

Flexible Lifelong Learning in Professional Education

Denise Kirkpatrick, PhD

Director, Centre for Enhancing Learning and Teaching
Charles Sturt University, Panorama Ave
Bathurst NSW 2795 Australia
dkirkpatrick@csu.edu.au
Phone: +61 2 6338 4314
Fax: +61 2 6338 4342

Robert McLaughlan, PhD

Senior Lecturer
National Centre for Groundwater Management
University of Technology, Sydney
PO Box 123, Broadway NSW 2007 Australia
Robert.McLaughlan@uts.edu.au

ABSTRACT

Universities are continually seeking effective responses to the challenges created by the increased demand for continuing professional education from a diverse client group responding to the pressures for lifelong learning. The growth in information and communications technologies has created new environments in which learning can occur. New technologies open up possibilities for bringing together distributed learners and the opportunity to support interaction between learners from diverse geographical and life contexts. The challenge for educators is to develop teaching-learning approaches that support learners and develop the skills and knowledge necessary to perform more effectively in the workplace and to continue to learn. The professionally oriented subject Contaminated Sites Management was re-developed to incorporate electronically supported problem-oriented learning. The new subject integrated professional understanding and practice with existing subject content and incorporated flexibility into a subject that had traditionally been taught face-to-face. Subject design was based on principles of problem-oriented and experiential learning and included individual and team-work and a polluted sites simulation conducted within a web-based learning environment. The incorporation of computer mediated communications technologies provided flexible and responsive support for student interaction and communication. Students responded positively to these flexible teaching and learning approaches and the subject developed students' professional skills and knowledge successfully.

Keywords

Computer mediated communication, Simulation, Professional education

Introduction

Increasingly universities are recognising the desirability of developing skills in students that will enable them to function effectively as lifelong learners. In recent years there has been a growth in vocationally oriented courses and continuing professional education. Indeed Boulton-Lewis (1995) argues that one of the goals of higher education is to teach students so that they develop knowledge of content and structure of their chosen disciplines and can apply it effectively in further development of knowledge and in vocational situations.

While professional university courses have focused on preparing students for employment in their chosen field we are seeing pressure for universities to pay even greater attention to the preparation of students for the workforce. This is exemplified in the notions of professional formation and graduate attributes related to potential employment and the professional workplace (Barnett, 1997). Universities are seeking to meet the needs of a more diverse client group comprising employers and students by creating more vocationally oriented courses and offering courses in more flexible ways incorporating aspects of open and distance learning (Bilton et al., 1987 cited in Hobbs & Spedding, 1997). Professionally oriented education seeks to cater to a more diverse group of learners, coming from a variety of educational and employment backgrounds. Advances in communications technologies have both increased the pressure for changes in education and made new modes of delivery possible. Broadly speaking, professional education has challenged educators to develop approaches to teaching that integrate subject discipline knowledge with ways of thinking and acting that are appropriate in the professional context.

As universities offer education in more flexible ways there is a need to establish approaches to professional education that can be delivered flexibly. Traditional distance education approaches with their usually behaviourist teaching foundations would not seem to sit comfortably with the teaching approaches that have been used to develop professional understandings (Thorpe, 1993). Because most teaching approaches utilised to develop professional learning rely on interaction and communication between learners the traditional print based approach to distance education would seem inadequate to support such interactions. In this paper we describe the re-development of a subject to focus more clearly on the development of professional skills, knowledge and attributes in a way that places less reliance on face-to-face meetings with students thereby providing more flexible learning opportunities.

The Subject Re-development

The subject Contaminated Sites Management had previously been taught in face-to-face mode using the lecture as the primary means of delivery. The redesign of this subject was intended to create a more flexible way of offering the subject to a more diverse group of students - both in terms of their background knowledge and experience and geographic location. We also wanted to make the subject more professionally focused; with more explicit attention to the development of professional attributes or competencies relevant to the profession. We wanted to teach the subject in ways which provided opportunities for students to interact with each other, actively engage them in the learning process, develop professional knowledge and understanding; and capitalise on the life/work skills and experiences that students brought to the subject. The subject aimed to develop in students the understanding that managing a contaminated site is about more than just solving the existing scientific problem.

