

Introduction to Problem-Based Learning



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Information Technology Institute
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Facilitated by
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Undergraduate Education



University of Delaware

Handouts for Day 1

STAGE 1

"Customer service is not an expense: it is a responsibility. It is a promise that we make each time a customer makes a purchase from Portal Systems."

--Emilio Chavez, founder and CEO of Portal Systems

Dan Stevens, The Vice President of Customer Relations for Portal Systems, looked at the framed picture on his wall and read the statement carefully. Emilio had handed it to him personally when he graduated from his new employee orientation class, almost fifteen years ago.

All Portal employees could recite the company's story from memory. Emilio Chavez emigrated from Mexico to the United States in 1985. He worked his way through college by selling computers out of his college dormitory room in Arizona. Initially, Portal focused on computer enthusiasts by advertising in technology magazines. Portal had continued to avoid physical stores, but it now sold products directly to consumers through its website. The company had grown into one of the top personal computer manufacturers in the United States: it had significant market share in the small business, home office, and corporate markets. Customers were typically attracted by Portal's low prices, but Dan knew the company's high quality products and excellent customer service were responsible for its high percentage of repeat customers.

Emilio had worked to create a family atmosphere in the company. Portal Systems' manufacturing facilities and customer call centers were located in the greater Phoenix area. The company felt its geographic cohesiveness was an advantage. Company sports leagues, picnics, and even pep rallies were a source of camaraderie for the employees. The company had grown to be one of the largest employers in the southwestern United States and was consistently regarded as one of the best places to work in the state of Arizona.

More recently, however, Portal was experiencing growing pains. Sales were down across the personal computer industry, and increased overseas competition had tightened profit margins. Portal Systems was losing ground against its competitors: the company had lost 3% market share over the past year. Although Phoenix had historically been a low cost area for businesses, increases in real estate costs, taxes, and wages had ballooned in recent years.

Perhaps even more troubling, the company's reputation for excellent customer service had eroded in recent months. Average hold time on the company's customer service lines had grown to thirty minutes, and fifteen percent of customers waited over 45 minutes before a technician answered. Because of high wage and health insurance expenses, Portal's cost per employee was among the highest in the industry and was increasing fifteen percent annually. Even though



the company was financially sound, Dan knew that the company needed to cut costs to remain competitive.

Amy Smith, the Executive Vice-President for Products and Services, had asked Dan to assemble a list of recommendations to improve the recent decline in Portal's reputation.

FOCUS QUESTIONS

1. (Individual). Consider Dan's options for resolving Portal Systems' problems. Write down your ideas on a sheet of paper.
2. (Team). Share your ideas with your teammates. Discuss the cultural and managerial implications and potential risks for each suggestion.
3. (Team). List the major learning issues: What do you know? What do you need to know? Where and how will you find the information you need?



Characteristics of Good Learning Issues

"...once you have learned to ask questions - relevant and appropriate and substantial questions - you have learned how to learn and no one can keep you from learning what ever you want or need to know."

Neil Postman & Charles Weingartner (1969)
in **Teaching as a Subversive Activity.**

Knowledge is power (Bacon). All of us have vast areas of ignorance and we will never come close to knowing more than a very small fraction of what there is to know. Nevertheless, being aware of what we don't know is also a type of power because it enables us to focus our learning where it counts when we have problems to solve. The more adept we become at defining what we need to know in away that it can be pursued, the easier it is to quickly locate needed information and the better problem solvers we become.

Most of us are reluctant to reveal our ignorance. Who wants to look "stupid?" A major tenet of problem-based learning is that learning occurs best in an environment where we can admit our knowledge gaps and do something about them by working together to achieve understanding. In problem-based learning, our knowledge gaps become our learning issues. The way we go about defining learning issues influences the depth of understanding we achieve. What are the characteristics of a good learning issue?

1. Presented in the form of a **question** or **series of questions**.
2. **Focused** so that it seeks specific information.
3. Constructed so that it asks an **answerable** question.
4. Pursues information that is **relevant** to the problem.
5. Goes beyond superficial knowledge to probe **conceptual** issues.
6. Often set in a **context** that provides direction. **Why** is the question important?

What Is PBL?



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Recommendations from the Carnegie Foundation

Make research-based learning the standard.
Build inquiry-based learning throughout the four years.
Link communication skills and course work.
Use information technology effectively.
Cultivate a sense of community.

Boyer Commission, 1998



What Is PBL?

*“...careful inspection of methods which are permanently successful in formal education...will reveal that they depend for their efficiency upon the fact that they go back to the type of situation which causes reflection out of school in ordinary life. They give pupils **something to do, not something to learn; and if the doing is of such a nature as to demand thinking, or the intentional noting of connections; learning naturally results.**”*

John Dewey (1916)



Characteristics Needed in College Graduates

High level of communication skills
Ability to define problems, gather and evaluate information, develop solutions
Team skills -- ability to work with others
Ability to use all of the above to address problems in a complex real-world setting

Quality Assurance in Undergraduate Education (1994)
Wingspread Conference, ECS, Boulder, CO.



What Is PBL?

“The principal idea behind PBL is that the starting point for learning should be a problem, a query, or a puzzle that the learner wishes to solve.”

Boud, D. (1985) PBL in perspective. In “PBL in Education for the Professions,” D. J. Boud (ed); p. 13.



PBL is...

“...a process of acquiring understanding, knowledge, skills and attitudes in the context of an unfamiliar situation, and applying such learning to that situation.”

- C. E. Engel, University of Newcastle

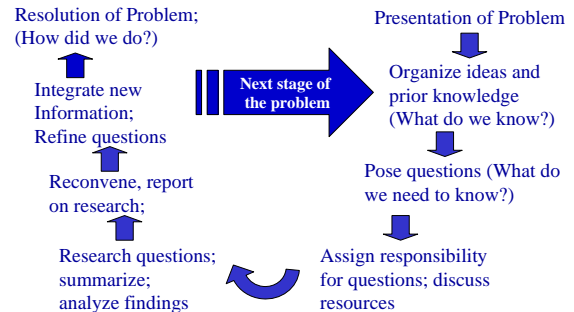


What are the Common Features of PBL?

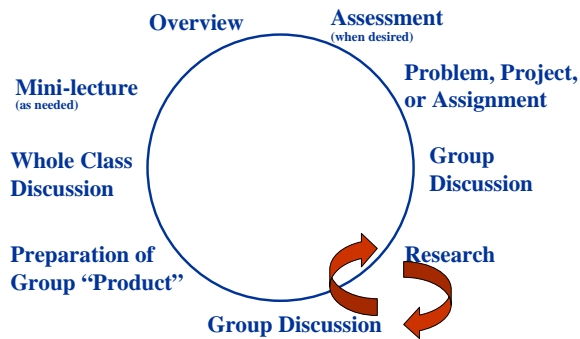
- Learning is initiated by a problem.
- Problems are based on complex, real-world situations.
- All information needed to solve problem is not given initially.
- Students identify, find, and use appropriate resources.
- Students work in permanent groups.
- Learning is active, integrated, cumulative, and connected.



PBL: The Process



The Problem-Based Learning Cycle



Factors in Choosing a Model

- Class size
- Intellectual maturity of students
- Student motivation
- Course learning objectives
- Instructor's preferences
- Availability of peer facilitators



Common Classroom Models

- Medical school
- Floating Facilitator
- Peer Facilitator
- "Hybrid"



Medical School Model

- Dedicated faculty tutor
- Groups of 8-10
- Very student-centered environment
- Group discussion is primary class activity

A good choice for

- Highly motivated, experienced learners
- Small, upper-level seminar classes



Floating Facilitator Model

- More structured format: greater degree of instructor input into learning issues and resources
- Group size: 4
- Instructor rotates through groups: Asks questions, directs discussions, checks understanding
- Other class activities:
 - Groups report out
 - Whole class discussions
 - (Mini-)lectures

A good choice for

- Less experienced learners
- Classes of all sizes



Peer Facilitator Model

Advanced undergraduates serve as facilitators

- Help monitor group progress and dynamics
- Serve as role models for novice learners
- Capstone experience for student facilitators

A good choice for

- Classes of all sizes



Dealing with Large Classes

Floating facilitator or peer facilitator models are the most appropriate.

Requires a more teacher-centered, structured format: instructor directs group activities

Group size: 4

Reduce grading burden through group (vs. individual) papers, projects



“Hybrid” PBL

- Non-exclusive use of problem-driven learning in a class
- May include separate lecture segments or other active-learning components
- Floating or peer facilitator models common

Often used as entry point into PBL in course transformation process



Effectiveness of PBL: Research

- Ample evidence for the value of active and cooperative learning (Johnson, Johnson and Smith, 1991)
- Strict comparisons of PBL and traditional approaches difficult to design (Prideaux, 2000):
 - Randomization, blinding difficult
 - Many uncontrollable variables: variants in PBL, resources, motivation
 - Appropriate outcome measures: content knowledge vs. process skills
- Most research studies from medical education



General Trends from Research

- Content knowledge comparable to that found in traditional courses (Newman, 2003)
- PBL leads to
 - improvement in student attitude and clinical performance (Vernon and Blake, 1993)
 - deeper approach to learning (Newble and Clarke, 1986)
 - better interpersonal skills and attitudes towards patients (Nandi et al., 2000)

What Is a Good PBL Problem?



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Good PBL Problems...

- relate to real world, motivate students
- require decision-making or judgments
- are multi-page, multi-stage
- are designed for group-solving
- pose open-ended initial questions that encourage discussion
- incorporate course content objectives, higher order thinking, other skills



Bloom's Cognitive Levels



- Evaluation** - make a judgment based on criteria
- Synthesis** - produce something *new* from component parts
- Analysis** - break material into parts to see interrelationships
- Application** - apply concept to a *new* situation
- Comprehension** - explain, interpret
- Knowledge** - remember facts, concepts, definitions



Rubric to Evaluate PBL Problems

Criteria	Descriptors		
	3	2	1
Realism	Based on an actual or fictionalized real-world situation linking topic to learner.	Contrived or contains unrealistic elements that decrease credibility.	Unrealistic, lacking relevant context.
Content	Addresses significant conceptual issues; directly related to major content goals.	Encourages superficial rather than in-depth understanding concepts.	Relevance of topic peripheral or not apparent.
Engagement	Stimulates discussion and inquiry through its relevance and presentation.	Generates limited or superficial discussion; provokes little curiosity.	Lacks a "hook"; obscure or pedantic presentation.



Rubric to Evaluate PBL Problems

Criteria	Descriptors		
	3	2	1
Complexity	Appropriately challenging; group effort and cooperation required; some ambiguity appropriate; integrates multiple concepts.	Difficult but may encourage a "divide and conquer" approach. Concepts not well integrated.	Solution accessible to most students working alone; focused on single concept.
Resolution	Open to multiple resolutions or multiple pathways to solution, depending on student assumptions and reasoned arguments.	Resolution is more obvious but allows reasonable opportunity for judgment and discussion.	One right answer is expected; limited opportunity for analysis and decision making.



Rubric to Evaluate PBL Problems

Criteria	Descriptors		
	3	2	1
Structure	Progressive disclosure via multiple stages, builds on existing student knowledge.	Staging does not flow well; transition could be improved.	Too much or too little information provided at once; short cuts thinking/research.
Questions	Limited in number, short, and open-ended; encourage deeper understanding.	Most are directive; preempt student-generated learning issues.	Lead to "yes-no" answers rather than thoughtful discussion.
Research	Promotes substantive research using multiple resources.	Research limited to textbook material.	Limited necessity for research.

Rubric to Evaluate PBL Problems

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Other possible rubrics:
Problem Delivery and Process
Associated Assignments
Student Products and Presentations

Comparison of Teacher-Centered and Learner-Centered Paradigms

From Figure 1-2 in Huba and Freed, *Learner-Centered Assessment on College Campuses: Shifting the Focus from Teaching to Learning*, 2000



What I know best I have taught...

...the individuals learning the most in the teacher-centered classrooms are the teachers there. They have reserved for themselves the very conditions that promote learning:

actively **seeking** new information, **integrating** it with what is known, **organizing** it in a meaningful way, and **explaining** it to others.

Page 35, Huba and Freed, *Learner-Centered Assessment on College Campuses: Shifting the Focus from Teaching to Learning*, 2000



First, an exercise:

1. Individually, write down five words or short phrases that come to mind when you think of:
Student-Centered Learning
2. In small groups, select three “most important”.
3. Finally, prepare to report out one choice.



Comparison of Paradigms

Teacher-Centered

Knowledge is transmitted from professor to student.

Learner-Centered

Students construct knowledge through gathering and synthesizing information and integrating it with the general skills of inquiry, communication, critical thinking, and problem solving.



Comparison of Paradigms

Teacher-Centered

Students passively receive information.

Learner-Centered

Students are actively involved.



Comparison of Paradigms

Teacher-Centered

Emphasis is on acquisition of knowledge outside the context in which it will be used.

Learner-Centered

Emphasis is on using and communicating knowledge effectively to address enduring and emerging issues and problems in real-life contexts.



Comparison of Paradigms

Teacher-Centered

Instructor's role is to be primary information giver and primary evaluator.

Learner-Centered

Instructor's role is to coach and facilitate.
Instructor and students evaluate learning together.



Comparison of Paradigms

Teacher-Centered

Teaching and assessing are separate.

Learner-Centered

Teaching and assessing are intertwined.



Comparison of Paradigms

Teacher-Centered

Assessment is used to monitor learning.

Learner-Centered

Assessment is used to promote and diagnose learning.



Comparison of Paradigms

Teacher-Centered

Emphasis is on right answers.

Learner-Centered

Emphasis is on generating better questions and learning from errors.



Comparison of Paradigms

Teacher-Centered

Desired learning is assessed indirectly through the use of objectively scored tests.

Learner-Centered

Desired learning is assessed directly through papers, projects, performances, portfolios, and the like.



Comparison of Paradigms

Teacher-Centered

Focus is on a single discipline.

Learner-Centered

Approach is compatible with interdisciplinary investigation.



Comparison of Paradigms

Teacher-Centered

Culture is competitive and individualistic.

Learner-Centered

Culture is cooperative, collaborative, and supportive.



Comparison of Paradigms

Teacher-Centered

Only students are viewed as learners.

Learner-Centered

Professor and students learn together.



Outcomes?

Moving away from:

Are students getting the right answer?



Outcomes?

Moving to:

Can students demonstrate the qualities that we value in educated persons, the qualities we expect of college graduates?



Outcomes?

Moving to:

Can students gather and evaluate new information, think critically, reason effectively, and solve problems?



Outcomes?

Moving to:

Can [students] communicate clearly, drawing upon evidence to provide a basis for argumentation?