Project and Problem Based Learning

Agenda
- Introduction to PBL and the history
- Change in teacher roles
- PBL Aalborg practice:
  - Teams, Projects and Problems
  - Supervisor/Facilitator
  - Documentation of success

The Origin of PBL

PBL is a didactic method focusing on the learner. It builds on pedagogic traditions like:
- Jerôme Bruner: learning by discovery
- Maria Montessori: playing is learning
- William Killpatrick: whole hearted learning
- Carl Rogers: student centered learning
- The Harvard method: case based learning

The early history of PBL

- Don Woods coins the words PBL for his teaching in a chemistry class in McMaster’s university by the end of the sixties.
- PBL chosen as the didactic method for the development of a new medical curriculum at McMaster’s university (1969).
- Introduction of PBL in Maastricht, also for the development of a new medical curriculum.

Characteristics of PBL

Focus on the learning process
- Cooperative learning in small groups
- Students responsible for their own learning

Thematic curriculum structure
- Integration of knowledge and skills
- Integration of different domains

PBL Learning Principles

Social
- Participant directed
- Team based learning

Content
- Theory practice relation
- Interdisciplinary learning
- Exemplary learning
- Meta-learning/Double loop learning

Learning
- Problem based
- Project based / organised
- Contextual learning
- Activity/experience based learning
Advantages of PBL-PO in Education

- Students learn knowledge and skills in the context of practice.
- Students become aware of their resources in practice-oriented problem solving.
- Students learn to communicate and cooperate across discipline boundaries.

Hazards of PBL-PO in Education

- Learning objectives requiring prolonged study activities can be neglected.
- Students may tend to concentrate on the product, ignoring personal learning results.
- Teachers focusing on their own experience in practice can unwillingly enforce this tendency.

Key Features in the Success of PBL

- Students responsible for their own learning process
- A clear purpose of all learning activities
- Sufficient attention for Communication Skills
- Balanced support from Technical experts to overcome knowledge barriers

Student centered learning

Teach me... and I will forget?

Tell me and I will forget
Show me and I will remember
Involve me and I will understand
Step back and I will act

Chinese proverb
Active involvement, discussing a topic is an effective educational strategy, for students as well as for teachers.

**Teacher roles and PBL**

The teacher as:
- Expert
- Facilitator
- Designing a stimulating environment for learning
- Management of the learning process, including evaluation
- Stimulates students to define their own learning goals and to direct their own learning process

**Susan**

- Is academically committed, bright, interested in her studies and wants to do well
- Has clear academic or career plans
- What she learns is important to her. She goes about learning in an academic way
- Comes to the lectures with sound, relevant background knowledge and possible some questions, she wants answered – or it may not be the answer she is looking for, and she speculates, wondering why it isn’t

Students like Susan virtually teach themselves, with little help from teachers

**Robert**

- Is at university not out of a driving curiosity about a particular project or a burning ambition for a particular profession, but to obtain a qualification for a decent job
- He is not studying in the area of his first choice
- He is less committed than Susan, possibly less bright (academically speaking), and has a less developed background of relevant knowledge
- He comes to the lecture with few questions
- He wants to put in sufficient effort to pass
- Robert hears the lecturer saying the same words as Susan, but he does not see a keystone, - just another brick to be recorded in his lecture notes
- He believes that if he can record enough of these bricks, and remember them on cue, he will keep out of trouble on exam.

We are told that there are many Robert’s!

**Which type of students do we have?**

[Graph showing student orientation, teaching method, and level of engagement]
PBL Aalborg Practice

Three main characteristics
• Problem
• Project
• Team work

Examples mainly from Engineering

PBL Aalborg Model - practice

• Problems – question – wondering within a frame
• a project each semester (1. year)
• each group has a group room
• group size of 6-8 students first year, 2-3 students the last year
• each group has at least one supervisor
• self selected group and projects within themes and disciplines
• group examination with individual marking

Team work

Why?
• A survey in 1997 showed that 75% of the companies wanted new employees to have good skills in team work
• Most brain work is done in teams
• The individual student in the group learns from the others (peer learning)
• Responsibility towards the group leads to very hard work
• Group members provide social support, thus lower drop-out rate

Projects

What?
• A unique task
• Have a lot of complex activities
• Needs several people with different skills
• Have a final goal/objective
• Limited resources (time, money, people)
• Have to deliver a result at a given time:
  – As a minimum a written report
Projects

Why?

• More and more companies use project organization
• Motivates the students and increases student activity
• Secures deep learning in subjects covered in the project
• Improves documentation skills

The New Aalborg Model

Timing of a semester

What?

• It can be theoretical, practical, social, technical, symbolic-cultural or scientific
• It grows out of students’ wondering within different disciplines and professional environments
• It is the starting point directing the students’ learning process and situates the learning in a context
• It may involve an interdisciplinary approach in both the analysis and solving phase
• It has to be exemplary

Problem Orientation

An Unsatisfactory Situation
– E.g. an increasing number of danish kids are getting fat

An Un-Utilized Potential
– The homepage of AAU is old fashioned

Unknown Impacts
– We want to investigate if and how IT and new technology can be used to improve kids habits towards doing regular exercising

Different type of problems

different strategies for problem analysis

• An unsatisfactory Situation
  – Bottom-up analysis – from practise to technology
  – WHO and WHY questions are dominating

An Un-Utilized Potential
– Top down analysis – from technology to practise
  – WHAT-IF questions are dominating

• Unknown Impacts
  – Theoretical analysis – from technology and within
  – WHAT questions are dominating
**EXEMPLARITY**

- Selection of relevant specific learning outcomes and content/scientific knowledge that is exemplary to overall learning outcomes
- That is, the problem needs to refer back to a particular practical, scientific and/or technical domain
- The problem should stand as one specific example of more general learning outcomes related to knowledge and/or modes of inquiry

**Projects started by Problems**

Three different types of problem based projects in Engineering at AAU:

**Assignment projects (AP)**
- planning and control by the teachers/supervisors
- problem and the subject chosen beforehand

**Subject projects (SP)**
- definition of the subject by the teachers beforehand.
- students choose a problem and method.

**Problem projects (PP)**
- problem determines the choice of disciplines and methods.

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**The assignment project**

![Assignment Project Diagram](image)

**The subject project**

![Subject Project Diagram](image)

**The problem project**

![Problem Project Diagram](image)

**What is a supervisor/facilitator?**

- A person who through facilitating questions encourages students’ learning process
- A person who points out the potentials in the student’ work
- A person who gives loyal and constructive critic of the students’ work
- A person who at the project exam is one of the examiners
What is a supervisor/facilitator not?

- Not a teacher who is responsible for the students’ learning process
- Not a person who tells the students’ what to do
- Not a person who decides what should be the content of the students’ project
- Not a member of the project group
- Not an inexhaustible resource – therefore: Supervisor hours should be used carefully

Levels of involvement

1. The facilitator acts like a group member
2. Dialogue based facilitation
3. The facilitator acts as consultant

4 types of facilitation

- Process facilitation
  - How are things in the group?
  - Make an index to the report as soon as possible
- Control facilitation
  - Can you please go to the blackboard and...
- Product facilitation
  - Well everything seems to be working fine – so ...
- Laissez-faire facilitation

Evaluation from Danish industry on graduates

Overall assessment of Danish Engineering Institutions. IDA, 2008