

Problem-Based Learning

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Abstract

Problem-based learning (PBL) is a tool that provides teacher educators with the opportunity to have their students encounter situations that they may be confronted with in their careers later-on. The PBL method, which was first used with medical students to enrich them with the opportunity to practice what they learned in "real life" situations instead of being confined to course content, has recently been shown by researchers working in education to have benefits for teacher training. Teacher training is an educational field that is particularly suited to the objectives and methods of the science of education, which constructs the framework of problem-based learning. Within the area of second language learning and teaching, problem-based learning aligns with approaches in which students learn the target language by using it, rather than being presented with and then practicing predetermined language structures.

Keywords: English language classrooms, traditional, language structures, student participation, problem-based learning, inquiry-based learning

Problem-based Learning

Problems are commonly classified as well-structured and ill-structured problems (Simon, 1978): the former come with a familiar solution strategy and a single possible solution; for the latter, the strategy has yet to be developed based on what is known and there can be several solutions which are, depending on one's perspective, approximately equal.

Kinds of Problems

Simple problems include those with a single known **solution and answer**.

- **logical problems** – like solving the Rubik's cube
- **algorithmic problems** – can be solved by applying a formula
- **story problems** – can be solved by applying a formula, but the task is presented in a narrative form and one needs to find out the parameters within the story before one can apply the formula.

- **rule-using problems** – rules (for example, right hand grip rule in physics, linguistic rules, norms of behaviour, traffic rules) can be applied to a number of cases. Examples: grouping, creating a crossword, finding pairs, filling in the gaps.

Complex problems include those with several solutions and answers or those lacking a clear solution and answer.

- **Decision making problems** (see also: decision making);
- **Troubleshooting problems**;
- **Diagnosis-solution problems** (see also: case-based learning);
- **Strategic performance**;
- **Case analysis problems** (see also: case-based learning);
- **Design problems**;
- **Dilemmas** (see also: decision making).

Task-based learning scenarios for solving simple problems

Task-based learning is used most often during school classes. Usually, simple problems form some part of a lesson. For task-based learning, choose a simple algorithmic, textual or rule-using problem. Simple problems have a single known solution.

Typically, solving a simple problem has four stages:

- preparing to create a solution, i.e. classifying the problem
- choosing or working out a solution strategy
- applying the chosen strategy to find a solution;
- evaluating the result that was generated.

Consider which digital tools could be used to support solving such problems. Learning Apps and other similar environments for creating tasks are suitable here.

Creative Classroom task-based learning scenarios:

- Countable/uncountable nouns
- Reformation in Estonian lands
- “Werewolf”
- How many seeds we need?
- Studying the working principle of a dynamometer and gravity
- Sum of angles in a triangle. The exterior angle
- Reading poetry as an Avatar
- Changes in nature
- Adjectives
- Countable/Uncountable
- How to build a marshmallow catapult?

- Heroes and religion in Ancient Greece
- A task-based lesson in the framework of Code Week

Inquiry-based learning circumstances for solving complex problems

- Learning needs to be initiated by a problem.
- The problem must promote constructive activities and knowledge that can be usefully applied in the future.
- Acquired knowledge will be integrated to the problem based on the problem rather than the subject.
- Students are directed to channel their activities (individually and collectively) in a way that contributes to solving the problem
- Various forms of group work (individually for the team, together for the team) rather than lectures are used.

Students are supplied with a general thematic framework within which they can choose to explore the problems of their interest. Topics that connect with real life are emphasized. Problems are raised by the students themselves, who then set out to find solutions for them.

Solving the problem with inquiry

The problem-solving cycle can be set off **inductively** (by looking for patterns of regularities – in this case, it is not possible to put forth hypotheses immediately) or **deductively** (by putting forth hypotheses that are based on some theory, which will then be tested in the inquiry).

Inquiry-based learning leads the student to ask:

- What does the problem consist in?
- How would it be possible to solve the problem?
- What kind of solution or strategy should I attempt?
- How correct is my solution?

Inquiry-based learning scenarios often involve a model of inquiry with the following stages:

- What is the topic, the problem of your inquiry?
- Are you working alone or in a team to solve it?
- What do you know about the problem? (one could use things like mind maps)
- What kind of information could you collect to understand, clarify, explicate the problem?
- Form a plan of how to tackle the problem and share it with the teacher.
- Explore and observe – what kind of information is required, where can one find it, who is collecting it and how to involve others, where do I store the data, is it accessible to others, what forms of data am I collecting?

- Presenting the results – How do I present the results, who will be involved in interpreting the data and drawing conclusions?
- How do I organize a discussion to reach a better understanding of the results?

Progressive inquiry phases

Progressive inquiry is a pedagogical model of inquiry-based learning, where learning is subjected to the same methodology as scientific research. The process of inquiry-based learning kicks off from a problem situation or context based one on which the student:

- presents the context
- formulates a research problem – raises important questions
- finds the relevant information sources for tackling the questions, seeks for deeper knowledge
- puts forth a working theory and provides critical evaluation – presents his/her own vision for others to analyse and analyses the ideas of others
- offers solutions of one's own based on the analysis
- conducts an in-depth investigation of the problem – carries out the necessary studies
- creates a new theory
- shares one's expertise (participates in constructive group discussion)

The main role for the teacher in inquiry-based learning is to guide the students toward asking important questions based on a given context and to encourage them to propose their own theories. In practice, this means that results will be reached through collaboration and independent analysis, using additional sources of information when needed.

Creative Classroom inquiry-based learning circumstances

- Indrek Hargla's historical crime fiction series about Melchior the Apothecary
- Discrimination
- Geometric shapes around the schoolhouse
- Properties of the graphs of linear functions
- Finding solutions to environmental problems
- Outdoor learning for 5th-6th grade nature education. Determining air quality by using lichen

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