

Active learning methods and PBL

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Higher education in a global context

- **Globalization:** people, market, capital, goods, services
 - increased competition
 - knowledge-based economy (digitization, big data, AI,)
 - innovation, entrepreneurship,
- **Internal dynamics**
 - deregulations, new universities/programmes/courses
 - univ. ranking (research publ., graduates, attractiveness, ...)
 - student mobility & education as a business
(efficiency, value for money, ...)
- **Importance of professional competences**

What kind of competences are needed ?

- **Knowledge**, skills and competences in their subject fields
- Ability to think creatively, differently and outside of the box
- Ability to work independently and take initiatives with entrepreneurial mindset
- Ability to analyse real situations, formulate problems, search for solutions based on sound knowledge base
- Ability to critically evaluate existing solutions, identify needs for improvement and seek new, better solutions
- Leadership & team work skills and ability to build collaboration networks
- Ability to identify personal needs of new knowledge and actively engage in life long learning (LLL)

Student-centered, active learning

- Higher education is meant for students, not for teachers
→ HE should be student-centered, not teacher-centered
- Teacher-centered teaching emphasizes the interests and expertise of the teacher. Student-centered learning focuses on the interests and needs of the student for future professional life
- Change of philosophy: from **teaching by teachers** to **active learning by students**

Simple, complicated & complex problems

SIMPLE	COMPLICATED	COMPLEX
<i>Baking a Cake</i>	<i>Sending a Rocket to the Moon</i>	<i>Raising a Child</i>
The recipe is essential	Rigid protocols or formulas are needed	Rigid protocols have a limited application or are counter-productive
Recipes are tested to assure easy replication,	Sending one rocket increases the likelihood that the next will also be a success	Raising one child provides experience but is no guarantee of success with the next
No particular expertise is required, but experience increases success rate	High levels of expertise and training in a variety of fields are necessary for success	Expertise helps but only when balanced with responsiveness to the particular child
A good recipe produces nearly the same cake every time	Key elements of each rocket MUST be identical to succeed	Every child is unique and must be understood as an individual
The best recipes give good results every time	There is a high degree of certainty of outcome	Uncertainty of outcome remains
A good recipe notes the quantity and nature of the "parts" needed and specifies the order in which to combine them, but there is room for experimentation	Success depends on a blueprint that directs both the development of separate parts and specifies the exact relationship in which to assemble them	Can't separate the parts from the whole; essence exists in the relationship between different people, different experiences, different moments in time

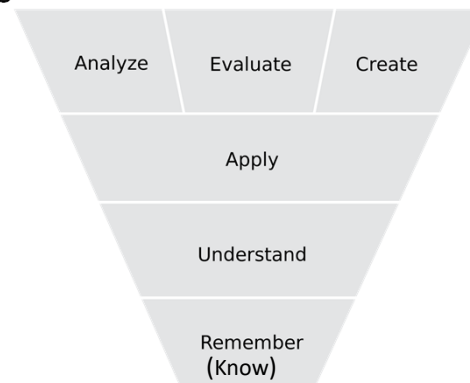
Glouberman S, Zimmerman B: Complicated and Complex Systems: What Would Successful Reform of Medicine Look Like 2004

Bloom's Taxonomy (revised)

Higher-order thinking skills



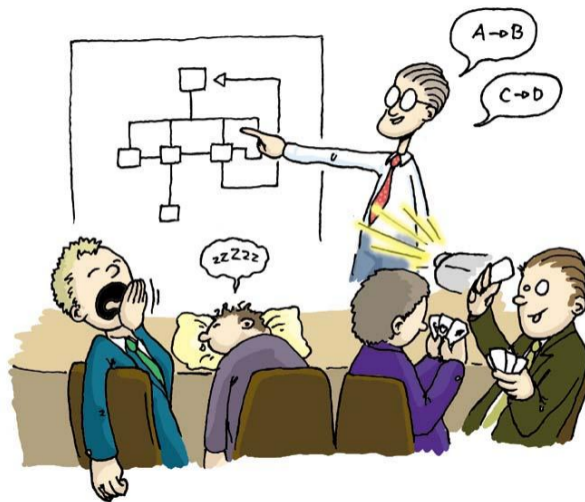
Create
Evaluate
Analyze
Apply
Understand
Know



