

PROBLEM-BASED LEARNING IN DISTANCE EDUCATION

S.K. Poon, Industrial Centre, The Hong Kong Polytechnic University

Catherine Tang, Education Development Unit, The Hong Kong Polytechnic University

Sue Reed, School of Applied & Environmental Sciences, University of Western Sydney, Hawkesbury

Reference Citation:

Poon, S.K., Reed, S. & Tang, C. (1997). Problem-based Learning in Distance Education. *Proceedings of the 5th International Conference on Modern Industrial Training*, Jinan, China. pp. 593-600.

ABSTRACT

Problem-based learning (PBL) is a curriculum development and instructional system that simultaneously develops both problem solving strategies and learning by placing students in the active role of problem solvers confronted with real-world problems. To achieve its full power, PBL needs to be well designed and the 'facilitators' employing this method need intensive preparation and a good command of PBL techniques. PBL is a student-centred learning process which places emphasis on motivating learners to assume responsibility for their learning and to develop their inquiry ability in the reasoning process. The approach is particularly suitable for distance learning education involving the acquisition and development of disciplinary knowledge and management skills. As described in this paper, PBL in areas of occupational safety and health is a unique example illustrating the viability of the approach for a well-conceived distance learning environment. The values are supported through well-structured PBL problems which challenge students to achieve higher-level critical thinking. We also observe the important role of local tutors in facilitating student-centred learning in distance learning mode.

INTRODUCTION

Recently the international trend towards professional training and lifelong learning has resulted in the need for many employees to study for additional qualifications whilst in full time employment. In areas such Occupational Safety and Health (OSH), it is often the case that a company has only a very limited number of safety representatives who can afford to attend training courses for extended periods of time. While employers are aware of the need to maintain an up-to-date knowledge base within the company, they are also looking for ways of achieving this as cost effectively as possible. These apply equally to public sectors agencies and government organisations. A training programme which does not require the employee to leave the workplace is ideal and hence, more employers and employees are looking into options such as distance learning programmes.

This paper reflects the unique experience of the University of Western Sydney Hawkesbury (UWSH) and The Hong Kong Polytechnic University in providing distance education in areas of advanced OSH and Safety Management at postgraduate level. A strategy to set up OSH distance learning in Hong Kong is briefly described below under 'Problem-Based Learning in Distance Education'. The strategy to be used is consistent with distance learning developments and the university's general philosophy of PBL. In this joint Postgraduate scheme in Occupational Safety and Health (POSH), practical problems are identified within the student's workplace and they are of practical immediate use to their employer.

We will start with some definitions of PBL and systems of distance education. We will then describe the features of PBL in occupational safety & health and safety management, and the PBL process being tried out in the course. Finally, we will address some of the tutoring issues based on the experience gained from this joint distance learning initiative between the two universities.

WHAT IS DISTANCE LEARNING?

The terms, "Distance education" or "Distance learning" are interchangeable and they have been applied with a similar meaning to many programmes, providers and participants. In the main, the basic characteristics are the separation of teacher and learner in space and time (Perraton, 1988), the volitional control of learning by the student rather than the instructor (Jonassen, 1992), and noncontiguous communication between student and teacher, supported by print or some form of technology (Keegan, 1986; Garrison and Shale, 1987).

Distance learning has a rich history as each form of instructional media evolved, from print, to instructional television, to current interactive multimedia technologies. The earliest form of distance learning took place through correspondence courses. Currently, the most popular distance learning media are computer-based communication including electronic mail (E-mail), internet and videoconferencing via sophisticated communication means. Amongst these technologies, Netscape or Microsoft Explorer, a graphical interface to the World Wide Web, has become popular. The use of this new Web-based internet system has only recently been taken seriously by educators over the past two years (Lim, 1997).

However, the major drawback of technology based distance learning is the lack of interaction between teacher and student. McNabb (1994) noted that, though students felt that the accessibility of distance learning courses far outweighs the lack of good communication between teachers and students, there is still a considerable lack of dialogue in technology-based distance learning courses when compared to face-to-face classes.

PROBLEM BASED LEARNING (PBL)

Problem-based learning (PBL), at its most fundamental level, is an instructional method characterised by the use of "real-world" problems as a context for students to learn critical thinking and problem solving skills, and acquire knowledge of the essential concepts of the course. Using PBL, students acquire life long learning skills which include the ability to find and use appropriate learning resources. PBL is also a curriculum development and instructional system that simultaneously develops both problem solving strategies and learning by placing students in the active role of problem solvers confronted with practical problems in the workplace.

PBL is a student-centre learning process which places emphasis on motivating learners to assume responsibility for their learning and to develop their inquiry ability in the reasoning process. To achieve its full power in distance learning, PBL needs to be well designed and lecturers/tutors employing this method need intensive preparation and a good command of PBL techniques.

