

## The What and Why of Problem Based Learning (PBL)

Before you read about the learning approaches that are used in a PBL class, have a look at a brief video expressing college students views about their own experiences in college. Viewed by over 4.5 million people it summarizes some of the most important characteristics of students today - how they learn, their goals, hopes, dreams, what their lives will be like, and what kinds of changes they will experience in their lifetime. *Created by Michael Wesch in collaboration with 200 students at Kansas State University.*

- **A Vision of Students Today (by Students!)** - <http://www.youtube.com/watch?v=dGCJ46vyR9o>

What do you think were the important messages about college that these students are sharing in this video?

**Why PBL?** - *“Insanity is doing the same thing over and over again and expecting different results ...”* Albert Einstein

What do we want of our students?	What do we often get of our students?
<ul style="list-style-type: none"> <li>• <i>Engaged – personally, professionally and civically</i></li> <li>• <i>Interdisciplinary learners</i></li> <li>• <i>Intrinsically motivated and self-actualized learners</i></li> <li>• <i>Independent, self-directed but also effective collaborators</i></li> <li>• <i>Meta-cognitive learners</i></li> <li>• <i>Confident learners</i></li> <li>• <i>“Knowledge miners” but also deep readers.</i></li> <li>• <i>Users of knowledge, wise/informed decision makers.</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>“Just tell me what I need to know for the test...”</i></li> <li>• <i>“My learning is the teacher’s responsibility...”</i></li> <li>• <i>“Read BEFORE class...no way!”</i></li> <li>• <i>Studying = highlighting, reviewing notes, memorizing, cramming.</i></li> <li>• <i>Why do I need to know this?</i></li> <li>• <i>“Facebooking” 15 min into class!</i></li> <li>• <i>“I’m just not a ‘science person’...”</i></li> <li>• <i>“Learn it for the test and let it go...”</i></li> </ul>

- Courses taught exclusively through lecture promote passivity, short term “surface” learning, and send a clear, albeit unintended message, that knowledge is something that is given to students, rather than something they must actively seek out.
- Students immersed in PBL classes report that the active, contextual, and collaborative nature of learning that occurs facilitates long-term learning, and more meaningful understanding.
- PBL courses stimulate interdisciplinary thinking and help students see the connections not only between different areas of science but also between such areas as economics and the environment, between social values and genetics, between politics and pollution and a host of other connections to science.
- PBL courses stimulate critical thinking by anchoring learning to problems or issues that will challenge students’ current worldviews and require them to explore other paradigms, & search for deeper meaning and understanding.
- PBL courses are meant to help students understand that the purpose of learning is to help them function more effectively both in and, perhaps more importantly, to our world.

### What is Problem Based Learning (PBL)?

In science course taught using PBL, students work collaboratively in small teams to solve (or better understand) social, environmental, and scientific questions, problems, and issues with the goal of learning how to use and evaluate relevant biological information, apply these biological concepts and principles, and communicate ideas and information to others. Class discussions, activities, and occasional lectures will help to build a conceptual framework, and to guide the classes’ efforts to learn and apply core concepts in biology.

**Problem Solving** - Effective learning is much more than memorizing information to answer questions on examinations. Learning (is) a process that culminates in the ability:

- to ask the right questions and frame problems
- to acquire information and evaluate sources of information
- to critically investigate and (re)solve problems
- to make choices among many alternatives
- to generalize to new situations
- to clearly explain concepts to others (both orally and in writing)

