PROJECT BASED LEARNING

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STUDENT-CENTERED LEARNING METHODS

- **Education through science**”, **rather than** “**science through education**”
- 4 C’s of education: Creativity, *Critical Thinking*, Communication and *Collaboration*

- Some types of student-centered learning methods
  - Phenomenon-based learning
  - Project-based learning (PBL, PjBL)
  - Problem-based learning
  - Inquiry based learning

PROJECT-BASED LEARNING

- Project-based learning is one of the forms of phenomeneon-based learning which tackles on superficial learning and boredom (Krajcik & Blumenfeld, 2005).
- Thomas (2010) simply describes PBL as a model that organizes learning around projects.
- Characterized by students' autonomy, constructive investigations, goal-setting, collaboration, communication and reflection within real-world practices (Kokotsaki et al. 2016)
- Central learning goals:
  - Content knowledge
  - 21st century skills
    - critical thinking, problem solving, collaboration, communication, and self-management, (Viro & Joutsenlahti 2018)

PROJECT-BASED LEARNING

- Two key components (Blumenfeld et al., 1991)
  - Driving question
    - Problem or question that needs to be solved
    - May be formed by students
    - Based on real life problem
      - Authenticity increases the relevance of teaching.
  - Artefact
    - Project-based learning culminates always with the production of an end product, artefact
    - Artefact is a product that addresses the driving question
    - **Learning process is more important than artefact**

PROJECT-BASED LEARNING – OTHER ASPECTS

- Collaborative
  - Students get to benefit from all the knowledge that different group members have
  - Learning teamwork skills whilst studying the content.
  - Groups can be formed in different ways
    - Teacher can assign different roles for students to help with work-load division

PROJECT-BASED LEARNING – OTHER ASPECTS

- Technology supports learning
  - Enhances the relevance of education
  - ”Doing research like real scientists”

- Scientific practices and inquiry
  - students will have to ask questions, plan inquiries, discuss and present results and reflect on their actions.
    - Philosophy of science and scientific methods

PROJECT-BASED LEARNING – WHY

- Many studies show benefits of project-based learning in students learning outcomes, social skills, engagement and motivation (eg. Johnson, Johnson & Stanne, 2000; Terenzini, Cabrera, Colbeck, Parente & Bjorklund, 2001)
- Students are able to recall what they have learned and get more profound understanding (Penuel & Means, 2000)
- Students learn collaboration skills, resolving conflicts; important skills in everyday life (Beckett & Miller; ChanLin, 2008)
- Collaboration in projects has a positive effect on learning outcomes (Johnson, Johnson & Stanne, 2000)
- Problem-solving skills and applying learned is enhanced. (Finkelstein et al., 2010)
    - Transfer effect

PROJECT BASED LEARNING – ROLE OF TEACHER

- Teacher needs to embrace new roles when using PBL or other student-centered learning methods
  - Facilitator, Coach, Supporter
  - **Teacher is a catalysator of learning**
- The most important part for teacher is to support students learning and working
  - Materials, resources, encouragement
- Ask questions, talk about students learning, taking observational notes and assess collaboration

PROJECT BASED LEARGING – SETTING THE GOALS

- Project-based learning should not replace the content you are teaching in a class. Instead, it should be a vehicle through which you can communicate it (Wolpert-Gawron 2015).
- Goals of PBL are aligned on syllabus / curriculum
  - Not anything extra, rather integrated part of studies

- PBL can have various ways of openness, depending on students age and time limits etc.
- Projects can be very broad or small
  - You don't have to go for full semester project right away, students need to train to method as well.
  - First aims could more focused about collaboration or some other skill
- Its beneficial to give students voice in goal setting

PROJECT BASED LEARNING – SETTING THE GOALS

- Goals guide action and assessment

	Discover	Create	Share
	Everything students need to discover. Content knowledge and background knowledge	What students do	How students share their work
Individual deliverables	Individual research points that came up with	Individual work	Reflection, presenting… depending on set up
Group deliverables	How collaboratevely put their ideas together	Interaction, collaboration	Depending on set up. Also group reflection

PROJECT BASED LEARNING – CONTEXT

- Setting the context an problem is one of the important part that guides the whole learning experience
- Students may define it themselves, what they are interested in.
  - Need to activate prior knowledge

- It is important to ”hook students in” contextwise
- Good context is authentic, topical, it may consider some local issue
  - Good way to incorporate other stakeholders as well

PROJECT BASED LEARNING – DRIVING QUESTION

- After setting the context, driving question is formed
  - It is iterative process, research/inquiry questions can be revised throughout the project
- Teacher can give it or students can form it themselves
  - It can be brainstormed with whole class
- Most important thing is to get students thinking about the problem
- “how”, “why” or “what if?”