Lecturers/tutors in PBL curriculum need to alter their teaching role. Hilary Perraton (1988) defines the role of a distance teacher as a facilitator. When, through the most effective choice of media, a lecturer or local tutor meets the distance students face-to-face, and becomes a facilitator of learning, rather than a communicator of a fixed body of information. The approach is particularly suitable for distance learning involving the acquisition and development of disciplinary knowledge and management skills to meet local industry needs.

THE POSTGRADUATE SCHEME IN OCCUPATIONAL SAFETY & HEALTH (POSH)

The content of the Postgraduate scheme in Occupational Safety and Health, jointly offered by the University of Western Sydney, Hawkesbury (UWSH), and the Hong Kong Polytechnic University, was considered in the context of distance learning mode. The programme was launched in mid of 1996 but the planning of which can be traced back to 1994. Considerations at the planning stage were given to the needs of the students and industry rather than on the distance learning technology itself. The idea was for the course to be developed by starting with a set of practical problems rather than a list of traditional topics for lectures. This was done by considering what a student should be able to do in stead of what she/he should know.

The programme was designed to enable the students to use research principles to:

- identify occupational safety problems and to develop appropriate remedial strategies.
- critically analyse the risks, process and outcomes involved in the development of occupational safety strategies.
- reflect critically on their own practice and that of their peers.
- describe new developments in science and technology in the assessment and management of occupational health and safety.
- demonstrate interpersonal and communication skills required for the effective management of occupational health and safety policy.
- be more aware of personal and group learning processes.

The structure and curriculum of the course will enable the graduate to extend their abilities in a diverse manner encompassing many disciplines. The program aims to produce graduates who will provide leadership in the field of occupational health & safety. It is anticipated that they will actively participate in the management and planning of strategic initiatives for the amelioration of traumatic accidents, and be actively involved in the generation and participation of research into specific problems that are causing industry to be uncompetitive and unsafe (University of Western Sydney, Hawkesbury, 1997 Course Handbook).

THE FEATURES OF PBL IN OSH AND SAFETY MANAGEMENT

The traditional type of projects in OSH training (originating in risk and hazard identification, and accident investigation) have shaped problem-based learning in this course. Safety management projects and related case studies are typically based on system safety analysis, risk assessment, accident phenomena and causation models. The broadening of this type of project to include management techniques, incorporation of other disciplines and amalgamation of various safety technologies, project management and policy development have led to a more integrated learning mode approaching situations that the student might experience in the workplace. By contrast, in traditional discipline-based learning such as construction safety, electrical safety, process safety, etc., only the individual tools tend to be developed, and the management context within which these tools are to be used can be lost.

In this course, a practical problem in the workplace is often presented in its context as much as possible, and students work in small groups to define and solve the problem. They typically must access various resource materials in order to find suitable information, data and techniques. Typical resources might be text/library books, printed study guides, reading materials, videos, and Web-based internet resources.

The programme is undertaken by distance education which utilises a combination of well developed study notes and books of readings together with lectures for each subject within the programme. Students are expected to make their own progress through each subject on an independent study basis using the distance education materials. Each

subject includes compulsory lectures/ workshops supplemented by tutorials. Lectures, workshops and tutorials are held on weekday evenings and weekends in the Hong Kong Polytechnic University.

THE PBL PROCESS

In this Postgraduate scheme, the PBL process takes place in four phases:

1. During the workshop conducted by a lecturer of UWSH, Students are presented with a problem (a case, a practical task assignment, or an investigation). Students (usually in groups) organise their ideas and previous knowledge related to the problem, and attempt to define the broad nature of the problem.
2. In the tutorial sessions, with the guidance of a local tutor, students pose questions in their group discussion on aspects of the problem that they do not understand. Students are continually encouraged to define what they know - and more importantly - what they don't know. These questions represent the "learning issues" to be addressed. During the discussion, students reason their way through the problem, bringing out prior knowledge they may possess to understand the basic mechanisms responsible for the health and safety problems and how these problems might be managed and, to identify the additional knowledge and skills that they need to better understand and manage the OSH problems.
3. When the students have gone as far as they can with the problem, they determine what resources they will use (e.g. course study guides, recommended reading materials, library, computerised data bases, on-line internet information sources, etc.) to gain the knowledge and skills needed. This is followed by a period of self-directed study during which the students, independent of the tutor, consult resources and work collaboratively in small group or individually.
4. In the final phase students apply the newly gained knowledge back to the problem, critique their prior thinking and knowledge, refine their understanding of the OSH problem, and develop concepts and abstractions. They also synthesise and reflect what they have learned in their assignment report, relate it to prior problems and anticipate how it might help with future problems.

