

Problem Based Learning in Engineering

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Summary

- Introduction to Problem Based Learning PBL and Why the need of PBL?
- PBL vs Traditional Teaching
- PBL in Engineering
- PBL Basic Structure
- Example PBL in Engineering
- Advantages and Disadvantages PBL in Engineering
- Conclusions

PBL - Introduction

- A new method of teaching used mainly in the Third Level education based on the 'learn to learn' concept
- PBL first developed as a small group, student-centred learning curriculum at the Mc Master Medical University in Canada (1960)
- The emergence of PBL as a concept: Barrows (1980) discovered through research into medical education that: 'Medical students and residents for the most part did not seem to think at all'

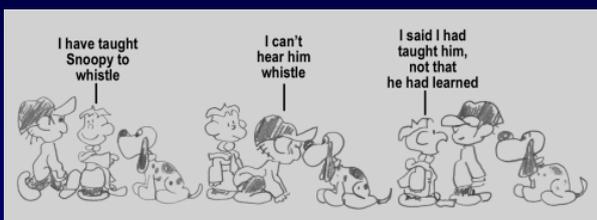
Why need PBL?

Barrows and Tamblyn (1980) concluded:

- Learning through problem situations -much more effective than memory based learning
- The medical skills that were most important for treating patients were problem solving skills rather than memorization

PBL vs Traditional Teaching

- Traditional Teaching: the message delivered could not be understood by the recipient



PBL vs Traditional Teaching ctd.

Tell me, and I will forget.

Show me, and I may remember.

Involve me, and I will understand.

(underlying principle of PBL)



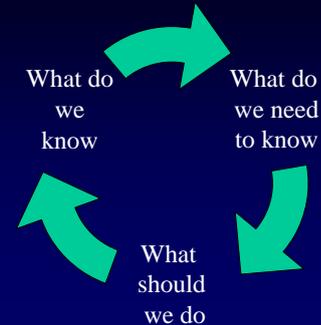
PBL in Engineering

Labour Market demands for key skills.
PBL addressed these issues and offered opportunities for students to:

- Work and learn in teams
- Develop presentation skills
- Learn negotiation abilities
- Develop research skills
- Develop a critical thinking



PBL - Basic Structure



Steps in solving a problem using PBL

PBL - Simplified Model

1. Introduce an "ill-structured" problem or scenario to students

2. List what is known

3. Develop a problem statement

4. List what is needed

5. List possible actions, solutions, or hypotheses

6. Present and support the solution

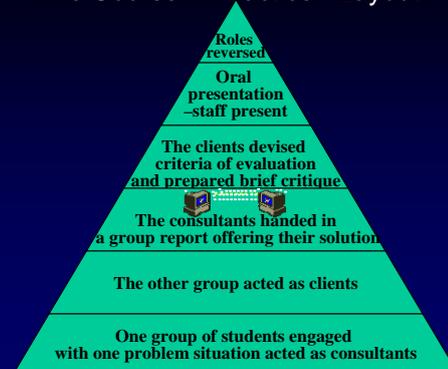
PBL in Engineering - Example

- In 1992 PBL replaced a conventional module on vibration for the third year BSc Mechanical Engineering course - Gimmer University (UK)
- Reason:
In the past students tended to avoid examination questions requiring problem solving abilities
- The aim:
Move away from the transmission of knowledge towards the development of professional skills

PBL in Engineering – Example The Course in Practice

- Introductory session - helped students decide whether to take the course or not
- The module comprised six problem situations which were dealt with in three pairs
- The problems covered all the technical material of the course and were also the vehicle for attitude and skills development
- Each pair phase lasted six or seven weeks (overall timetable 30 contact hours over 20 weeks)

The Course in Practice - Layout



The Course in Practice - Assessment

- Consultants reports on three problems
- Client reports on three problems
- Oral presentations of the reports
- One solution to an example on a particular topic
- One-hour test of 'understanding' at the end of the course - to check the students 'grasp' of the basic principles of the subject



Hybrid Model in Engineering (PBL + Traditional Teaching)

Trinity College Dublin, Mechanical and Manufact. Eng. Dept.,
Mechanics of Solids and Materials course

- First Semester -Traditional Teaching Method
- Second Semester – PBL
 - Independent teaching and learning module with an integrated web course called: 'Learning through failure'
- Assessment :
 - exam questions - traditional format
 - reports and exam questions on real life engineering cases using knowledge gained throughout the years

Advantages and Disadvantages PBL in Engineering

- Advantages:
 - Develops independent and critical thinking
 - Simulates real life engineering cases
 - Develops team working and presentation skills
 - Improves motivation for learning
 - Enhances long term retention knowledge
 - The cost of running PBL curricula is comparable with that of running traditional ones for classes sizes up to 100
- Disadvantages:
PBL can be seen as a method of 'giving' students skills, limiting the possibility to offer them a broader image of the engineering concepts



Conclusions

- PBL in Engineering helps students developing skills required by the labour market
- Helps students managing and dealing with real life engineering scenarios
- Develops independent and critical thinking - essential engineering feature
- However PBL in Engineering tends to limit developing a broad view on Engineering concepts
- By using a hybrid approach (PBL+Traditional Method of Teaching) the above obstacle could be easily overcome

References

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