Lower-order thinking skills

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Traditional *teaching*



Active *learning*

*I hear and I forget, I see and I remember, I **do** and I understand.*

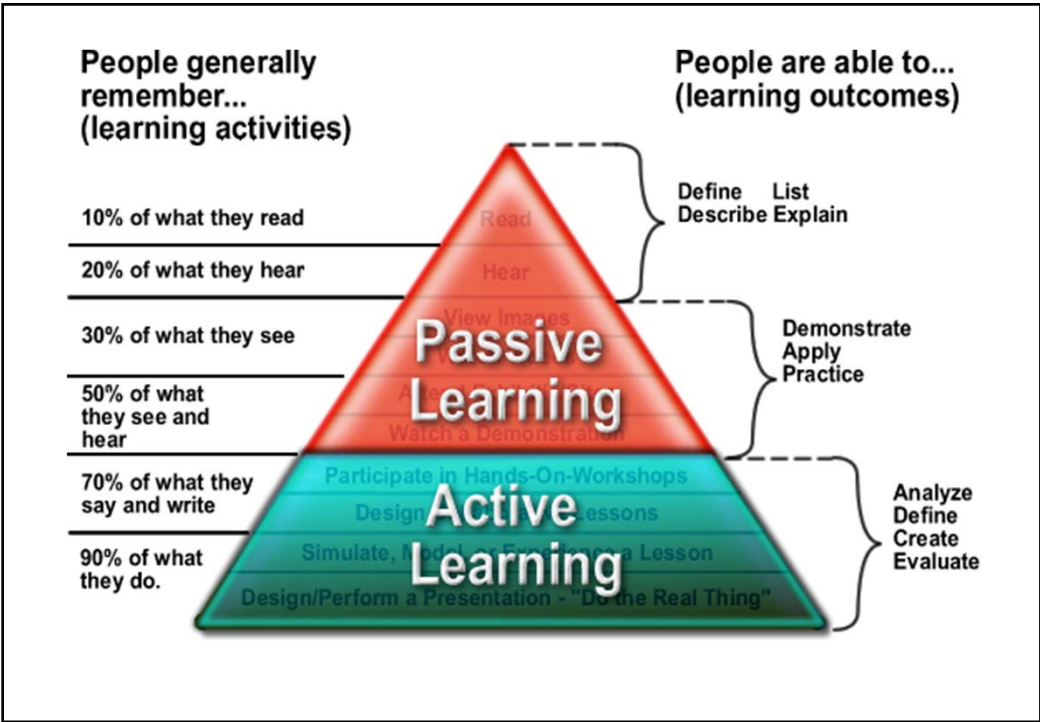
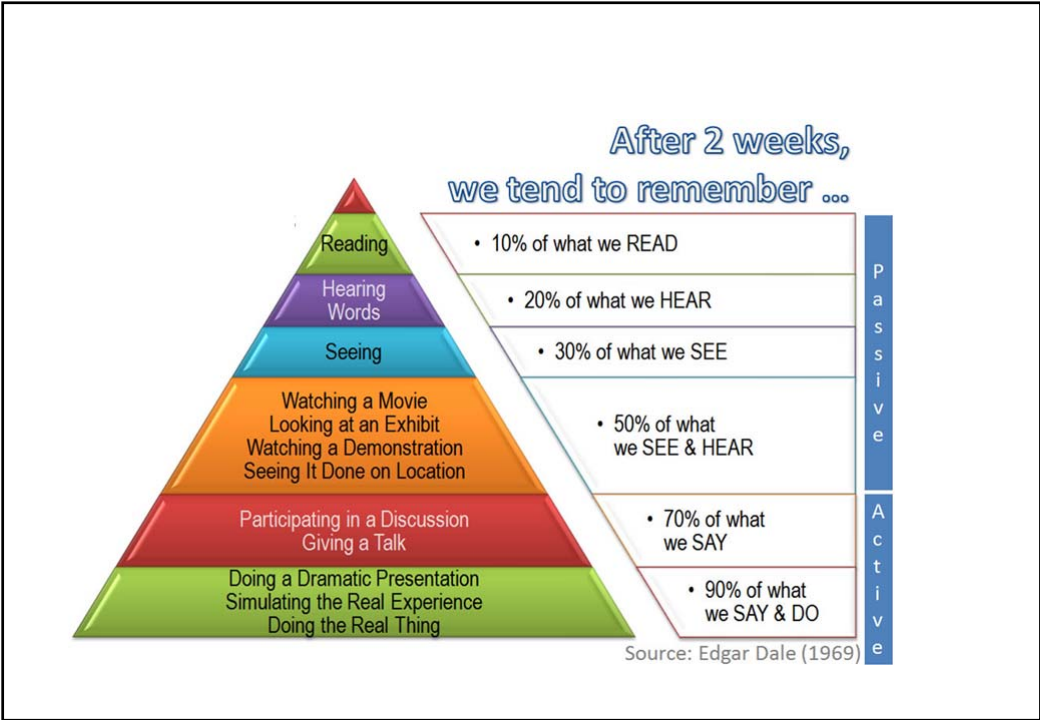
~ Confucius, 450 BC

