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Transfer of Innovation

Report on use of PBL in European VET education



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A Little Historical Background

Problem-Based Learning (PBL) is a curriculum development and delivery system that recognizes the need to develop problem solving skills as well as the necessity of helping students to acquire necessary knowledge and skills.

The first application of PBL, and perhaps the most strict and pure form of PBL, was in [medical schools](#) which rigorously test the knowledge base of graduates. Medical professionals need to keep up with new information in their field, and the skill of life-long learning is particularly important for them. Hence, PBL was thought to be well suited for this area.

Many medical and professional schools, as well as undergraduate and graduate programs use PBL in some form, at varying capacities internationally. For more information about a few schools that use, implement, and support PBL endeavors can be found in [Schools that practice PBL](#).

There are several organizations that provide support for teachers and students of PBL and others that research PBL and related topics. More information about these organizations can be found in [Resources](#), [PBL Organizations](#), and [Ways to learn PBL methods](#).

The next page gives an overview of PBL and its characteristics.



Overview and Characteristics

Problem based learning has several distinct characteristics which may be identified and utilized in designing such curriculum. These are:

- Use of real world problems - problems are relevant and contextual. It is in the process of struggling with actual problems that students learn content and critical thinking skills.
- Reliance on problems to drive the curriculum - the problems do not test skills; they assist in development of the skills themselves.
- The problems are truly ill-structured - there is not meant to be one solution, and as new information is gathered in a reiterative process, perception of the problem, and thus the solution, changes.

(Adapted from Stepien, W.J. and Gallagher, S.A. 1993. "Problem-based Learning: As Authentic as it Gets." *Educational Leadership*. 50(7) 25-8 and Barrows, H. (1985) *How to Design a Problem Based Curriculum for the Pre-Clinical Years*.)

- PBL is learner-centred - learners are progressively given more responsibility for their education and become increasingly independent of the teacher for their education.
- PBL produces independent, life-long learners - students continue to learn on their own in life and in their careers.

From [*Schools of California Online Resources for Education*](#) and [*Problem Based Learning Initiative at Southern Illinois Institute*](#)

The next page will describe one common version of PBL, Problem Stimulated PBL.



In *Problem Based Learning for Administrators*, Edwin Bridges suggests that there are two versions of PBL that have been implemented in the classroom: Problem Stimulated PBL and Student Centered PBL.

Problem Stimulated PBL (PS PBL)

Problem stimulated PBL uses role relevant problems in order to introduce and learn new knowledge. The Prospective Principals Program at Stanford University's School of Education employs PS PBL in its curriculum.

PS PBL emphasizes three major goals:

- development of domain-specific skills
- development of problem-solving skills
- acquisition of domain-specific knowledge

The PS PBL Process

- Students receive the following learning materials:
 - the problem
 - a list of objectives that the student is expected to master while working on the problem
 - a reference list of materials that pertain to the basic objectives
 - questions that focus on important concepts and applications of the knowledge base
- Students work in teams to complete the project, resolve the problem, and accomplish the learning objectives.
 - each student has a particular role in the team - leader,
 - facilitator, recorder, or team member
 - time allotted to each project is fixed



- the team schedules its own activities and decides how to use the allotted time
- Student performance is evaluated by instructors, peers, and self using questionnaires, interviews, observation, and other
- assessment methods.

Throughout the process, instructors serve as resources to the teams and provide guidance and direction if the team asks for it or becomes stymied in the project.

Student Centered PBL (SC PBL)

Student centered PBL is similar to PS PBL in some aspects. SC PBL has the same goals as PS PBL, but includes one more: fostering life-long learning skills.

Physicians are one group of professionals who are required to stay current with new developments in their fields. The skills of a life-long learner are particularly important for this group. Hence, several medical schools employ student centered PBL.

The SC PBL Process

- Students receive the problem situation.
- Students work on the problem in project teams.
- Students are evaluated in multiple ways by instructors, peers, and self.

The process appears to be similar to that of PS PBL, but there are significant differences in each step, which are driven by the goal of fostering life-long learning skills. The major differences are in student responsibilities. In SC PBL,

- students identify the learning issues they wish to explore;
- students determine the content to be mastered;



- students determine and locate the resources to be used.

In short, students have self-defined learning issues.

As is the case with PS PBL, students decide how to appropriately use the newly acquired information and knowledge in order to solve the problem at hand.

The next page will outline the reasons for using PBL.

There are several reasons for using PBL and many of them have resulted from the findings of research.