Educating for the Professions

The notion of what constitutes a professional has received much attention in the literature. Generally professionals are held to possess skill based theoretical knowledge and a range of related skills and attributes. Professional knowledge goes beyond a defined set of skills and facts; it is more integrated involving not only knowledge and skills but the ways that individuals and groups work with these, and how they use them. General attributes required for the performance of key professional tasks are generally viewed to include: cognitive skills (problem solving, knowledge, critical thinking); interpersonal skills; affective attributes; and technical/psychomotor skills.) These are usually described more specifically within disciplines. In addition to theoretical and technical knowledge, effective professional practice requires reflective and practical knowledge and competencies for dealing with problems in the indeterminate zones of practice that do not yield to technical or familiar solutions (Hager & Gonczi 1996; Harris, 1993; Schön, 1991). In a climate of rapid technological, cultural and economic change such competencies are crucially important to the education and development of professionals.

Which Professional Knowledge and Skills?

Moving from more general literature that identifies what is involved in being a professional we considered what was involved in being a professional in the field of environmental management. Broadly speaking, environmental decision making involves dealing with a diverse range of stakeholders, complex scientific information and conflicting value systems about environmental protection and restoration. Approaches to solving these problems can require understanding of a range of perspectives on the issues. We needed to identify the knowledge and skills that were necessary to act professionally in such contexts. There was little documentation which identified the competencies of an environmental professional in an Australian context. However, recent US work provided some guidance (State of Connecticut - Department of Environmental Protection) which was supported by aspects of an Australian consultancy report (Woodward-Clyde, 1995) which described skills and knowledge deemed necessary by the industry.

These reports identified the major domains (or areas of content knowledge) and tasks, knowledge and skills that an environmental professional should be able to perform. The reports describe the key professional/conceptual tasks that such professionals should be competent in and the knowledge and skills associated with performance. Also incorporated were the notion of industry values such as teamwork, including effective communication, effective conflict management, and team goal achievement.

Teaching Professional Knowledge and Skills

Schön (1991) argued that we need to prepare students for the unique role they will play as professional decision makers. Approaches such as problem based learning, resource based learning and experiential learning have been effective in developing students' professional knowledge and understandings and have been used extensively in relation to professional education in universities. Such problem-oriented approaches aim to: integrate students' learning of different disciplines making their knowledge more relevant and useful to them as professionals; develop effective and efficient reasoning skills based on this knowledge; teach students how to learn independently; and make curricula more interesting to students and staff (Ross, 1991). Such approaches support student collaboration in order to foster student-directed learning and encourage independent studies and reflection on the learning process. Problem-oriented approaches allow teachers to foster both what and how their students learn (Wilkerson & Hundert, 1991) and they have been portrayed as a means of revitalising disciplines or professional practice (Muller, 1984) while providing students with opportunities to develop professional behaviours.

Mostly, these approaches have been used successfully in face-to-face teaching situations. We wanted to develop a subject that would use problem-oriented approaches to develop professional skills and knowledges in a way that would provide flexibility of time and place for students. We believed that it was possible to develop a professionally oriented subject that could be taught in distance mode utilising experiential and problem-oriented approaches. Thorpe (1993) argues that it is possible to create opportunities for experiential learning in distance education settings and cautions that these should not be considered a simple 'add on' to a conventional course package. The design of this subject sought to embed these experiences in the learning activities. Implicit in professional education is the need to encourage deep approaches to learning where the student intends to understand the material, to relate parts to a whole, to integrate it into existing knowledge and to apply it in real world situations. The learning experiences in the subject were designed to constitute a reflective practicum (Schön, 1983; 1987) where opportunities were provided for students and the teacher to reflect together on practice using examples of practice in the form of cases (through site studies and a simulation).

Aims of the Subject

The subject was essentially concerned with developing students' necessary foundational scientific knowledge and their understanding of the process of managing a contaminated site including the associated environmental decision making and related issues.

The Subject

The subject was taught to senior undergraduates and postgraduate students from a range of courses including Coastal Resource Management, Civil and Environmental Engineering and Groundwater Management. As a consequence of this diversity in background, students came to this subject with a wide range of variation in their understanding of the scientific and social dimensions of the management of contaminated sites and environmental decision making. The subject Contaminated Sites Management was designed to develop necessary scientific disciplinary knowledge to provide a base from which students could engage in professional decision making.