*Tell me and I forget, Teach me and I remember, **Involve** me and I will learn.*

~ Benjamin Franklin, 1750

*The most powerful learning occurs when the student is dealing with **uncertainty**.*

~ John Dewey, 1938



Active learning

- Students are actively or experimentally involved in the learning process
- Students do more than passive listening: read, write, discuss, debate, engaged in problem-solving
- Students try to obtain Bloom's higher-order thinking skills: analyse, evaluate and create

Active learning methods

Flipped class

Collaborative learning

Case method

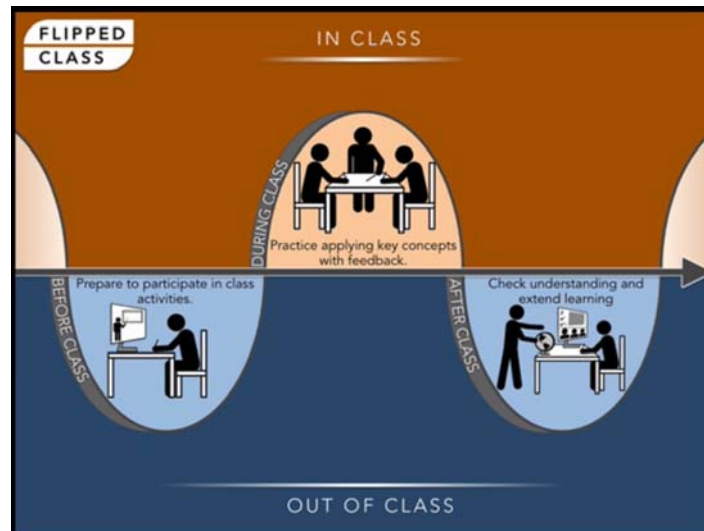
Self-directed learning (skills)

Project-based learning (pBL)

Problem-based learning (PBL)

Online learning methods

Flipped classroom



VIDEO (59''). <https://vimeo.com/70893101>

Collaborative learning

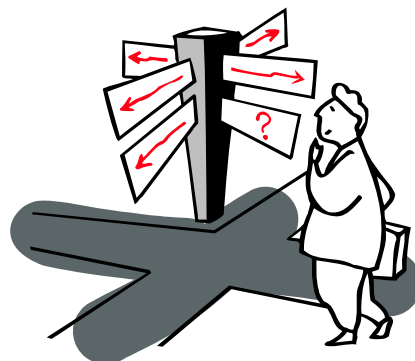
- Two or more students learn together, by sharing each other's experiences, skills and resources
- Students are divided into groups and they are given assignments or tasks to work on together
- Assignments can be answer questions or present a project work to the entire class
- Each study group often has a leader and a note-taker to ensure effective work

Case method

- The case method is based on *decision-forcing case* which put students in a role of *protagonist* and ask them to design, defend, discuss and refine the solution to the problem
- Decision-forcing case is similar to case study, an examination of an incident in the past. Case study is often practised in law schools and also in science education. While case study is retrospective, decision-forcing case asks students to engage in problems prospectively.
- Teachers should avoid providing their own opinion about the case in question, though they can provide background information and relevant materials regarding the case.
- Learning by the case method often involves *role play*