- Students retain little of what they learn when taught in a traditional lecture format (Bok 1989).
- Students often do not appropriately use the knowledge they have learned (Schmidt 1983).
- Since students forget much of what is learned or use their knowledge appropriately, instructors should create conditions that optimize retrieval and appropriate use of the knowledge in future professional practice.
- PBL creates the three conditions that information theory links to subsequent retrieval and appropriate use of new information (Schmidt 1983):
 - *activation of prior knowledge* - students apply knowledge to understand new information.
 - *similarity of contexts in which information is learned and later applied* - research shows that knowledge is much more likely to be remembered or recalled in context in which it was originally learned (Godden and Baddeley 1975). PBL provides problems within context that closely resemble future professional problems.
 - *opportunity to elaborate on information that is learned during the problem-solving process* - elaborations provide redundancy in memory structure, reduces forgetting, and facilitates retrieval. Elaboration occurs in discussion with peers, peer-teaching, exchanging views, and preparing essays about what students have learned during the



problem-solving process.

From Bridges, Edwin M., *Problem Based Learning for Administrators*, 1992.

The next page will describe what PBL typically looks like in the classroom.

There are several models of how PBL works in the classroom. All of them agree that in a PBL curriculum,

- students work through a series of problems designed to:
 - *be authentic (i.e. address real-world concerns)*
 - *target defined areas of the curriculum*
 - *be "ill-structured" - they must be defined and analyzed through inquiry from a minimum of presenting information*
 - *approximate the real world, so that students find themselves actually engaged in the problem and not just observers of it;*
- the role of the instructor changes from a "sage on the stage" to a "guide on the side";
- students work collaboratively in small groups toward the problem's resolution.

Barrows proposes the following model of the PBL process in *How to Design a Problem-based Curriculum for the Preclinical Years*, 1985.

Schmidt and Moust from the University of Maastricht describe the main frame of the process of PBL as iterative and cyclical in nature.

- Students approach the problem, without any prior background research.
- In the small group tutorial, they analyze the problem based on prior-knowledge. They elaborate on the knowledge through

discussion. They develop new knowledge structures. They formulate their own learning objectives.

- Students proceed to a period of self-directed study. This helps them to develop, fine-tune, and restructure the existing knowledge structure.
- Students then return to the small group tutorial, where they integrate and apply the knowledge they gained during self-directed study in order to problem-solve.

Students will then return to the first step and continue to cycle until the problem is fully addressed.

From [*Processes that Shape Small-Group Tutorial Learning: A Review of Research*](#) by Henk G. Schmidt and Jos H.C. Moust, Paper presented at Annual Meeting of the American Educational Research Association, 1998.

Teams are responsible for scheduling their own activities and deciding how to use their time to solve the problem and master the learning objectives.

Depending on the [version of PBL](#), the teams have more or less responsibility for determining learning issues and locating resource materials required to solve the problem.

Groups usually consist of 5 to 7 students. Each member of the group maintains a particular role throughout the duration of the project. The four possible roles are:

- project leader - proposes meeting agendas, suggests division of labor, and develops the overall project plan.
- facilitator - describes the process to be followed during the steps of the project plan, determines appropriate time to proceed in plan, and suggests adjustments to the plan as needed.
- recorder - takes group notes of each meeting.
- team member - takes individual notes, participates in discussion, and reviews resource materials.



Other PBL models include a mentor or tutor in the group. This is often a faculty member, but another student sometimes functions in this role. Research is mixed as to the domain-specific expertise required of the mentor. It is unclear whether subject expertise is necessary in order to be an effective tutor.

Organization of teams

- *Vertically organized teams*: project leader makes crucial decisions are made if team is unable to reach a consensus.
- *Horizontally organized teams*: crucial decisions are made by majority vote.

From Bridges, Edwin M., *Problem Based Learning for Administrators*, 1992.

The individual plays an important role in PBL. This is outlined on the next page.

The individual student in PBL has an active role in learning. PBL requires that students have responsibility for their own learning by identifying their learning issues and needs.

According to Schmidt and Moust, the student progresses through a series of steps, "The Seven Jump", during the PBL process.

- Clarify unknown terms and concepts in the problem description.
- Define the problem(s). List the phenomena or events to be explained.



