PBL, especially when rehearsed and then reapplied under different conditions, as is the case here, also tends to enhance deep learning. How we assess whether such is the case is a point of some debate. However, the team considers that the module in its current form is more accessible, flexible and international than previously. Despite a greater physical distance between the student and the teacher the module provides an opportunity for a closer and more interactive relationship than is often the case with conventional delivery modes. The forthcoming module trials will test these assertions.

A potentially critical aspect relates to management of future delivery. The PBL design and shift to electronic medium was underpinned by educational theory but was also driven by university management-led market considerations. To what extent the potential social and educational benefits can be exploited is largely contingent on the time allocation that tutors devote to course management, especially to email interaction with students. This in turn raises important questions about costing and work planning for academics who are not physically present in the classroom. The resource intensive nature of the initial development implicitly suggested to university work planners that module delivery would be less resource intensive than the former traditional delivery mode. Little or no experience was available to serve as a guide to appropriate work planning practice. Thus, a further question of balance emerges with regard to the distribution of resource input between design and delivery. Educational designers and managers must agree work planning standards for such non traditional delivery and not assume that the time input is entirely front loaded with minimal demands at the delivery stage. The challenges to the success of this module lie as much in cost and management decisions regarding its implementation as in its design.

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