Self-directed learning

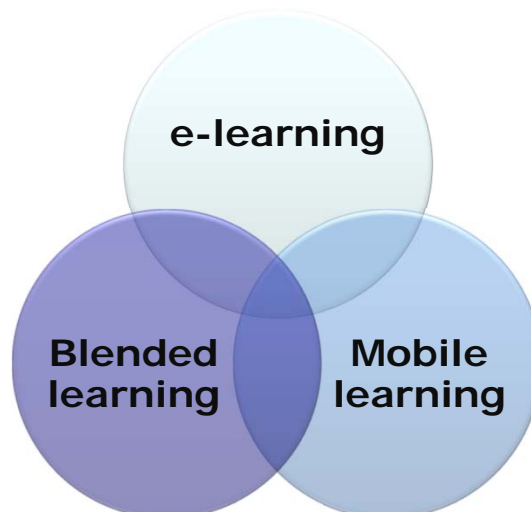
- Under the guidance of the teacher, students take initiative to diagnose their learning needs, formulate learning goals, identify needed resources, implement learning and assess LO.
- either individually or in a group
- Teacher & students negotiate on scope, time frame & end results
- Example: Study of a geographic area. Students may choose:
 - ✓ create a web-based map for South america with country information
 - ✓ study the historical development
 - ✓ investigate environmental problems in different countries



Project-based learning (pBL)

- Active learning by working with not-too simple, real-life tasks of R&D which are limited in time and scope.
- Integrate knowing and doing: students apply what they know and learn new knowledge to solve real problems
- Project work is (not always/most often) done in a student group
- A kind of *collaborative learning* where students learn to work in group and learn other soft skills
- The project involves a systematic process, i.e. done in stages or in steps which needs some "system thinking"
- Suitable for training engineering students to *integrate* different types of knowledge and technologies to carry out a *complete process or procedure* or perform *complex professional tasks*

Online learning

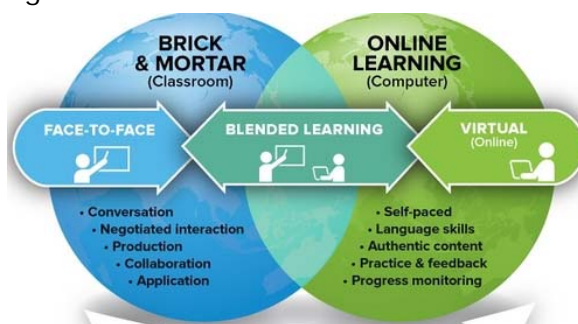


e-learning

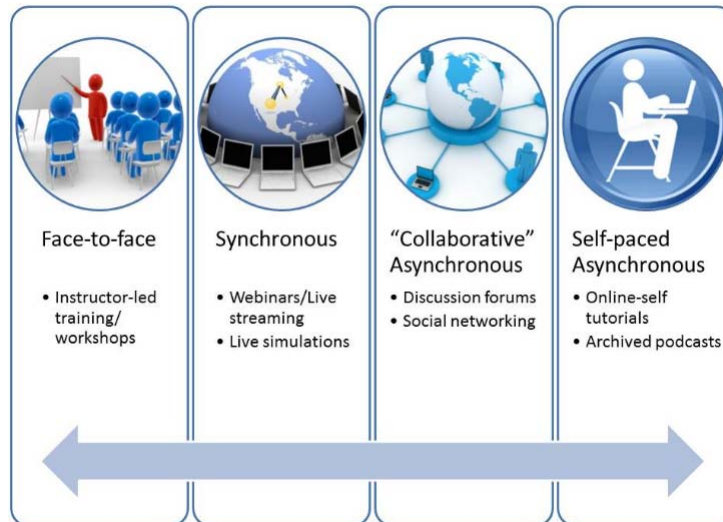
- Active learning process using electronic technologies, e.g. the internet and web
- Allow spatial-temporal separation (asynchronous relation) between the teacher and student
- Global, tailored, individually-adapted, flexible learning

Blended learning

- Combine face-to-face learning with online (virtual) learning
- Also called “hybrid” learning
- Even mainly *traditional* learning can be complimented by e-learning



