

data, reading journals, consulting colleagues or merely looking it up in the dictionary!). Admitting to students that we don't always know the answer can feel risky - will we lose our credibility? - but by supporting the student in finding the answer for themselves, we have the potential to provide them with valuable skills training as well as deeper, and possibly more extensive, learning.

To Summarise

The intention of this publication is to provide information on PBL, rather than to advocate it as 'the only way to teach'. However, the processes and issues involved in learning and teaching through PBL are transferable to other types of learning environment. To quote Chris Lee:

"In summary, therefore, PBL postulates that:

- 1) Learning through problem solving is much more effective for creating in a student's mind a body of knowledge that is useable in the future, than didactic traditional methods of learning.
- 2) In life / industry, problem solving skills are more important than factual memory recall alone."

Further Sources of Information

In addition to the references quoted in the articles, further sources of information and examples of practice can be found at:

- Your institution's educational development unit (or equivalent)
- LTSN-GEES PBL Enquiries: The team working with the LTSN-GEES Environmental Science Senior Advisor has considerable expertise in PBL and can offer advice and information for anyone in Geography, Earth and Environmental Sciences. Contact Marianne Hall: m.hall@herts.ac.uk
- LTSN-GEES Resource Database (contains examples of practice from Geography, Earth and Environmental Sciences)
<http://www.goodpractice.gees.ac.uk/>
- "A Staff Resource Book to Support Earth Science Learning and Teaching in Higher Education"
A few hard copies are available from LTSN-GEES or the handbook can be downloaded for free from the LTSN-GEES web-site: (<http://www.gees.ac.uk/Resbook.pdf>). This contains some examples of practice on PBL in forensic geology, geophysics and mineral exploration and exploitation.
- Hertfordshire Integrated Learning Project (HILP)
<http://www.herts.ac.uk/envstrat/HILP/>
"HILP is a multi-disciplinary consortium covering eleven subjects at the University of Hertfordshire, led by the Department of Environmental Sciences. One of the most significant facets of the HILP project is the development of Problem-Based Case Studies. The purpose of such studies is to provide students and staff with a number of situations and exercises which may be used in the design, development and support of Problem-Based Learning (PBL)."
- LTSN Generic Centre Project on Problem-based Learning
Project details: http://www.ltsn.ac.uk/about/prob_based.asp
PBL web-site: <http://heracles.coventry.ac.uk/pbl/>

Helen King
LTSN-GEES
h.king@plymouth.ac.uk

The Problem-Based Learning Landscape



Maggi Savin-Baden, Coventry University

Introduction

Problem-based learning is an approach to learning that has grown in breadth and depth across the world since the 1970s, yet the bulk of the literature concentrates on practical applications of problem-based learning in particular settings rather than on the examination of the complexities and challenges involved in its application. Problem-based learning is increasingly being seen as a means of managing knowledge explosion, since curricula can no longer expand to cope with such demands. As a result students involved problem-based programmes are increasingly being equipped to 'manage knowledge' rather than being expected to have assimilated it all before entering employment.

There have been many debates about what counts as problem-based learning and how it may and may not be used in higher education. In this article I will begin by describing the background and development of problem-based learning, argue that there is a difference between problem solving learning and forms of problem-based learning and then suggest that it is possible to use problem-based learning in a variety of ways within curricula.

Background to Problem-based Learning

It is possible to trace the origins of problem-based learning right back to early forms of learning that demanded the diverse kinds of problem-solving and problem management that we can see in problem-based curricula. Socrates presented students with problems that through questioning enabled him to help them explore their assumptions, their values and the inadequacies of their proffered solutions. More recently the work of Dewey (1938) has influenced the way in which knowledge is perceived - not as something that is reliable and changeless but as something that is an activity, a process of finding out. Dewey's challenge to the world of science - that we are the very stuff and substance of the world and as such we must work from the middle of a situation in which our most reliable beliefs are at best imperfect or inadequate - is that we are not spectators, but agents of change. Dewey's perspective was thus a pragmatic stance towards knowledge. He argued that knowledge was bound up with activity and thus he opposed theories of knowledge that considered knowledge to be independent of its role in problem-solving inquiry. His views on this were played out in practice by his emphasis on learning by doing, which can be seen as essentially a problem-solving approach to learning. The fact that much of what Dewey proposed is now largely taken for granted in many areas of higher and professional education can perhaps be said to be a measure of his success.