CHECKLIST FOR YOUR DRIVING QUESTION

1. Is the question open-ended?
2. Does the driving question challenge students to do intellectual tasks
3. Does the driving question leave room for the students to plan their own investigations and present their own questions?
4. Will the students learn central content and skills through the driving question?
5. Is the learning environment familiar and local for students?
6. Does the driving question direct the students to see the meaning of the studied topic in their own lives?
7. Does the driving question tackle controversial socio-scientific issues?
8. Is the driving question meaningful and interesting for the students?
9. Is the driving question feasible for the students' age and skill level?

EXAMPLE

- How come 2/3 of worlds area is water but there is still lack of water
  - On average finnish person uses 155 litres of clean water
    - Water scarcity affects more than 40 per cent of the global population and is projected to rise
    - It is estimated that 783 million people do not have access to clean water
      - What kind of problems does this cause?

PROJECT BASED LEARNING – ARTEFACT

- PBL project revolves around producing an end product, an artefact, to address the driving question
- An artefact is a visible and critiqueable presentation of students' cognitive work and the level of their understanding about the topic (Blumenfeld et al. 1991)
- an effective artefact should: (Krajcik & Shin (2014)
  - address the driving question of the project
  - Support students to develop their understanding
  - be connected to the learning goals of the project
  - demonstrate students' level of understanding regarding the learning goals of the project.
- Artefacts can be in any form and students should get to choose
- Communication of the findings is in an important role. Artefacts should be presented and shared

ASSESSMENT OF PBL

- Individual assessment and collective assessment

- Variety of assessment methods
  - Self- assessment, peer assessment,
  - Formative assessment is very important – guiding and encouraging students
  - Summative assessment at the end

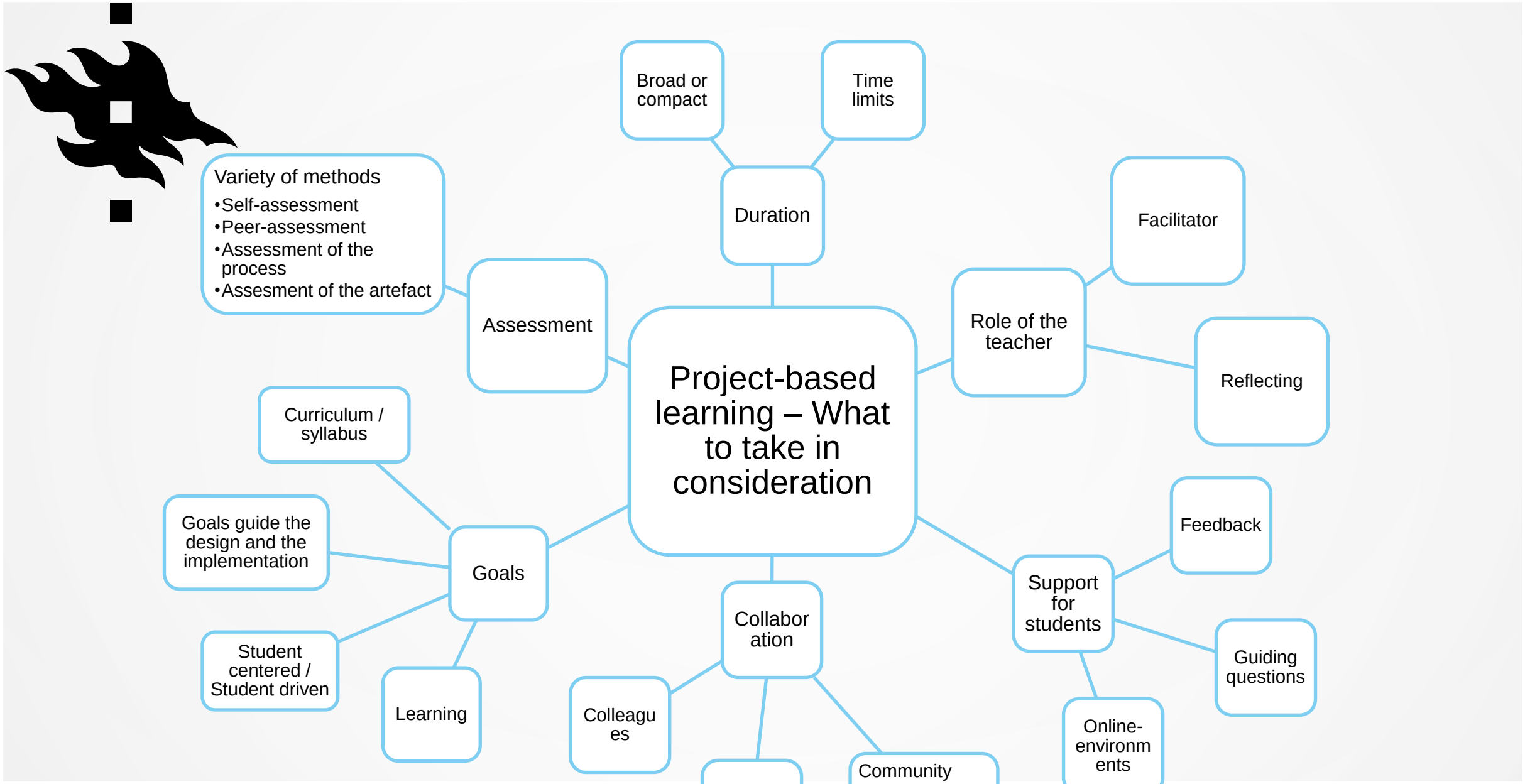
- Need to assess the whole process, the artefact, the presentation