Online blended learning

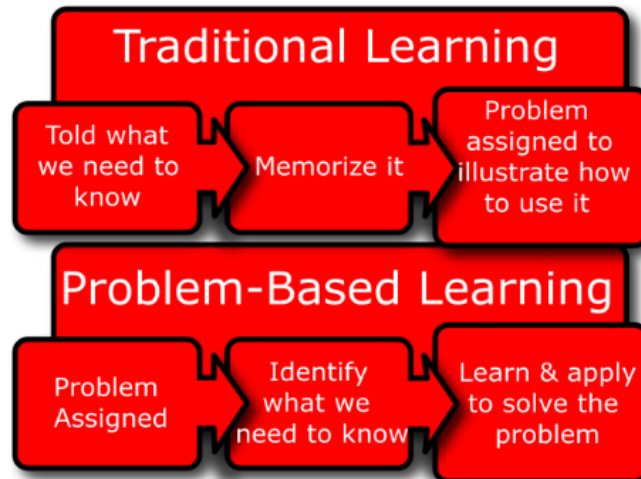


Mobile learning

- Active learning using personal electronic devices (smartphone, tablet, ...)
- Allows learning *any time* and *anywhere*
- Enhancing *digital* competences



Problem-Based Learning (PBL)



PBL at Maastricht University

VIDEO 1 (4' 30'')
<https://www.youtube.com/watch?v=cMtLXXf9Sko>



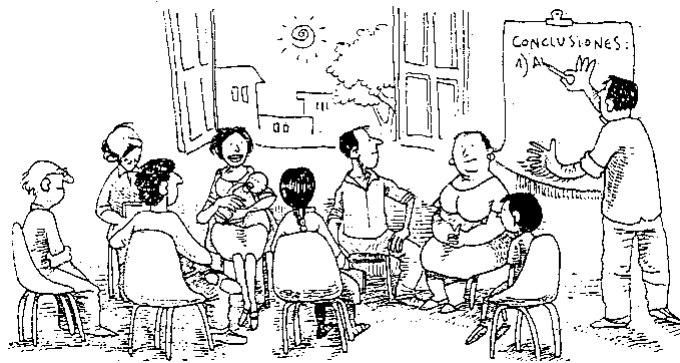
VIDEO 2 (6' 21'')
<https://www.youtube.com/watch?v=IZS2MbxBGCM>



PBL: key features and definition

“**Student-focused** learning method in **small groups** which uses a **true-to-life problem** as a **trigger**/stimulus to develop **problem-solving skills** and to acquire **domain knowledge**”

McGrath, D. (2002): “Teaching on the Front Lines: using the Internet and Problem-Based learning to enhance classroom teaching”. *Holist Nursing Practice*, 16, 2, 5-13



PBL: key features

- A learning process which starts with asking questions on real-life problems
- PBL can be implemented for a whole university/programme, or a course (module), or a part of a course
- At the beginning of a course, students are divided into groups. Each group can have a leader, a secretary and other members. The positions within the group can (and should) change during the progress of the course
- A course can consist of a number of **scenarios** (or **cases**). For each scenario (to be described by the tutor/teacher), ask relevant questions. To answer the relevant questions, students have to learn new subject knowledge and skills.



Cartography cases: How to make maps?

7 scenarios + 16 tasks

Scenario 1: "How can I decide which type of mapping technique is the most suitable?"

Scenario 2: "How can I extract thematic information from the data?"

Scenario 3: "How can I set groups and classes in a map?"

Scenario 4: "Reference systems and generalization: how do I use them?"

Scenario 5: "Choropleth mapping. Making maps 1, 2, 3: population density in León, by province and municipality"

Scenario 6: "Isoline mapping. Making maps 4, 5, 6: temperature, precipitation, lightning"

Scenario 7: "Maps with points, and proportional symbols. Making maps 1, 6: population density, lightning"



Remote sensing cases

Scenario 1.

Identification and quantification of the burnt areas (caused by wildfires) in the province of León (Spain) in 2014 (from March to October, both inclusive). Required outcome: 1:50.000 map. Comparison with the extent and location of burnt areas in 2000. Write a 10 pages scientific paper with the findings.

Scenario 2.

Identification and quantification of urban growth in Dubai from 1994 until 2014 (5-year update). Required outcome: 1:50.000 map. Comparison between dates. Write a 10 pages scientific paper with the findings.