Problem-based learning was popularised in the 1960s as a result of research by Barrows (Barrows and Tamblyn, 1980) into the reasoning abilities of medical students. Their research stemmed from a desire to develop in medical students the ability to relate the knowledge they had learned to the problems with which the patients presented something they found that few medical students could do well. Yet when Barrows and Tamblyn undertook their study, which in many ways could be said to have alerted the world of higher education to problem-based learning, they probably had little real understanding of the world-wide impact it would still be having decades later. What they highlighted were clear differences between problem-solving learning and learning in ways which used problem scenarios to encourage students to engage themselves in the learning process; problem-based learning.

Yet the attraction of problem-based learning and its uptake in the 1970s and 1980s in Canada, Australia and the United States, and in the late

1980s in the UK, seemed to lie not only in its timely emergence in relation to other world-wide changes in higher education, but also because of new debates about professional education. These related to a growing recognition that there needed to be not just a different view of learning and professional education, but also a different view about relationships between industry and education, between learning and society and between government and universities. Such debates continue today.

Problem-based learning or problem-solving learning: a vital distinction

There is currently confusion about the difference between problem-based learning and problem-solving learning. Problem-solving learning is the type of teaching many tutors have been using for years, where the focus is upon giving students a lecture or an article to read and then a set of questions based upon the information given. Students are expected to find the solutions to these answers and bring them to a seminar as a focus for discussion. In some curricula students are given specific training in problem-solving techniques, but in many cases they are not. The focus in this kind of learning is largely upon acquiring the answers expected by the lecturer, answers that are rooted in the information supplied in some way to the students. Thus the solutions are always linked to a specific curricula content which is seen as vital for students to cover, in order for them to be competent practitioners and/or eligible to receive an honours degree. In this kind of learning the role of the facilitator is largely focussed on examining the students' knowledge through Socratic methods. The solutions are therefore clearly bounded by the content and guided by the facilitator.

Problem-based learning is different. The focus here is in organising the curricular content around problem scenarios rather than subjects or disciplines. Students work in groups or teams to solve or manage these situations but they are not expected to acquire a predetermined series of 'right answers'. Instead, they are expected to engage with the complex situation presented to them, and decide what information they need to learn and what skills they need to gain, in order to manage the situation effectively. There are many different ways of implementing problem-based learning, but the underlying philosophies associated with it as an approach are broadly more student-centred than those underpinning problem-solving learning. This is because students are offered opportunities, through problem-based learning, to explore a wide range of information, to link the learning with their own needs as learners and are encouraged to develop independence in inquiry. Problem-based learning is thus an approach to learning that is characterised by flexibility and diversity in the sense that it can be implemented in a variety of ways in different subjects and disciplines in diverse contexts.

Using problem-based learning in various ways within curricula

There are many ways of implementing problem-based learning in curricula and what you do depends upon a number of issues.

- The organisational support for problem-based learning;
- The discipline in which you want to use it;
- The extent to which staff are prepared to implement problem-based learning;
- The provision of staff development.

1. The organisational support for problem-based learning

There is little point in attempting to implement problem-based learning wholesale across a curriculum unless you have got support for this approach to learning within the wider structure of the university. This may sound incredibly negative but without support and funding it is difficult, hard work and demoralising. Universities who provide staff with time to develop the curriculum and materials, along with monies to bring in experts to help seem, world-wide, to be much more successful than those that do not.