- Analyze the problem(s). Step 1. Brainstorm. Try to produce as many different explanations for the phenomena as you think of. Use prior knowledge and common sense.
- [student outcomes - activation of prior knowledge, elaboration, restructuring of information, organization of information, intrinsic motivation]
- Analyze the problem(s). Step 2. Discuss. Criticize the explanations proposed and try to produce a coherent description of the processes that, according to what you think, underlie the phenomena or events.
- Formulate learning issues for self-directed learning.
- Fill in gaps in your knowledge through self-study.
- Share your findings with your group and try to integrate the knowledge acquired into a comprehensive explanation for the phenomena or events. Check whether you know enough now.
- [student outcomes - restructuring, applying, problem solving]

From [*Processes that Shape Small-Group Tutorial Learning: A Review of Research*](#) by Henk G. Schmidt and Jos H.C. Moust, Paper presented at Annual Meeting of the American Educational Research Association, 1998.

WEB SITES and articles about European experiences in EU

Aalborg University, Denmark

The editorial provides a background for the special issue on Problem Based Learning and ICT and focuses on three core themes: Problem Based Learning (PBL) and its background and pedagogical principles; learning characteristics of information and communication technology (ICT); and intercultural perspectives. The editorial presents a Danish perspective on PBL based on the long tradition for PBL within university teaching and learning and international collaboration.



The editorial is concluded through a short presentation of the articles in this special issue.

Keywords: Problem Based Learning; Project Based Learning; Social appropriation of technology,

The project “VOICE. Developing citizens – Paths to core competencies through a problem- based learning project in civic education” was a two-year Comenius project, started in January 2011. The project’s overall aim was to foster active citizenship through innovative school materials for civic education in European schools.

To achieve this, educational experts from Austria, Estonia, Germany, Slovenia and Turkey developed collaboratively teaching/learning material for classroom-use. The VOICE school materials focus especially on the promotion of pupils’ key competences which are considered as essential for active citizenship: Social, civic and learning-to-learn competences. Additionally, a teacher training course dealing with theory, practice and challenges regarding competence-oriented teaching was developed, including an accompanying curriculum rationale.

This report shall give an overview of the project work of the last two years.

The first year started with national needs analyses in the participating countries to find out more about the specific needs of teachers in terms of teaching key competences more efficiently in class. The results of each countries’ needs analyses were summarised into an overall needs report that enabled the project consortium to conceptualise customised modules for both target groups: teachers and students. The overall needs report as well as the national reports on policies regarding the promotion of key competences in the participating countries are available via the VOICE project homepage: www.voice-comenius.org Needs Analysis.



After the needs of the project's target groups have been analysed, the project team developed prototypes of the teaching/learning materials.

As regards the school materials for pupils, there are (1) *four thematic modules*, dealing with the essential topics concerning European politics and European integration: Democracy, Europe, Human Rights and Migration, and (2) *three key modules*, focusing on training pupils' social, civic and learning-to-learn competences. The modules can be flexibly combined with each other and, therefore, are adaptable to the concrete needs of pupils and conditions of curricula. The structure of the thematic modules is oriented towards the problem-based learning (PBL) approach. PBL is a learner-centred pedagogical approach which promotes experiential learning organised around the investigation of real world problems in small groups of learners and therefore promotes key competences like working collaboratively, learning independently and finding creative solutions for complex issues.

In regard to the teacher training course, three modules have been developed, focusing on promoting teachers' skills and background knowledge needed in order to confidently implement competence-oriented materials in their lessons of civic education. The VOICE teacher training course is intended for secondary school teachers in the field of political / civic / citizenship education in European schools. It is designed for those teachers who want to gain a broader insight into learner-oriented, practice-oriented and competence-oriented means of teaching and facilitating.

Practice tests have been conducted in spring 2012 in order to ensure that all materials are flexible enough to be practicable and usable all over Europe.

You are cordially invited to download the final school manual freely downloaded via the project's homepage: www.voice-comenius.org > School materials. Besides PDF versions of the materials there are also modifiable WORD files in order to allow an even higher adaption to the concrete classroom situation.

<http://docs.lib.purdue.edu/ijpbl/aimsandscope.html>



The **Interdisciplinary Journal of Problem-based Learning (IJPBL)** will be a global outlet for PBL scholarship, representing excellence in discovery and promoting transformative educational pedagogy. IJPBL will provide access to the most current research and practice related to PBL pedagogy, thus enhancing efforts of both PBL scholars and practitioners.



Mission

The mission of IJPBL is to Publish rigorous research, representing a variety of disciplines, related to problem-based learning Engage key and emerging scholars in significant discussion of key issues facing PBL researchers and practitioners Provide up-to-date information to scholars and practitioners who are new to PBL research and pedagogy, enabling them to address current gaps in the literature and/or to transform current learning environments and practices

IJPBL Goals, Strategies, and Metrics

Goal: Establish IJPBL as a pre-eminent journal dedicated to PBL scholarship

Strategy: Increase credibility of IJPBL Action steps:

Secure listing in key citation indices (esp. PsycInfo, ERIC, Scopus).
Solicit manuscripts from key scholars doing PBL research
Recruit key scholars for advisory and editorial board positions
Maintain quality blind review process
Establish and maintain acceptance rate < 15%

Metrics:

Publication of three consecutive volumes of the journal (necessary to achieve indexing in citation indices)
List of key journals in which citations occur (determined through analysis of Google Scholar citations)
Increase in number of manuscripts submitted by key scholars, including those from PBL “hotbeds” in Europe and Asia (e.g., Republic Polytechnic, Singapore; Erasmus University, Netherlands)
Securement of 2 new key scholars/year to serve on editorial and advisory boards
Yearly acceptance rate



Strategy: Increase visibility of IJPBL. Action steps:

Implement marketing strategies designed to reach PBL scholars in multiple disciplines (conference presence Distribution of information [call for manuscripts, announcement of new issues, etc. to faculty] Advertisements/calls in relevant journals, newsletters, etc.) Publish topical issues related to PBL research and practice in specific disciplines (engineering education, pharmacy, educational psychology, etc.) or contexts (STEM, rural education, etc.) Enhanced web presence

Metrics:

Number of submissions/year Number of full-text downloads Number of disciplines represented in each volume Number of conferences in which IJPBL is marketed (exhibits, panel presentations, distributed brochures)/year

Goal: Establish Purdue, particularly the COE, as a key player in PBL scholarship and practice

Strategy: Create and strengthen ties with PBL scholars across colleges/schools at Purdue Action steps:

Engage colleagues in conversations about PBL pedagogy and research through established forums (Conversations on Teaching, CIE workshops, brown-bag seminar series, etc.) Solicit manuscripts from Purdue faculty engaged in PBL research Recruit Purdue scholars doing PBL research to participate on IJPBL board and/or as reviewers Participate on cross-disciplinary grants related to transformative pedagogy, including PBL



Metrics:

Number of attendees at PBL-based forums
Annual survey of COE faculty efforts related to PBL
Number of Purdue departments and colleges represented by authors of submitted manuscripts
List of reviewers and/or board members representing multiple colleges at Purdue
Collaborations with faculty from the College of Engineering and/or College of Science on NSF, DOE, and IES grants that include a PBL component

Strategy: Establish links between IJPBL, Purdue's COE, and national and international PBL initiatives

Action steps:

Participate in national and international efforts (PBL-focused conferences, PBL consultancies; advisory boards on multi-institutional grants)
Create an International Section in IJPBL - Publish articles and/or special issue related to international PBL scholarship
Host workshops, webinars, online discussions related to PBL pedagogy.

Metrics:

Number of national and international events with a Purdue/IJPBL presence
Invitations to participate in national and international efforts
Articles/issues related to PBL scholarship and/or initiatives at Purdue
Workshops, webinars, etc. hosted by Purdue with IJPBL presence.



Web based PBL training to improve headmasters skills and promote an 'innovative school'

The AHEAD project aims at promoting the headmasters leadership and school management, and specifically it provides headmasters with the need skills (leadership and management) for building and managing research teams to carry out innovative research activities thanks to the AHEAD didactic model, which combines a web based PBL – Problem – Based Learning approach with a peer training method to promote the ongoing updating of headmasters' practical skills.

The project answers to the COMENIUS priority: “to develop an approach to provide headmasters with practical training in school management”.

To this aim the AHEAD project aims at designing and testing an innovative didactic model to improve headmasters skills. In detail the AHEAD didactic model combines two main learning approaches which are a virtual Problem Based Learning –PBL methodology with a peer-to-peer learning approach.

Thanks to this didactic model, focused on the developed of practical abilities, the project intends to provide headmasters the needed skills and self-learning tools to cope with the management of national / international projects as well as to coordinate a team within the schools in charge of these projects.