Subject Design

The subject comprised 3 modules addressing the concepts of contaminant fate, contaminated site investigation and management. The modules were designed to move from micro-level knowledge (context independent knowledge) to macro level/scale applying processes in real work contexts to a more holistic scale responding to range of other related factors, taking a broad view of other factors impacting on the subject knowledge and application. Individual and group site investigations used problem-oriented learning to engage students with key content knowledge– the "knowing what" of the subject as well as learning "how to" in the subject. A simulation was used to create opportunities for students to apply this knowledge to a hypothetical contaminated site and experience the complexities of decision making in such an environment. Opportunities for reflection were considered essential in order to encourage reflective practice (Schön, 1983; 1987) and were included in all modules. All modules were web-based and all necessary resources were available on the subject website along with links to related sites.

Boulton-Lewis (1995) emphasised the importance of carefully designed assessment procedures that are explicit and implemented in ways that encourage and recognise the development of aspects of learning that lead to higher order thinking. Each module contained several assessment tasks and assessment in the subject incorporated a variety of techniques, providing students with a range of ways in which they could demonstrate their learning. We were concerned that assessment should address the learning that was intended to occur and mirror real life professional tasks (Boulton-Lewis, 1995; Nickerson, 1989). Tasks were designed to do more than focus on recall of declarative and procedural knowledge and were intended to indicate students' understanding of subject matter and quality of thinking. Student learning was assessed through problem solving leading to the production of reports written to industry standards (individually and in teams); engagement in a role play; the development of concept maps; self reflective writing; and assessment of peer's work.

Delivery of the Subject

Web-based delivery was selected because it allowed the subject to be offered flexibly. Learners had the opportunity to engage with the subject in their own time and location. In addition, the use of web-based software (TopClass) provided an easily accessible on-line learning environment which supported synchronous and asynchronous interaction and communication. All subject materials and resources required to support problem-oriented learning could be accessed via the website and students could also access relevant external resources.

The use of an on-line learning environment presented additional challenges to the design of the subject. According to Ehrman (1991) a key issue relating to good practice in technology mediated courses is that of increasing student engagement with the subject. The use of independent and group projects and the use of the simulation to teach about managing polluted sites were intended to increase students' engagement with the subject. On-line courses are effective when: they are well structured; train both students and staff in the use of technologies; vary the media which deliver content and support interaction; and develop approaches which cater to the individual needs of students (Mason, 1998). These criteria guided the design of the learning experiences within the subject.

Subject Content

Module 1 (Contaminant Fate)

This sought to develop students' knowledge of processes and key information through individual resource based learning. This was based on the key scientific and technical knowledge that had been deemed necessary by the profession. Content related to the type and properties of contaminants and the processes that influence their fate. This was intended to serve as a knowledge base for professional practice. Students worked individually to compile a site report in response to a problem relating to contaminants and contaminated sites. The investigation task was broken into its component sub-tasks to provide structure to assist students in solving the problem and completing the task. The report was to be written to industry standards and students were provided with an example of such a report. Criteria for assessment and peer assessment were posted to the website and were related to the objectives of the module, specifically identification and application of key concepts relating to contaminants; and report structure and argument. Individual reports were posted on the subject website and peer assessed against the same criteria. This created an opportunity for all students to see a range of approaches to tackling a problem.

Module 2

The aim of this module was to develop the professional skills and attributes of team work, communication, negotiation and group evaluation. The module was designed to provide opportunities for students to apply content knowledge to real work processes and tasks. Students worked in groups to investigate a hypothetical contaminated site and prepare a team site investigation report written to industry standards. The site investigation was based on a more complex problem than that used for the individual investigation in module one. Each sub-task was self and peer assessed. Group reports were posted to the subject website for peers to read and assess. While this provided a simple and effective method of distributing student work for assessment it also provided students with examples of others' work and provided them with opportunities to see alternative ways of

approaching the problem. Reports were assessed against criteria relating to appropriate and correct application of key concepts relating to contaminants.

