



INNORESOLVE



INNORESOLVE Industry 4.0



Asociación de Fundidores
País Vasco y Navarra



UNIVERSITÀ TELEMATICA
INTERNAZIONALE UNINETTUNO



CAMERA DE COMERȚ ȘI INDUSTRIE CLUJ
IMPREUNĂ PENTRU AFACEREA TA



Associação
Portuguesa de
Fundição



○ What is Problem Based Learning?

- Problem Based Learning (PBL) is a learner centered approach in which a tutor facilitates the activity by guiding the learner in the process.
- Thus the tutor plays the role of a mentor, by motivating and a guiding learners.
- In PBL rather than a tutor explaining the content the learner needs, teaching them and assessing students, the learner identifies or is presented with a complex business problem. The learner then undertakes a process to identify and apply the relevant material required to solve this problem.
- It is known to positively affect learning outcomes and develop the skills that are critical in today's workplace, namely problem solving, logical thinking, creative thinking. (Sendag 2009)



○ Benefits to SMEs

- Provides immediate return on investment.
- Is low cost.
- Is on the job training, thus the learning is highly contextualised and situated.
- Is practical and related to the SME's needs.
- Encourages innovation and independent thinking.
- Provides a greater understanding of a topic due to active learning and engaging in the material.
- Requires an increased motivation to learn thus helps develop a learning culture.
- Develops skills in critical thinking, leadership, communication and problem solving.



PBL major components

PBL requires considerable time and effort to implement.

This suggests the advisability of using existing PBL projects or adapting existing PBL or case materials.

PBL has eight major components:

1. Introduction,
2. **Problem**,
3. Learning objectives,
4. Resources,
5. Product specifications,
6. Guiding questions,
7. Assessment exercises,
8. Time constraints.



1. Introduction

- This component introduces the staff to the focal problem for the project (scenario).
- The introduction states how and why the project is relevant to the work of the manager and connects the problem and the learning objectives to the reality of the workplace. *“Why would I want to participate in this project, and what will I gain from it?”*



2. Problem

- 2.1. How to elaborate PBL problems
- 2.2. Kind of problems
- 2.3. Criteria to take into account for problems elaboration
- 2.4. Selection of the problems

2.1. How to elaborate PBL problems

- Each PBL project is structured around a high-impact problem. A high-impact problem is one that has the potential to *affect large numbers of people for an extended period of time*.
- The problem serves as a stimulus for learning.
- The problem comes first, then the learning.
- The problem motivates the workers to learn and study the relevant information to answer these questions and solve the problem.
- It is important to point out that the objective is not focused on solving the problem situation, but on the fact that it is used as a starting point to identify learning topics and study them independently or in groups.



2.2. Kind of problems (in terms of complexity)

- Level 1: the problem usually refers to the contents of the module, and all the information necessary to solve it is in that module. It only requires applying knowledge and understanding.
- Level 2: it adds some motivation to solve the problem because it involves making decisions or applying theories. It requires applying knowledge, understanding and application of theory.
- Level 3: It is the level for the PBL problems. It requires capacity for analysis, synthesis and evaluation. They are related to the real world, and not all the information necessary to solve it is contained in the problem or module itself. Consequently, it is necessary to investigate, discover new materials and arrive at judgments or decisions based on the information learned. The problem may have more than one acceptable response.



2.2. Kind of problems (in terms of thematic)

- *The swamp*, consisting of a complex problem that contains numerous sub-problems.
- *The dilemma*, in which the manager knows what is wrong but must choose among alternatives involving a sacrifice or trade-off of important personal and/or organizational values or objectives.
- *The routine problem*, one that most managers encounter regularly in their work.
- *The implementation problem*, in which the manager must figure out how to ensure the successful implementation of a new policy or program.



2.3. Criteria to take into account for problems elaboration

Structuring: PBL problems must be *poorly structured* and must be *open*:

- "Poorly structured": we mean that they have to present an ambiguous meaning and must be difficult to define.
- "Open" problems: means that not all the elements of the problem should be known, that sometimes it is appropriate to have different solutions (or no solutions), and that they should, as far as possible, represent approaches from more than one discipline.

Actual problems: They should refer to current or contemporary situations, that is, current or recent real-life or professional context problems.



Complexity: problems must have a certain level of difficulty; in other words, they should not be easy to solve and therefore should not be limited to a single solution.

But this complexity must be intermediate because, if the problem is too complex, it will demotivate the worker.

Appropriate at workers cognitive and motivational level: The contents of the problems must be adjusted to the level of knowledge and intellectual, emotional, social development and the interests of the workers.



2.4. Selection of the problems

Once we have more or less clear how a good PBL problem should be, we must decide who makes it, select it and find it.