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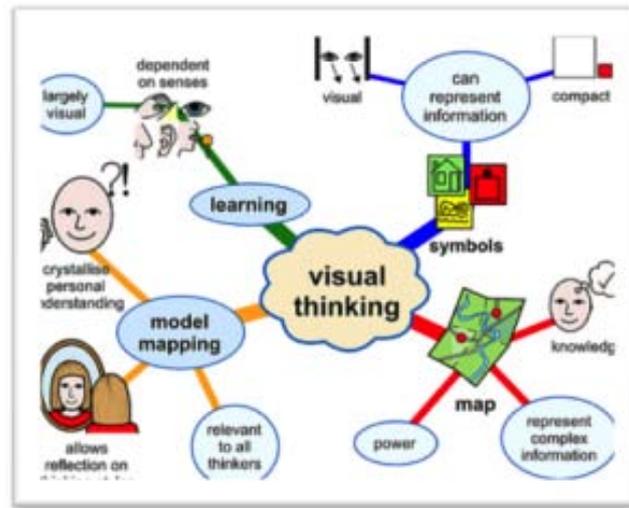
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ANNEX : YES Digital PBL Methodology for VET

*How to use the PBL approach in the VET environment
promoting the visual learning*



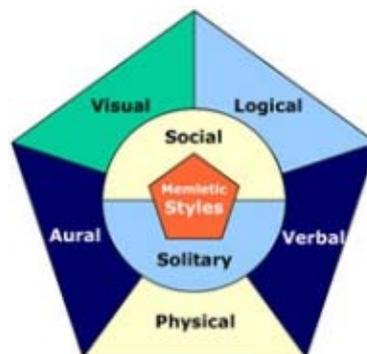
The Visual (Spatial) Learning Style

If you use the visual style, you prefer using images, pictures, colours, and maps to organize information and communicate with others.

You can easily visualize objects, plans and outcomes in your mind's eye.

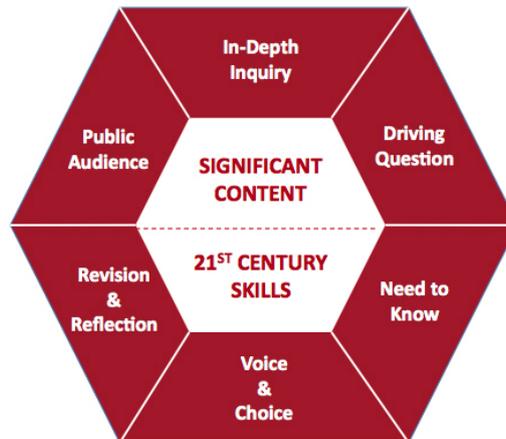
You also have a good spatial sense, which gives you a good sense of direction. You can easily find your way around using maps, and you rarely get lost.

When you walk out of an elevator, you instinctively know which way to turn.



Just resuming PBL

The essential feature of a teaching system designed to emulate professional practice is that the crucial assessments should be performance-based, holistic, allowing plenty of scope for students to input their own decisions and solutions. (Biggs, 2003: 237)



1. **Driving question**
2. http://pbl-online.org/driving_question/dqoverview/movie/FLV1_dqmovie3.htm
3. **Students divided into groups (defining the roles)**
4. **The real problem is presented and discussed**
5. **Students identify what is known, what information is needed, and what strategies or next steps to take**
6. **Individuals research different issues, gather resources**
7. **Resources evaluated in group | cycle repeats until students feel the problem has been framed adequately and all issues have been addressed**
8. **Possible actions, recommendations, solutions, or hypotheses are generated and publication (and defence!)**

1st suggestion - How to use videos

YES DIGITAL has a very big library of videos related to energy.



The suggestion 1 is based on using the videos for driving the real problems.

2nd suggestion - How to use videos

- Discussing a real problem related to the energy sustainability and
- Creating a NEW Video following the Yes Guide: presenting the problem and starting discussing it.

3rd suggestion

- Selecting a video (or videos) in the Internet

The PBL scheme in VET “dressing”:

1. Driving question

The problem has to be very practical and real:

e.g. How the solar panels can be optimized and how to calculate the convenience in relation with the school level of energy consumption:

Problems strictly related to the problems they are used to discuss.

2. Students divided into groups (defining the roles)

SAME: but the role has to be related to the future professions of the students and NOT generic. Creating the group just if they were already involved in their future profession!

3. The real problem is presented and discussed

SAME



4. Students identify what is known, what information is needed, and what strategies or next steps to take

SAME

5. Individuals research different issues, gather resources

SAME

6. Resources evaluated in group and cycle repeats until students feel the problem has been framed adequately and all issues have been addressed

SAME

7. Possible actions, recommendations, solutions, or hypotheses are generated and publication (and defence!)

SAME (please, privilege technical documents as projects and graphics)

Advantages of PBL and visual learning

- Greater recall of knowledge, retention interdisciplinary, can require accessing and using information from a variety of subject domains
- Better integration of knowledge
- Development of life-long learning skills: how to research, how to communicate in groups, how to handle problems
- Increased motivation, interest in subject areas
- Increased student-student interaction, and student-instructor interaction