Module 3 (Contaminated Site Management)

This module was intended to develop the skills of: team work; cooperation; collaboration; conflict and dispute resolution; arguing a case; locating, collecting, analysing and synthesising data; sharing ideas; and making judgments. A key learning objective of the simulation was for participants to be able to identify the political, social, economic as well as scientific dimensions to decision making during an environmental conflict. It consisted of a contaminated site simulation which ran over six weeks and was designed to allow students to experience and develop an understanding of the complexity of professional decision making and action. The simulation was intended to integrate social, political and economic perspectives with scientific knowledge. All essential role play related communications were supported electronically within TopClass although students could communicate outside this environment if they wished. In response to feedback from previous implementation of the simulation two face-to-face meetings were scheduled at critical points in the simulation and the debrief was also conducted face-to-face. While such meetings could have been conducted using videoconferencing or teleconferencing in this case most of the students lived locally and expressed a preference for meeting in-person. In addition to participating in the simulation students developed a concept map prior to and after the simulation and wrote a reflective essay on the management of contaminated sites.

Assessment of the simulation focused on application of discipline knowledge to problems; resolution of the problem; professional communication skills; use of information technologies for communication of ideas; task completion; persona development; and information location. Students demonstrated their understanding of these concepts in a reflective essay supported by concept maps developed at the beginning and end of the simulation. The essays and concept maps were intended to play a role in debriefing and consolidating student learning. Students were provided with descriptions of the characteristics of low, middle and high scoring responses. Structural complexity of the reflective essays was analysed using the SOLO taxonomy (Biggs, 1992; Biggs & Collis, 1982). The reflective essay was assessed against criteria relating to awareness of the complexities of decision making and understanding of the processes and strategies involved.

Results

Evaluation of the subject used data relating to students' performance on subject assessment which indicated the extent to which the subject design had supported the achievement of subject objectives; analysis of transcripts of electronic communications; and student feedback.

Student Learning

Because this subject represents significant redesign of the learning experiences, presentation methods and assessment tasks we have not compared student assessment results of this group with previous groups.

Module 1

All students who submitted reports achieved satisfactory performance demonstrating at least minimal level of understanding and correct application of the key scientific concepts involved. 40% demonstrated high levels of understanding of the key concepts.

Module 2

55% of students demonstrated high levels of understanding and application of key concepts relating to contaminated site management and all students who submitted reports achieved satisfactory levels of understanding of concepts.

Module 3

Analysis of the reflective essays showed that all participants who attended the face-to-face debriefing demonstrated the ability to generalise the events within the simulation to underlying concepts. We suggest that a facilitated group reflection process provides participants with a structured opportunity to express feelings about the experience and to clarify the concepts or principles about the decision making process. The concept maps may have assisted participants in organising ideas and representing the relationships between key concepts fulfilling an important planning function in students approach to writing the essay.

Student Interaction and Communication

The simulation was also intended to develop students' understanding of the responsibilities and appropriate responses of key players in the management of polluted sites; and to develop communication, negotiation and decision making skills. Peer assessment of the nature of participation and appropriateness of behaviour provided information about this along with analysis of the content from the electronic dialogue. Analysis of the electronic messages during the simulation showed that all participants stayed within appropriate boundaries for their character without facilitator intervention. Students' role profiles showed that they were generally aware of their professional responsibilities.

Student activity within the simulation was predominantly focused on negotiating positions and making decisions based on rhetoric rather than scientific data. There was little evidence that students engaged in investigation of the scientific basis for decision-making or research of salient topics. While this may have occurred outside the simulation web site there was little to suggest that students introduced additional information being via their personae. The simulation appears to be more successful at providing opportunities for and encouraging participants to integrate and communicate their existing knowledge rather than collecting specialist knowledge specific to the scenario. Further support for this is provided by the fact that students with no training in groundwater contamination were the only ones to report that they had learned scientific dimensions associated with this management problem.

Student Feedback

While the extent to which a teaching program achieved its stated learning objectives is a primary measure of the effectiveness of that program student responses to teaching innovations are also important. Students' responses are likely to influence the extent to which they engage with learning in that subject and in the case of part-time students with work and other commitments there must be something about the distance learning package that attracts them to work with it. Students were also the ones experiencing the aspects of this subject so their feedback was considered an important indicator of the success of the subject design (Ramsden, 1992). An end of semester subject evaluation provided information about students' responses to the subject and its mode of delivery.