2. The discipline in which you want to use it

Many people have suggested that it is easier to implement problem-based learning in some disciplines rather than others. The argument is often made that it is easier to use problem-based in applied disciplines such as health and engineering. However colleagues in maths and physics say it is possible there too. Many of the arguments about the use of problem-based learning in different disciplines relates to the traditions of the discipline, ways of teaching, views about knowledge and the space available for small group work.

3. The extent to which staff are prepared to implement problem-based learning

Implementation of any innovation or change in curricula is hard work and time consuming, whether it is the introduction of Web CT, action learning, new forms of assessment or problem-based learning. To implement an innovation such as problem-based learning you need commitment from staff. This does not demand that everyone has to be a problem-based learning facilitator, but it does mean that most people have to agree to its implementation. If it is imposed on staff then they can become very effective saboteurs. Implementing problem-based learning also often feels risky because it demands a shift away from designing curricula around chunks of content. Instead, learning is centred around problem situations - lectures, labs and tutorials are value added.

4. The provision of staff development

Effective staff development is now perceived to be one of the keys to successful implementation of problem-based learning. A workshop approach, with the incremental development of cohorts of facilitators, seems to develop a sense of cohesiveness amongst the groups of facilitators and is a valuable source of support and advice for the teaching staff (Murray and Savin-Baden, 2000; Savin-Baden, 2000). The key issue seems to be one of ensuring that contentious issues are debated in an open forum and that dissent is tolerated and managed, thus avoiding the situation of two or more opposing camps expending more energy defending their own standpoint(s) than contributing to the development of the curriculum. Thus recommendations that have resulted from research and practice, are:

- Preparation of facilitators needs to start as early as possible, at least one year in advance of the commencement of the programme/module in which problem-based learning is to be used;
- The development of trigger materials should involve all groups of staff contributing to the delivery of a particular module;
- Learning resources are vital to the success of problem-based learning and related departments need to be involved from the outset;
- Faculty support is vital to the success of introducing problem-based learning into the curriculum;
- In depth discussion of assessment methods should be a key component of any staff development programme.

In conclusion

Problem-based learning can help students to see that there are not straightforward answers to problem scenarios, but that learning and life takes place in contexts, that affect the kinds of solutions that are available and possible. Learning such as this is not just a simple method of solving problems, but it helps people to learn how to learn and to link learning with their own interests and motivations. Problem-based learning is an approach to learning that can offer students opportunities to develop independence in inquiry and the ability to contest and debate. For staff it can offer a means of responding to the problem of ever increasing pressures on curriculum content and for implementing teaching that is grounded in the world of work which can stimulate students to engage with the complexity and diversity of everyday problem situations.

References

- Barrows, H.S. and Tamblyn, R.M. (1980) *Problem-based Learning, an approach to Medical Education*. New York: Springer.
- Dewey, J. (1938) *Experience and Education*. New York: Collier and Kappa Delta Pi
- Murray, I. and Savin-Baden, M. (1999) Staff development in Problem-based learning, *Teaching in Higher Education*, 5 (1)
- Savin-Baden, M. (2000) *Problem-based Learning in Higher Education: Untold Stories*. Buckingham: Open University Press/SRHE.

Maggi Savin-Baden

Coventry University

m.savinbaden@coventry.ac.uk

Using Problem-Based Learning to Develop Graduate Skills



Jennifer Blumhof, Marianne Hall and
Andrew Honeybone,
Hertfordshire Integrated Learning Project (HILP)

Introduction

The Hertfordshire Integrated Learning Project's ⁽¹⁾(HILP) model for developing Graduate Skills is based on the integration of skills development with academic content using problem-based learning (PBL) as the integrative mechanism. This paper considers how, in modified form, it can be used as one of the principal means of implementing an explicit embedded approach to skills development in the curriculum. The modified form, developed to suit local conditions and requirements, is referred to as the HILP hybrid PBL model.

