Problem-Based Learning

General

Problem-based learning is a constructivist instructional strategy. One of the first and most commonly cited examples of problem-based learning was introduced in **1960s** medical education in Canada. It suggests learning will be more effective if **learners are faced with a real-life practical problem** they need to solve and

- "*empowers learners to conduct research, integrate theory and practice, and apply knowledge and skills to develop a viable solution to a defined problem.*"[1)]

What is problem-based learning?

In the 1960s at the McMaster University in Canada it was noted that medical education students were mostly bored during their classes, until they reached a stage where they were supposed to work with patients and try to help them solve their problems. It was then decided that biomedical problems, analyzed in small groups would be introduced into whole educational process, what remained a practice until today[2)] and has also spread to other medical schools as well as other fields like nursing, law, engineering, management, business administration and other[3)4)].

Although problem-based learning can be implemented on a variety of ways, its main **characteristics** are the following[5)]:

- Problem-based learning is a **learner-oriented approach**. "*Under the guidance of a tutor... the students must take **responsibility for their own learning**, identifying what they need to know to better understand and manage the problem on which they are working and determining where they will get that information...*"[6)]
- Learning occurs in **small groups** with usually 5-8 members and collaboration with other learners is necessary.
- Teacher has the role of a facilitator. Not by correcting students or providing them knowledge and guidance but by **asking questions** that the learners should be asking themselves in order to better understand the subject and by encouraging them to **apply their knowledge**.
- New (possibly interdisciplinary) information is acquired through **self-directed learning** and has to be applied on the problem.
- The **problem** learners are dealing with must be similar to **real-world** problems, **motivating** and **ill-defined** to enable multiple hypotheses to be constructed.

A possible **flow** of a problem-based learning course expects the following tasks from the students:

- be **presented with a problem** with characteristics described above,
- **discuss**, clarify the problem (activate prior knowledge[7)]) and develop a plan for further working on the problem,
- **work on the problem independently** and learn through self-discovery,
- **share and discuss** their individual approaches and work together,
- **present their solutions** to the problem, and
- **review** what they have learned.

Problem-based learning can be a helpful method in the educational process, but it can also be viewed as a **total education strategy**[8].

Different experimental results have been obtained using problem-based learning, but generally showing not much difference in declarative knowledge in students learning through problem-based design and those using classical teaching methods. Still, there is evidence that problem-based learning **supports development of reasoning skills, problem-solving skills and self-directed learning skills**[9].

What is the practical meaning problem-based learning?

An example of problem-based learning from an introductory course in psychology[10]:

PBL: Little Monsters	
The problem: *Coming home from work, tired and in need of a hot bath, Anita, an account manager, discovers two spiders in her tub. She shrinks back, screams, and runs away. Her heart pounds, a cold sweat is coming over her. A neighbor saves her from her difficult situation by killing the little animals using a newspaper. Explain what has happened here.*	**PBL activities**: Activities begin with a discussion where unknown terms are clarified and students use their prior knowledge to describe processes underlying described phenomenon and develop theories. Issues that arise will be dealt with during individual learning. For example, students will learn about the nature of phobic fear, classical and operant conditioning in fear development, biological basis and evolutionary reasons for such responses, or treatment of phobic fears. Group will meet two or three times a week to discuss and see if students' understanding of the problem has deepened due to individual research. The tutor will stimulate discussion and monitor students' activity and contributions. Between group meetings individual learning and discovery takes place.

Criticisms

Problem-based learning was addressed in criticisms of Kirschner et al.[11] These criticisms mostly refer to cognitive load imposed by **lack of guidance**, possible **frustration** caused by lack of knowing what is important, what should be learned and where these information can be obtained. It also ignores the proved positive effects of **worked examples**.

A reply to these criticisms was written by Schmidt et al.[12] and Hmelo-Silver et al.[13][14][15].

Keywords and most important names

- **Problem-based learning**, **PBL**, **discovery-learning**, **self-discovery**

Bibliography

Barrett, Terry, Iain Mac Labhrainn, and Helen Fallon. Handbook of Enquiry and Problem-Based Learning: Irish Case Studies and International Perspectives. CELT, NUI Galway, 2006.

Savery, J. R. Overview of problem-based learning: Definitions and distinctions. The Interdisciplinary Journal of Problem-based Learning 1, no. 1: 9–20. 2006.

Roberts, N. Problem Based Learning: Generic Problem Based Learning Essentials. Retrieved April 20, 2011.

Kirschner, P. A, J. Sweller, and R. E Clark. Why minimal guidance during instruction does not work: An analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching. Educational psychologist 41, no. 2: 75–86. 2006.

Sweller, J., P. A Kirschner, and R. E Clark. Why minimally guided teaching techniques do not work: A reply to commentaries. Educational Psychologist 42, no. 2: 115–121. 2007.

Schmidt, H. G, S. M.M Loyens, T. Van Gog, and F. Paas. Problem-based learning is compatible with human cognitive architecture: Commentary on Kirschner, Sweller, and Clark (2006). Educational Psychologist 42, no. 2: 91–97. 2007.

Read more

The Interdisciplinary Journal of Problem-based Learning (IJPBL).

Barrett, Terry, and Sarah Moore. New Approaches to Problem-Based Learning: Revitalising Your Practice in Higher Education. Taylor & Francis, 2010.

Schwartz, Peter. Problem-based learning: case studies, experience and practice. Routledge, 2001.

Savin-Baden, Maggi. A practical guide to problem-based learning online. Taylor & Francis, 2008.

1)
Savery, J. R. Overview of problem-based learning: Definitions and distinctions. The Interdisciplinary Journal of Problem-based Learning 1, no. 1: p9. 2006.

2)
Jubien, P. Problem-Based Learning in Canadian Undergraduate and Continuing Medical Education. Canadian Journal of University Continuing Education 34, no. 2: 111–125. 2008.

3) , 5) , 6)
Barrows, Howard S. Problem-based learning in medicine and beyond: A brief overview. New Directions for Teaching and Learning 1996, no. 68: 3-12. December 1, 1996.

4)
Boud, D. J., & Felleti, G. (eds.). The Challenge of Problem-Based Learning. New York: St. Martin’s Press, 1991.

7) , 9)
Hmelo-Silver, C. E, R. G Duncan, and C. A Chinn. "Scaffolding and achievement in problem-based and inquiry learning: A response to Kirschner, Sweller, and Clark. 2006

8)
Barrett, Terry, Iain Mac Labhrainn, and Helen Fallon. Handbook of Enquiry and Problem-Based Learning: Irish Case Studies and International Perspectives. CELT, NUI Galway, 2006.

10)
Example borrowed from: Schmidt, H. G, S. M.M Loyens, T. Van Gog, and F. Paas. Problem-based learning is compatible with human cognitive architecture: Commentary on Kirschner, Sweller, and Clark (2006). Educational Psychologist 42, no. 2: 91–97. 2007.

11)

Kirschner, P. A, J. Sweller, and R. E Clark. Why minimal guidance during instruction does not work: An analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching. Educational psychologist 41, no. 2: 75–86. 2006.
12)

Schmidt, H. G, S. M.M Loyens, T. Van Gog, and F. Paas. Problem-based learning is compatible with human cognitive architecture: Commentary on Kirschner, Sweller, and Clark (2006). Educational Psychologist 42, no. 2: 91–97. 2007.
13)

Hmelo-Silver, C. E, R. G Duncan, and C. A Chinn. Scaffolding and achievement in problem-based and inquiry learning: A response to Kirschner, Sweller, and Clark (2006). Educational Psychologist 42, no. 2: 99–107. 2007.)) suggesting positive **characteristics/improvements** to problem-based learning and compatibility of it with the human cognitive structure like: * activation of **prior knowledge** in the initial discussion of the group, * training students in collaboration skills before a problem-based learning curriculum to decrease cognitive load, * sequencing learning tasks **simple to complex**, * **recommending learning materials** to students when they need help, * **scaffolding and guiding students** when necessary to prevent them from losing too much time on irrelevant information. Yet most of the proves for these thesis seem not convincing enough, the positive effect of worked examples is still ignored and even though some of the above statements could improve problem-based learning, they oppose the **basic assumption that problem-based learning is self-directed**(([[http://www.cogtech.usc.edu/publications/sweller_kirschner_clark_reply_ep07.pdf|Sweller, J., P. A Kirschner, and R. E Clark. Why minimally guided teaching techniques do not work: A reply to commentaries. Educational Psychologist 42, no. 2: 115–121. 2007.
14)

McMaster University: Department of Chemical Engineering. Problem-based Learning, especially in the context of large classes.
15)

Savery, J. R. Overview of problem-based learning: Definitions and distinctions. The Interdisciplinary Journal of Problem-based Learning 1, no. 1: 9–20. 2006.