EXAMPLES OF PBL IN OSH STUDY

In designing a 'problem', several concepts of a particular subject were incorporated into a single problem. For example, design of a safety management programme in a workplace includes a good understanding of the local legislative requirements, OSH policies, key process elements of OSH management as well as the need for proper documentation. Example 1 shows a typical assignment in Safety Management.

Example 1 : Recommend the key process elements of an OSH management programme based on a detailed needs assessment undertaken in a real workplace. Document the steps you took in arriving at the programme design.

In this assignment, a student is confronted with the big issues of safety management, rather than learning about the key process elements from the information provided by the lecturer or textbooks. With different perception and working environment, each student might come up with a set of elements which is unique to his/her workplace but might be different from those suggested by his peers. Putting the ideas together through brainstorming and group discussion, a more thorough understanding of how an OSH management programme is devised.

Alternatively, students are given an option to design, conduct and report on a complex work system safety audit in a real workplace.

Example 2 : Design, conduct and report on a complex work system safety audit in a real workplace. Complicated work in a confined space or other work requiring clearance certification would be an appropriate example of the sort of work you should choose. (Please do not choose a simple work such as answering the telephone.)

In this assignment, aspects of safety policy, planning and implementation of a safety programme, hazard and risk management, compliance with legislation and regulations, etc. are the considerations required of an experienced safety practitioner who performs many of the functions to ensure an effective safety programme is introduced in the workplace.

A wider view than this can also be taken. As most project and problem work involves group work, the added dimension of managing the group, and the interrelated group dynamics could also be developed as part of the problem. Work along these lines has been undertaken as part of the OSH and management subjects in this joint programme between the two universities. It would be very appropriate that this be explicitly included in the content of the course. The review of the system of why, when, what and how things happen would then be of increased relevance to the students.

By comparison, if the traditional 'spoon-fed' method is used, there is little linkage to the real-world problem to entice the desire for more knowledge.

The improvement in student motivation and enjoyment of learning is a significant purpose for PBL. The desire for learning, as well as emotional and other qualities of human behaviour that take part in the learning process, are often ignored in the training process, but are nonetheless present and important. The introduction of different values into the OSH learning process comes from integration of many disciplines that are involved in safety and health. Students find that they need little guidance at achieving good solutions to a large variety of problems in their studies by using PBL. A further benefit is that they see the relationship between their studies and their daily work.

FEATURES UNIQUE TO THE PBL PROCESS

As can be seen from the above examples, the problems used are based on real workplace/tasks, the simulations require the students to apply the same reasoning used in safety practice, and all the behaviors required in learning are the very behaviours required in the world of professional safety practice. It has the following characteristics rarely found in other courses involving distance education:

1. the development of occupational safety and health reasoning skills is directly addressed and facilitated in the format of the problems and in the PBL process employed.
2. the process is student-directed, not teacher directed, at every step. The subject matter to be learned, the resources used and the time to be allocated to study with each problem are determined by the students guided by the tutor as necessary.
3. a lecturer from the host university and a local tutor are available to meet the distance students face-to-face, and becomes a facilitator of learning, rather than a communicator of a fixed body of information.

These are the unique features that make PBL a viable and effective approach in distance education without relying too much on sophisticated information and interactive communication support. In addition to these characteristics, good problems should challenge students to achieve higher-level critical thinking. Too often, students view learning as remembering facts, terms and definitions in order to answer questions on tests. Many students seem to lack the ability or motivation to go beyond factual material to a deeper understanding of a subject.

THE TUTORING EXPERIENCE

The POSH programme was launched in mid of 1996. Upon completion of the first stage of work, the local tutors were invited to provide feedback on their experience of tutoring in the first offering of PBL with a view to both learning from the experience and offering ideas and suggestions for the future. Topics raised included: (1) what they felt about the experience, (2) how they had gone about conducting the tutorial sessions and (3) their evaluation of the approach. The following is a summary of the feedback :-

Content to be covered

The findings from the feedback have produced a varied portrait of what the experience of tutoring was like for these tutors doing PBL for the first time. They said that it was a good teaching experience for them but some of them seemed unclear about how much content they were to teach when they first read the problem statements. Their concerns were resolved after discussion with the subject lecturer who designed the 'problems' in the first place.

Understanding the purpose of PBL

While the feedback from a review such as this do not provide conclusive proof, they do provide a picture of perspective in the process of implementing a new focus. It is important to keep in mind that this was a first time offering and that most of the tutors were novices at this type of training. Many of them were willing to take the chances involved in such a new venture. For some, however, there were times of frustration and anxiety. This was to some extent due to lack of clarity about the nature and purpose of PBL. In spite of attempts to clarify the aims of PBL, the message did not get through to all staff or students.