What is Problem-Based Learning?

PBL is an approach to learning and teaching that encourages the development and application of problem-working strategies and the acquisition of disciplinary knowledge bases and skills by placing students in the role of problem-workers⁽²⁾. The emphasis may vary between attention given to the process of problem-working to greater attention being given to the solving of the problem. Students usually work in small groups on specific problem-based exercises supported by relevant case study material and tutor expertise. The problem has to be analysed in terms of underlying principles, mechanisms or processes through group discussion and the study of relevant resources. PBL is often introduced at an early stage of the HE learning process and problems presented are appropriate to the level of study. At this early stage tutors usually need to provide a substantial amount of scaffolding and guidance. During subsequent years, problems may increase in complexity and tutor scaffolding decreases culminating in a final year project.

It has been suggested that PBL can be a very effective learning method in that it is a vehicle for stimulating academic study that enables the natural acquisition of transferable and discipline-specific skills. Through PBL activities students are expected to develop the ability to:

- identify information to understand the problem;
- identify resources to be used to gather information;
- pose questions;
- formulate and test hypotheses;

- make decisions;
- generate possible solutions;
- analyse solutions;
- present solutions/conclusions orally and/or in writing.

Students are also encouraged to engage positively in the learning process by:

- directing their own learning;
- being active, reflective and critical learners;
- thinking deeply and holistically;
- extending learning beyond the presented situation (the 'problem') into new areas whereby some transfer of skills may take place.

In other words, students are being given the opportunity of acquiring a range of skills, often with a discipline-specific slant, and to understand their importance in a wider context.

Of special relevance to HILP is the stress that much of the literature on PBL puts on the process of learning and then on its indivisibility from content. Barrows and Tamblyn (1980) for example, define problem-based learning as "the learning that results from the process of working toward the understanding or resolution of a problem. The problem is encountered first in the learning process." Margetson (1997) then develops the link with content by arguing that within the education system "content and process are like two blades of a pair of scissors. Unless the blades function together properly, they don't work". In PBL content and process are treated as an integrated whole, stimulating knowledge, understanding and skills development. The Centre for Problem-Based Learning at Illinois Mathematics and Science Academy advocates PBL because it "...simultaneously develops both problem solving strategies and disciplinary knowledge bases and skills." (IMSA, 1998). It can also be argued that PBL encourages students to achieve those higher educational objectives defined by Bloom et al. (1956) as the intellectual skills of analysing, synthesising and evaluating.

It is in the light of these arguments that HILP has adopted PBL as the key learning mechanism for integrating skills development with academic content and why learning how to learn skills (e.g. self-assessment, self-reflection) have been included in the self-management category of its Graduate Skills Menu⁽³⁾.

The Development of Problem-Based Learning

Interest in implementing PBL in Higher Education (HE) curricula appears to have occurred at a time when the purpose of HE and its relationship with 'outside' worlds of business, industry and society has been challenged and changed. In her discussion on the origins of PBL, Savin-Baden (1998) maintains that "the growing popularity of PBL in the late 1970s and 1980s could be said to be aligned to a more global philosophy which recognised that there needed to be not just a different view of learning and professional education, but also a different view about relationships between industry and education, between learning and society and between government and universities."

How and where problem-based learning originally developed has been reported differently. Alavi (1995) reports that in its modern form, PBL has been a distinctive method since the 1950s, when Case Western Reserve University began developing a problem-based course in its medical faculty. However, the development of the 'medical school' model, centred on problem-based tutorials, is more often attributed to the Faculty of Health Sciences at McMaster University, Canada, around 1965 where its originators were apparently influenced by the case-study method as developed at Harvard Law School in the 1920s (Schmidt, 1993). The Harvard Medical School adopted a 'hybrid model' of PBL by integrating problem-based tutorials with traditional lectures, labs and conferences in order to accommodate a variety of learning styles (Armstrong, 1998).