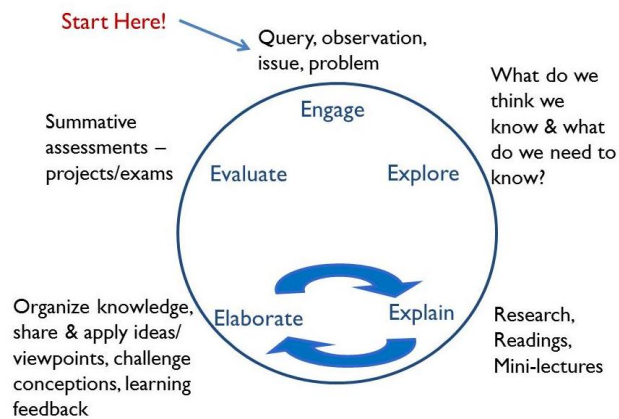
Problems or case studies are used to introduce various ideas or topics and to serve as focal points for learning new material. Students sometimes find this a bit unusual since it is customary to work on problems or explore relevant issues after the pertinent

concepts have already been thoroughly presented in a lecture or reading. The purpose of PBL is to have the problem/issue/query provide a context and reason to learn the material, and to serve as a contextual focal point that guides knowledge acquisition. Students are not expected to be able to come up with a solution or understand all facets of the problem instantly. Instead problems or case studies are meant to encourage a dialogue about what knowledge or insights students bring to the situation, what information is collectively still lacking, and where to find that information.

The rate of generation of new information in the scientific and technical sectors is truly staggering. Information becomes outdated rapidly and is updated constantly. Much of what our students will need to know following graduation has not yet been discovered! Therefore identifying when new information is needed, where to find it, how to analyze it, and how to communicate it effectively are essential for our students' success in their personal, civic, and future professional lives.

The general process by which students learn in a PBL course follows a learning cycle, whose pedagogies are based in constructivist learning theory. A general diagram of this cycle of learning, which can play out in a single class (or lab) or over several classes or unit of study, is presented below.

## PBL & the Learning Cycle



- Each problem begins with a short problem or case study reading, story, film clip, news article or podcast that frames the problem or issue, and ENGAGES the learner.
- Problems are always framed around issues that are likely to be engaging to the students given their level of expertise, background and life experiences.
- The major concepts needed to solve the problem are not immediately given. Instead, students come to learn how to identify what information is needed to proceed through the problem, and where to find this information as the course progresses.
- The problem solving process is supported through readings, research, team-based activities, discussions, and lectures that help students to elaborate on knowledge, synthesize concepts and apply them to the problem.
- Much of the learning process is collaborative in small teams, similar to most professional working environments.
- Teams work together towards the development of a final problem project, and these are designed to engender positive interdependence among team members while facilitating individual accountability. This is best done by providing opportunities for team members to
  - Share ideas, viewpoints
  - Share research resources
  - Develop protocols
  - Work together to collect data and information
  - Reach a consensus recommendations or solutions
  - Evaluate each other's work
  - Acknowledge/assess the contribution of their peers to the project.
- However, problem projects always require individual use and integration of knowledge elaborated on by the team. So the project problem is always constructed individually by each member of the team.
- Each problem will be concluded with a whole class discussion or activity that will help clarify concepts that may still not be understood and to allow teams to share & justify their recommendations or possible solutions.

**Roles and Responsibilities** - In a PBL course, student and instructor roles and responsibilities may differ somewhat from more traditionally-taught (lecture-based) courses. Students assume more responsibility for their learning, while the instructor is more of a

facilitator of learning. Facilitators generally design an environment that fosters learning, rather than simply explaining topics or disseminating knowledge or information. **As a general guideline, students are expected to:**

- Come to class prepared and on time.
- Participate in team discussions, problem solving, and lab investigations.
- Fulfill responsibilities assigned by your team, and course instructor.
- Listen to others' expression of their opinions and ideas.
- Provide and be receptive to constructive feedback so that teams work effectively.

**The course instructor is expected to:**

- Provide a challenging learning environment for the class.
- Support students as they work in teams to explore and elaborate on knowledge needed to resolve problems.
- Guide students to appropriate learning resources and strategies.
- Listen to student views and concerns and take appropriate action.
- Answer students' questions (when and as appropriate).

*Credits: In these sections on problem-based learning and working in teams, I have borrowed liberally from the writings and syllabi of Deb Allen (Biological Sciences), and George Watson (Physics) and others at the University of Delaware's Institute for Transforming Undergraduate Education (<http://www.udel.edu/inst/>).*