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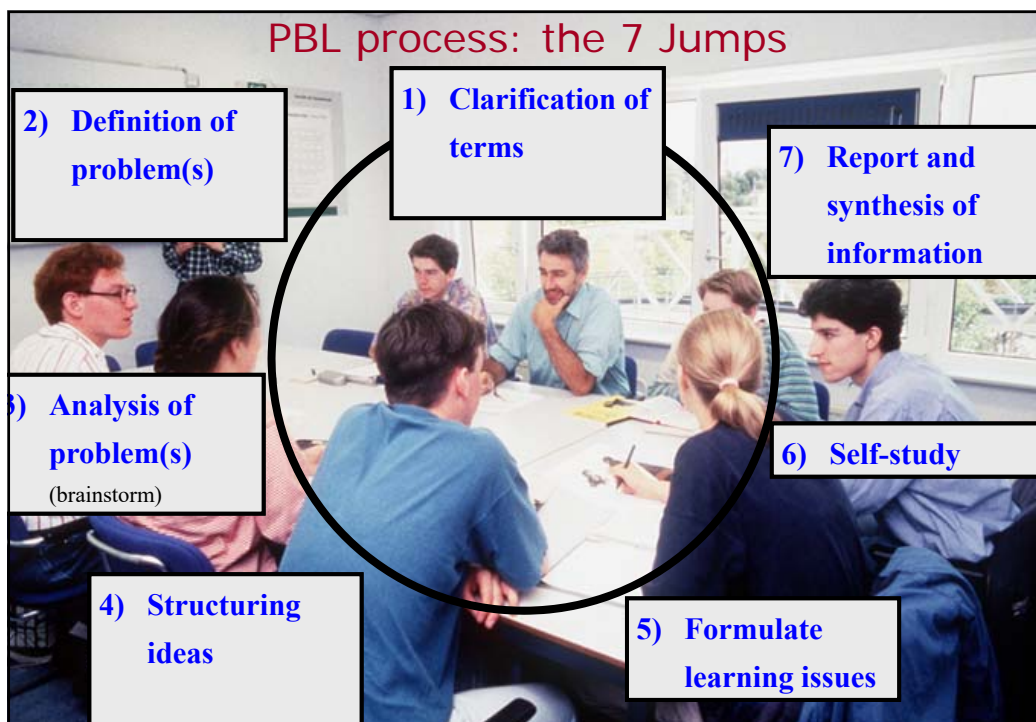
PBL key features: a spring-board for learning

- Problem-solving skills are important. But the most important in PBL is not the problem itself or the solution to it, rather using the problem as a trigger to stimulate students to learn
- Teacher defines LO, but not how to achieve it.



What is **not** PBL ?

- Teaching using 12 well-organized lectures and 8 detailed described exercises are **not** PBL
- Lectures using practical problems as examples are **not** PBL
- Lectures followed by exercise problems are **not** PBL
- Well defined, clearly described assignments are **not** PBL
- Real-world project work where tasks, process, procedure, methods, equipment, input data are defined and provided by the teacher are **not** PBL.



PBL process: the 7 Jumps

- 1) **Clarify** unknown terms and concepts in problem description
- 2) **Problem statement:** List phenomena or events to be explained
- 3) **Brainstorm** to produce as many different ways to explain the phenomena as you can using prior knowledge and common sense
- 4) **Clustering.** Discuss and critically evaluate proposed explanations to produce a coherent description of the process which underlie the phenomena or event
- 5) Formulate **learning goals** for self-directed learning
- 6) Fill in gaps in your knowledge through **self-study**
- 7) **Synthesis:** integrate acquired knowledge into a comprehensive explanation of the phenomena or event. Share your findings with your group. Check if you know enough now.

How to plan a PBL course ?

- Start with the end in mind
- Form student groups
- Design scenarios/problems
- Set guidelines and rules for students
- Provide resources

A good scenario

- Resemble real-life problems or tasks
- Contains cue which trigger search for learning objectives
- Not too hard, not too easy
- Multiple perspectives, multiple outcomes
- Motivational, relevant
- Any data given should be raw data

The role of the teacher

- Not a lecturer, not an instructor
- A facilitator, a mentor, a tutor
- Subject expert, resource guide, task group consultant
- Planning the PBL, the content, scenarios, sequence
- Monitor to **keep the students on track**
- Provide immediate & appropriate feedbacks to students

Summary

- HE should be student-centered. Focus should be moved from teaching by teachers to active learning by students
- Active learning can lead to higher learning efficiency, more creative students with higher-order learning skills
- All active learning methods are good methods
- pBL and PBL are only two of many active learning methods
- Some active learning methods are overlapping. They can be implemented in different ways. They can also be integrated and blended to achieve the best results.