Student feedback on the subject indicated that students appreciated the flexibility offered by the on-line delivery. In general, they found the learning activities useful, and reported that the activities encouraged them to become more independent learners. In particular they found the simulation an engaging and worthwhile learning experience. Several indicated that they found aspects of the group work exercises particularly in Module 2 problematic. While the use of asynchronous discussion facilitated communication between students, some felt the lack of face-to-face contact made it difficult for them to establish the rapport necessary to work effectively.

Students reported that the simulation helped them develop an awareness of the need for and the skills of communication and negotiation in contaminated sites management. The enthusiasm of other participants was identified as playing a significant role in the effectiveness of the simulation. While the extended time-frame of the simulation was desirable because it resembled real life, students felt this made it difficult to sustain interactions and involvement. It may be desirable to limit the duration in order to sustain interest and involvement.

The need for timely and informative teacher feedback emerged as a key concern for students. They found opportunities to see the work of others valuable but expressed a need for information as to their progress. In part the length of turn around time for teacher feedback was extended because of the process of peer assessment that had been implemented. This request for more immediate and informative feedback is not surprising as students

have fewer opportunities to obtain direct and indirect feedback when they are not physically present on a regular basis. In addition, the use of computer mediated environments removes non-verbal and incidental cues about the appropriateness of responses and ideas.

Conclusion

Mason (1998) argues that the different demands of a traditional lecture based course and a web-based asynchronous course make it hard to imagine a student could do equally well in both contexts. We believe that the point here relates to the need for choice, allowing students some options in the ways they work. Despite Mason's claim that we should not expect students to learn equally well in either context, this exercise has shown that students did achieve the learning objectives studying the subject asynchronously. It may be that these students worked in areas that provide them with familiarity in working in electronic environments and that the media used for learning provided few barriers for learning. Alternatively it may be that the flexibility provided outweighed unfamiliarity with media and presentation form or that the use of a range of media provided additional motivation for learners to engage.

This approach appeared to achieve much of what was desired: the model provided flexibility of access for students; facilitated interaction between learners; and learners from a range of professional backgrounds developed professional knowledge and skills in an electronic environment. The results provide support for ways of supporting problem-oriented, experiential learning in a 'distance' non-face-to-face environment. Finally, the teaching-learning approach and learning activities achieved the desired learning outcomes and built on the experiences of students and allowed room for learning. As a consequence of studying this subject in this way learners developed not only discipline related knowledge and professional skills but skills that will allow them to continue to learn in their professional and academic lives.

The use of computer mediated communication within an electronic environment allowed flexibility of interaction and participation allowing students to engage in learning activities at a time and place convenient to them. The subject provided only some student choice of learning activities as students could select an independent learning alternative to the role play but lacked flexibility in relation to the determination of learning outcomes since these were closely associated with the professional area.

Directions for the Future

Many of the issues that arose in this course parallel those with which we are familiar in conventional classroom teaching. However the electronic environment focuses attention on these areas and exerts new pressures on some aspects of teaching. The need for feedback appears to increase when there is less face-to-face interaction. Therefore it is important to provide prompt, frequent and informative feedback to provide means by which students can assess their progress. Associated with this are other pressures for ensuring that an environment of trust and reliability is established electronically. This includes developing alternative ways of providing cues about performance and expectations to students and is relevant in relation to developing trust between students within the group. While it is possible to create effective electronic problem-oriented experiential learning and environments that provide flexibility of access for students, there are some limitations on the quality and nature of interactions that can be supported. There is a greater need for scaffolding the teaching of skills of team-work and critical self reflection particularly in asynchronous distributed learning environments. Greater emphasis on the teaching of professional skills is also accompanied by pressure to develop effective techniques for assessing generic skills. The exploration of appropriate methods requires attention. To this point the subject described in this paper has been offered only as a component of a formal university program. However, the content and approach are relevant to the on-going professional development of practitioners in a number of related fields and it is likely that a similar experience may be offered in the workplace.

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