# Problem based learning

An introduction

## What is Problem Based Learning?

Problem based learning (PBL) is a style of learning in which the problems act as the context and driving force for learning. All learning of new knowledge is done within the context of the problems. PBL differs from problem solving in that in PBL the problems are encountered before all the relevant knowledge has been acquired and solving problems results in the acquisition of knowledge and problem-solving skills.

## Where did it come from?

PBL is well established in medical education. It started at the McMaster University in Canada in the 1960s. Since then it has spread across other practice-based, health related disciplines such as nursing, social work, dentistry, veterinary science, nursing, etc. PBL is now being adopted in other 'professional' disciplines such as architecture, law, management, and engineering and there is an increasing trend for it to be used within other disciplines.

## What are the outcomes of a PBL approach?

It is claimed that a PBL approach produces more motivated students, develops a deeper understanding of the subject, encourages independent and collaborative learning, develops higher order cognitive skills and develops a range of skills which include problem solving, group working, critical analysis and communication.

## How is it different in practice?

In PBL, the curriculum is organised around the problems. Consequently, students learn the 'content' that is required to solve those problems. So problems have to be carefully matched to the desired learning outcomes. In PBL students work in groups to solve the problems. There are no lectures, instead students engage in self-directed learning and the tutor acts as a facilitator, mentor or guide.

## How do PBL students compare with traditional students?

Research suggests that PBL students perform as well as or slightly worse than students from traditional courses on conventional examinations of knowledge. However, PBL students are superior with respect to their approach to study and learning, long-term retention of knowledge, motivation, use of resources, key skills and subsequent success as postgraduates.

## What makes PBL problems different?

Problems that are used for PBL should address curriculum objectives, be real and engaging, be 'fuzzy', place the group in a professional role, i.e. as scientists, require students to develop a problem solving strategy, require the acquisition of new knowledge and require the students to make judgements, approximations and deal with omitted/excess information.

## How does PBL work in practice?

During the first classroom session the students are divided into groups and presented with the problem. They may brainstorm in order to clarify the nature of the problem and identify their learning needs, They may delegate roles within the groups and share existing knowledge. The tutor's role is one of observation, guidance and support. Outside the classroom session, the students engage in independent study in order to fill any gaps in subject knowledge. They come together again in a group or classroom session to share and critically evaluate resources and information gathered. Using the newly acquired information they work towards a solution to the problem. Again, the tutor's role is one of guidance and support. This cycle of independent study, group interaction and critical analysis may be repeated as many times as dictated by the problem. Eventually the students present their solution and reflect on the process and solution.

## What about assessment?

As this is a very different type of learning activity it may not be appropriate to assess students in a traditional way. The assessment should be matched to the desired learning outcomes. Assessment may focus on the solution to the problem, or the problem solving process or the skills development aspect. Tutors must decide whether they wish to give each member of a group the same mark or whether they wish to build in an individual element. Students may be involved in assessing each other's contribution to the activity or may be involved in self-assessment and reflection. Useful assessment tools include logbooks and diaries, written reports, oral presentations and reflective evaluation.

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## What are the resource implications?

The major resource implication is time; time to develop and trial good problems, to train staff and to tutor the students. PBL takes more staff time than traditional methods because the group sizes have to be restricted. A PBL session with 200 students in a lecture theatre doesn't work! Many institutions may be short of the sort of space that helps PBL work well – flat seminar rooms with movable furniture. In addition students need to have ready access to any relevant resources in the library, Internet etc.

## What are the advantages of PBL?

Students should develop the ability to learn and gain a sound understanding of knowledge. They should be able to make sense of the material by integrating new knowledge with prior knowledge and experiences. In order to successfully solve the problems student should develop a range of critical, cognitive and transferable skills within the context of their discipline.

## And the disadvantages?

Time and resource implications should not be underestimated. In addition, the content covered in this way is reduced compared to the amount that is covered in lecture-based courses. PBL may be a new experience for staff and students and they may require some support or training. Group work often suffers from non-participation or personality clashes and strategies have to be put in place to deal with groups that don't work. Some students may not take the need for independent study seriously and some time may be required to make to make clear the outcomes and commitment required.

## Are there any factors that aid successful PBL?

As PBL is different from traditional lecture-based learning then the assessment strategy has be changed accordingly. Tutors should consider what the desired outcomes of the PBL activity are and then match the assessment tools to those outcomes. Students should be clear about how they are going to be assessed and careful use of assessment tasks can motivate students to take the experience seriously. The tutor should decide whether the each student is going to get the same mark as the rest of the group or whether there is going to be an individual contribution built in to the assessment scheme. The implications of each should be discussed with the students

As with many group-based activity, it is usually helpful to randomise the student groups rather than let them choose their own groups. The tutor should check at each stage that students have a strategy for their independent work and problem solving in order to ensure they come back with meaningful information. The tutor should decide whether it is important that the students get the 'right' answer or whether it is acceptable to let the students go down a 'blind alley' for the sake of the learning experience involved.

A PBL activity should be rounded off with a tutor led debriefing to encourage reflection on the process and tidy up loose ends.

## Useful Resources

'The Challenge of Problem-Based Learning' by David Boud, Grahame Feletti, Kogan page, 1991

'Problem-Based Learning in Higher Education : Untold Stories' Maggi Savin-Baden, Open University Press, 2000

Facilitating Problem-Based Learning, Maggi Savin-Baden, Open University Press, 2003.

PossiBiLities:a Practice Guide to Problem-based Learning in Physics and Astronomy, Derek Raine and Sarah Symons, HEA Physical Sciences, 2005 www.heacademy.physsci.ac.uk

<ublib.buffalo.edu/libraries/projects/cases/ubcase.htm>

<www.udel.edu/pbl/>

<www.fhs.mcmaster.ca/pbls/>

<www.mcli.dist.maricopa.edu/pbl/problem.html>

A review of useful PBL web resources can be found in the UK Physical Sciences Primer 'Web Resources for PBL'.

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