- Research diary is very useful for reflections

PROJECTS VS PROJECT BASED LEARNING

”Traditional” project	**Project based learning**
Context: Simple, unattached	Context: Challenging and complex
Object: Going through big information mass	Object: Exploring central phenomena
Learning goals: Separate, no interaction	Learning goals: Shared goal, that requires collaboration and interaction
Support: Trusting on students’ capabilities	Support: Scaffolding and supporting
Assessment: Assessing the end result	Assessment: Formative, engouraging aiming to improve students’ performance
Aim: Make impressive end result	Aim: Supporting thinking process

Hakkarainen et al., 1999


Project-based learning – What to take in consideration
Duration
Broad or compact
Time limits
Assessment
Variety of methods
•Self-assessment
•Peer-assessment
•Assessment of the process
•Assesment of the artefact
Role of the teacher
Facilitator
Reflecting
Goals
Curriculum / syllabus
Goals guide the design and the implementation
Student centered / Student driven
Learning
Collaboration
Colleagues
Between students
Community
•Eg. companies
Support for students
Feedback
Guiding questions
Online-environments

START – PROJECT BASED PROGRAM

An international programme by the LUMA Centre Finland that supports collaborative project-based learning on all levels of education

https://start.luma.fi/en/materials/

REFERENCES

- Beckett, G., Miller, P., 2006. Project-based Second and Foreign Language Education: Past, Present, and Future. Information Age Publishing Inc.
- Blumenfeld, P. C., Soloway, E., Marx, R. W., Krajcik, J. S., Guzdial, M., & Palincsar, A. (1991). Motivating Project-Based Learning: Sustaining the Doing, Supporting the Learning. Educational Psychologist, 26(3–4), 369–398.
- Finkelstein, N., Hanson, T., Huang, C.-W., Hirschman, B., and Huang, M., 2010. Effects of Problem Based Economics on high school economics instruction. (NCEE 2010-4002). Washington, DC: National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education
- Johnson, D., Johnson, R., Stanne, M., 2000. Cooperative Learning Methods: A Meta-Analysis. University of Minnesota.
- Krajcik, J. S., & Blumenfeld, P. C. (2005). Project-Based Learning. In R. Keith Sawyer (ed.), The Cambridge Handbook of the Learning Sciences (s. 317-334). (1st Edition). Cambridge: Cambridge University Press.
- Terenzini, P., Cabrera, A., Colbeck, C., Parente, J., Bjorklunk, S., 2001. Collaborative Learning vs. Lecture/Discussion: Students' Reported Learning Gains. The Research Journal for Engineering Education. Volume 90, issue 1, pp. 123-130.
- Thomas, J. W. (2000). A review of research on project-based learning. San Rafael, CA: Autodesk Foundation.
- Viro, E., & Joutsenlahti, J. (2018). The StarT Project Competition from the Perspective of Mathematics and Academic Literacy. