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.

Instructional element	**Problem-based learning activity**
Presenting problem	A 15-year-old boy with asthma comes with his father to a clinic visit. The father wants his son tested for drugs because his behavior has changed over the past several months. The father wants a perfect son (like his older son) and doesn’t understand why his son is withdrawn and doing poorly in school. The son is initially sullen, resentful, with poor eye contact. The father is angry and feels that he has been treated poorly because he has HMO insurance.
Actual dilemma	The actual dilemma is to establish trust with the son. Specifically, to understand reasons for the son’s behavioral change and to ensure that the son returns for future visits. During the encounter, learners must convince the father to leave the room, to have an open conversation with the son. The son is quite upset that he can’t participate in sports, because he gets short of breath from uncontrolled asthma. His friends have changed because of this, and he feels isolated at school. Once the learner discusses confidentiality, the son reveals that he has tried drugs in the past, but he is not a frequent user. His father is domineering and judgmental. The son doesn’t want his father told about his sporadic drug use. “This is just between us, right?”
Time for session	Three hours per session. The SPs arrive about 30 minutes into the session.
Faculty training	50 minutes before each session, plus faculty guide given a week before the session.
Student pre-session preparation	None.

Instructional element	Problem-based learning activity
Initial question to begin discussion	“Why is the patient here?”
Student approach	May interrupt, pose questions, provide answers/approaches to dilemmas that occur during the session.
Faculty approach to students’ incorrect knowledge or assumptions	Faculty will not interfere, and will allow the students to continue their discussion. Mistakes may be corrected by other students, but only if students recognize the mistake. Otherwise, the mistake or misperception will go undetected by the learners.
Faculty approach to “clinical blind-alley” digression	Does not interfere, and allows the students to continue their discussion, unencumbered by learning objectives.
Student use of additional resources during the session	The students generate questions during session. Students are given time to look up articles, Web sites, and references based on discussion by the group.
Student additional work after the session	The group assigns individuals homework assignments between sessions, because the same case will continue over several sessions. These PBL assignments would require obtaining information about the topic. These assignments would take about the same preparation time as the CBL student pre-session preparation for reading one to two articles.
Case continuity	The same case will continue over several consecutive sessions. For instance, a patient presents with abdominal bloating, is found to have a testicular and abdominal masses, is treated for a mixed germ cell tumor, and suffers multiple chemotherapy complications before recovering. In session 1, the students may discuss any number of issues around approaches to abdominal pain. In session 2, the students may discuss any number of issues around testicular cancer (breaking bad news, sexuality, prognosis). In session 3, students may discuss issues surrounding chemotherapy and clinical trials (informed consent, health status measurement, economic impact, stigmatization).

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**[12], can lead to false conclusions or time inefficiency[13].

A reply to these criticisms was written by Schmidt et al.[14] and Hmelo-Silver et al.[15] 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**[16)17)18)]:

- *"In a PBL approach... the tutor does not provide information related to the problem — that is the responsibility of the learners."*[19)].

Keywords and most important names

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

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Read more

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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.
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