- Who should elaborate it: generally the problems will be selected by the managers / responsible.
- Where you get it from: the best problems are those that come from the manager's personal or professional experience, from real situations or that reflect a real situation.



3. Learning objectives

- The learning objectives are those that should drive the design of the problem, and not the contrary.

What do you need to learn before you can solve the case problems?

- These objectives, limited in number and short, signal what knowledge and skills the staff is expected to acquire by completing the project.
- These objectives often emphasize higher order thinking (e.g., analysis, application synthesis, evaluation), as well as basic concept understanding.



4. Resources

For each project, the employees receive / have to look for some combination of the following types of resources: books, articles, videos, website links, and consultants.



5. Product specifications

- Each project culminates with some type of performance (e.g., role play of a supervisory conference, oral presentation of a plan), product or both.
- One characteristic of PBL problems is that they require a group collaboration for their solution: The clarification of the problem and the activities for the solution require the cooperation of all the members of the group to investigate, communicate and integrate the information.

Some examples:

- A table that shows the relationships between the concepts or didactic contents of the subject involved (conceptual map).
- A situational diagnosis in which are defined the contents that already know and those that must investigate, the skills that are required to develop and the technological skills that must be applied, as well as the necessary resources (available and to be achieved).
- A report with the possible solutions to the problem.
- A presentation of the solution that includes the use of a technological tool.



6. Guiding questions

With each PBL project, we provide learners several guiding questions. These questions serve several purposes:

- To direct participants to key concepts,
- To assist workers in thinking through the problem, and
- To stimulate employees to view the problem from alternative perspectives.

How learners choose to use these questions rests entirely with them.



7. Assessment exercises

The solution can be assessed not only in academic terms, but also according to professional standards relevant to the workplace. Assessment in PBL serves learning and, thereby, promotes personal growth and improved performance. Purposes:

- To contribute to the revision of projects to make them more productive and meaningful learning experiences for participants,
- To promote retention, transfer, and application of learning,
- To foster introspection and reflection,
- To cultivate the appropriate use of knowledge and skills,
- To determine the extent to which employees, individually and collectively, have achieved the learning objectives of the project.

Assessment exercises stimulate staff to reflect on what they have learned how they might use these insights in the future.



8. Time constraints

Most projects designed require six to 21 hours. Examples of possible formats:

- once per week for three hours,
- week-end mode,
- all-day sessions,
- twice per week for 90 minutes.....



○ Phases for the PBL methodology

1. Planning phase

The facilitator states the situation, the problem and clearly delineates the contents, activities, the rules, products, resources....necessary for the achievement of the learning goals (PBL major components).

2. Development phase

Definition of the learning activities to be carried out by learners:

- Analyze the problem situation,
- Determine the learning needs,
- Establish a work plan -both independent and as a team,
- Perform the search for pertinent information,
- Inform about the progress
- Propose and develop possible solutions.



○ Phases for the PBL methodology

3. Assessment phase

In this stage, learners should have the possibility of:

- Evaluate themselves.
- Evaluate your colleagues.
- Evaluate the teacher as a facilitator or guide in the process.
- Evaluate the group's work process and its results.

Another important function of this stage is the evaluation of each one of the elements that intervene in the PBL: learning achieved, attitudes of the participants, group dynamic, resources used, products made....



Bibliography

BROWN, S.M.; GARNJOST, P; HEILMANN, S. (2011). *Problem-based Learning: Leadership Development Program in a Multi-National Company. Journal of Executive Education*: Vol. 10: Iss. 1, Article 1. Available at:

<http://digitalcommons.kennesaw.edu/jee/vol10/iss1/1>

DUCK, J. (1993, Nov.-Dec.). Managing change: The art of balancing. *Harvard Business Review*, 109-118.

HAMBURGA, I; VLADUTB, G. (2016) *PBL - Problem Based Learning for Companies and Clusters*. Elsevier B.V.

O'BRIEN, E.; CARROLL, L. (2015) Handbook on the implementation of Problem Based learning in SMEs. The Archimedes project (funded under the 2014 Erasmus Plus programme).

<https://www.pmi.org/learning/library/problem-based-learning-advanced-education-6412>



○ Bibliography

ROMERO MEDINA, A.; GARCÍA SEVILLA, J. (2008) La elaboración de problemas ABP. En J. García Sevilla (Coord.), *El aprendizaje basado en problemas en la enseñanza universitaria*. (pp. 37-55). Murcia: Servicio de Publicaciones de la Universidad de Murcia. I.S.B.N.: 978-84-8371-778-3.

SENGE, P. M. (1990). *The fifth discipline: The art and practice of the learning organization*. New York: Doubleday.

WATERMAN, R., Akmajian, P., & Kearny, S. (1991). *Community-oriented problem-based learning at the University of New Mexico*. Albuquerque, New Mexico: University of New Mexico School of Medicine.