

History of implementation

Problem-Based Learning was developed in the 1960s but wasn't codified formally until around 1980. The idea stemmed from a desire to invert a medical curriculum, so that students would have "2 years of patient exposure and then 2 years of basic science" (Barrows & Tamblyn, 1980), as testing knowledge retention of clinically relevant prior learning showed there was very poor recall of basic facts years later.

Use in other fields

Since then, problem based learning has been applied more broadly, beginning with other patient-centred healthcare fields and spreading to mathematics, astronomy, economics, and creative arts (Capon & Kuhn, 2004; Fidan & Tuncel, 2019). Examples of problem based learning can now be found in nearly every field because the types of problems used are those faced in day-to-day situations, a point I'll come back to a little later.

Process

One of the hallmarks of problem based learning that differentiates it from other methods is that a key element is problem *finding* (Biggs & Tang, 2011). When presented with new information, students are expected to parse it, then use their existing knowledge to formulate a problem that they can then research independently to bring back for further group discussion.

Format

Often, a chair and scribe are assigned per case, or per class. The chair's role is to encourage everyone to participate, and keep everyone on time and task; the scribe's role is to document and collate all of the relevant parts of the discussion as it occurs. The teacher's role is only to facilitate the discussion and guide students to the intended learning outcomes for the scenario.

Process details

The common steps in each scenario within a problem based learning subject usually include (Barrows & Tamblyn, 1980; Fidan & Tuncel, 2019; Gallagher, Stepien & Rosenthal, 1992; Wood, 2003):

1. Clarifying the unfamiliar terms and ensuring everyone understands the scenario
2. Defining problems as a group, and recording those the group agrees upon
3. Brainstorming the problems, coming up with possible explanations for them, and recording all of that discussion
4. Reviewing the problems from steps 2 and 3, forming the explanations into tentative solutions, and having the scribe organise these into a coherent document
5. Formulate LOs, reach consensus on LOs, have the tutor/facilitator ensure they are focussed, achievable, comprehensive, and appropriate to the task
6. Students then break off for private study, before
7. Returning as a group to share results, with the tutor checking the learning and assessing the students new knowledge

Ill-structured problems

The sort of problems that don't have solutions, or have many paths to potential answers that might not fully solve the issue - like many problems in daily life - are ill-structured problems (Gallagher et al., 1992). Solutions are generally not predictable, and they are frequently interdisciplinary. The need for broad input to find a solution is what makes

problems selected for problem based learning effective (Jonassen, 2003).

Choosing appropriate scenarios

Obviously, choosing an appropriate ill-structured problem is one of the most important aspects of problem based learning. It needs to address the learning objectives, build on prior learning, be engaging, stimulate thought and discussion, while being open-ended and covering a wide enough scope that students can gather a broad range of resources to encourage deep learning

Example scenarios

I've listed here a few examples of scenarios that have been used in research papers on problem based learning. You can see that the problems are not ones that have a simple answer, and require looking at a range of factors that may not have a defined outcome or even be solvable. These are all examples of ill-structured problems that have been used in classes.

“A middle school teacher, who began her career three years ago, wants to improve her teaching practice by integrating instructional design models and strategies. She actually tried some new tactics such as using videos, and group activities, but in her class, her students did not pay attention, failed to answer to the questions, and so on. She needs some help in terms of promoting and sustaining student motivation for learning” (Kim & Lim, 2019).

“Can we have a web application for waste disposal management of a city/area?” (Anitha, Jeyamala & Kavitha, 2018)

“Design a bridge model, within the prescribed boundary conditions, which must connect two points 30 cm apart, and which cannot deflect more than 5 mm with the prescribed forces acting on the bridge. Design the structure, cross section of the bars or beams, and select the material used to manufacture it by additive manufacturing technique” (Gomez-del Rio & Rodriguez, 2022).

“Billy Green, an eleven year old boy, is brought into the Emergency Room at 3:00 PM. According to his mother's advance telephone call, he is “passing out just like he did before.” As Billy is wheeled into the Emergency Room, you are told by the senior resident on call from the Department of Pediatrics that Billy is an “old friend.” The nurse says she will order his old hospital chart. As you start to examine Billy, his mother provides the following history. About 3 days ago, Billy developed a runny nose, sore throat, headache, and a mild fever. There was some “flu” going around the family at that time. Billy's appetite has been poor since then, although he has been more thirsty than usual. About 7:00 on the previous evening he developed stomach pain. This was somewhat relieved by a light supper of soup and milk. However, about 45 minutes later he vomited his supper. He continued to vomit through the evening and once or twice after midnight. He has not eaten anything today. He last vomited about 10:00 a.m. He has become less and less responsive over the past 20 hours. He seems to understand when his mother speaks to him directly, and answers in single words or short phrases” (Hmelo, Gotterer & Bransford, 1997).

Advantages

Some of the often-referenced advantages of problem based learning include focusing learning on real-world scenarios; developing skills for lifelong learning, communication and team-work; encouraging students to become responsible for their own learning; and promoting deep learning by requiring students to have a holistic view of how resources can be applied to the problem at hand (Barrows & Tamblyn, 1980; Jones, 2006).

Disadvantages

Problem based learning does bring its own challenges as well - multiple facilitators are required, rather than a single lecturer, which can impose significant time and financial burdens; information acquisition is less organised than traditional learning; and the assessment methods required are very different to traditional methods, making a direct comparison of efficacy difficult (Barrows & Tamblyn, 1980; Jones, 2006)

PBL in the age of online learning

Online tools allow learners to communicate efficiently, share resources and thus jointly construct new solutions. It also offers learners the ability to find and extract information far more readily than they used to be able to. Using scaffolding to guide source selection and limiting the domains of knowledge they should pursue at particular stages prevents overloading learners with information (Kim & Lim, 2019).

Considerations

Some of the most important considerations for problem based learning come to questions of support that is provided to students (Kim & Lim, 2019; Law, Ge & Huang, 2020). Should their pursuit of knowledge be guided gently, or not at all? Are your learners a diverse cohort, or do they all come from a similar knowledge domain? How broad is the scope of the problem? These questions will inform how much and what type of structures will need to be in place.

Learners from diverse academic backgrounds will need more guidance on communicating new knowledge effectively within their group. If the problem is broad in scope, limiting the field of study between meetings might be important to keep students on time and task. Reflective tasks will also help students recognise the process of solving the problem, which brings us to the question of assessment in problem based learning.

Assessment methods

The objectives of problem based learning include integrating knowledge, to learn reasoning methods specific to the domain, and to help students become lifelong learners (Barrows & Tamblyn, 1980); so assessment should reflect those goals. This will obviously be a more involved process than testing recall, and as such will need serious consideration for larger class sizes, but doesn't mean it can't be applied even to very large classes.

How then do we achieve these goals? A number of methods have been tried and tested, and some combination of them is likely to be effective in any setting; this will take some thought and planning to determine which would be most applicable to assessing reasoning and knowledge integration in your field. Let's have a look at some of the more common options that are being used.

Self-and peer assessment are a good fit, as they focus on the self-directed and collaborative learning elements important in problem based learning (Bilbao, Varela, Rebollar, Bravo & García, 2018). Individual and group presentations meet similar objectives, but can have a much larger cost in terms of time when it comes to marking (Huysken, Olivey, McElmurry, Gao & Avis, 2019). A portfolio can offer a chance for critical and reflective thinking, with the challenge of creating an appropriate rubric for marking against.

Conclusions

Problem based learning has been implemented in various courses and programs since the late 1970s, with varying degrees of uptake and use in classes. One of the primary challenges to broader application seems to be the difficulty in comparing problem based learning to traditional methods. Problem based learning focusses on the process of learning, rather than what has been learned.

Is problem based learning right for your subject? Well, like any learning theory, it depends. It might be best as part of your syllabus, rather than forming the entirety of learning activities in the subject. As an activity that requires

engagement and discussion between your students, it could at least bump up our QILT scores...

A list of all the references used here can be found on the edublogs post.

References

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