Training of Local Tutors

Training for tutors was provided largely through a 4-day training workshop offered by the Education Development of the Hong Kong Polytechnic University. Some progress was made in helping the tutors to see the students in a more adult-like manner. What did happen, however, was that the process encouraged students to see themselves as responsible for their learning. Observations suggested that many students felt a real sense of ownership over the content and of the progress. This, in turn, caused most of the tutors to express respect for the work of the students. Therefore, one might conclude that much of the necessary behavioural change will come through positive experiences of tutoring more than through actual training. Some of the improvements for ongoing learning of PBL approaches may have to include peer tutoring, feedback from students and discussions with "experts" on what was observed.

Recruitment of tutors

Other major concerns were about recruitment and the preferred background experience of the tutors. The feedback suggested that recruitment for the first round was varied and that the reasons people gave for becoming involved was quite typical. Some tutors said that they had a little extra time which they were interested in spending with PBL. A subjective impression is that those who tutored the first round were willing to take chances with something new and were conscientious enough to make it work.

OTHER OBSERVATIONS

Time demands

Although students generally favour PBL courses, and their ability to solve real-life problems appears to increase over traditional instruction, the tutors have not given adequate attention to the move toward this type of learning.

Contributing to this divergence is the time requirement placed upon staff to cope with the changes, think critically about the problems, search information, prepare tutorial materials and allow themselves to see the correlation between the problems and training objectives.

Role of the student

Another major problem with PBL is the traditional assumptions of the student. Most students have spent their previous years assuming their teacher was the main disseminator of knowledge. Because of this orientation towards the traditional memorisation of facts required of students, many students appear to have lost the ability to cope with the change.

Role of the teacher

Lecturers/tutors in PBL curriculum need to alter their traditional teaching methods of lectures, discussions, and asking students to memorise materials for tests and examinations. In PBL, the lecturer/tutor acts more as a facilitator than disseminator of information. As such, instructors focus their attention on questioning student logic and beliefs, providing hints to correct student reasoning, providing resources for student research, and keeping students on task. Because this role will be foreign to some tutors, they may have trouble breaking out of their past habits.

Appropriate problems

Generating the proper question is the most critical aspect of PBL. Without appropriate problems, there is a good chance that important subject matters will not be covered. If the students are expected to work more on their own, and think for themselves, then less content is expected to be covered within the time constraint. The trick is to make sure that the key concepts are included in the problems being solved. The students will, in turn, pick up much of the peripheral issues - sometimes in greater depth than in a traditional course, sometimes less. What the students are learning is that knowledge must be assembled from many sources when solving problems - not spoon fed in lectures. They must think in order to assemble the knowledge into problem solutions. This is an excellent preparation for life as a safety professional.

CONCLUSIONS

As the problems faced by safety professionals become more complex, it seems obvious that advanced training in OSH must also adapt. At postgraduate level, there is a need for more PBL, built around real-world problems. This has the advantages of placing the individual safety management skills in context, and of motivating the students to succeed. At the moment, there is too much emphasis on individual knowledge and skills without corresponding guidance in the integration of these skills in solving real-life problems.

Safety professionals are facing an increasing diversity of problems for which standard techniques are sometime not readily available. Skills for handling such problems must be built at university by tackling several such problems. Although basic safety knowledge is important, the ability of the student to integrate the knowledge is crucial. This can only be learned through practice in courses where the content becomes the problem solving environment rather than the substance of the course.

REFERENCES

- Cambre, M.A. (1991). The state of the art of instructional television. In G.J. Anglin, (ed.), *Instructional technology, past, present, and future* (pp. 267-275). Englewood, CO: Libraries Unlimited.
- Jonassen, D.H. (1992). Applications and limitations of hypertext technology for distance learning. Paper presented at the Distance Learning Workshop, Armstrong Laboratory, San Antonio, TX.
- Keegan, D. (1986). *The foundations of distance education*. London: Croom Helm.
- Lim, B.L. (1997). Generating an IT Culture in Education. Keynote speech delivered at the Symposium of "Education on Demand", (The Hong Kong Polytechnic University), 22 Apr 1997, Hong Kong.
- McNabb, J. (1994). Telecourse effectiveness: Findings in the current literature. *Tech Trends*, 39-40.
- Perraton, H. (1988). A theory for distance education. In D. Sewart, D. Keegan, & B. Holmberg (Ed.), *Distance education: International perspectives* (pp. 34-45). New York: Routledge.
- University of Western Sydney Hawkesbury, 1997 Course Handbook (Master of Applied Science, Safety Management), UWSH, Sydney.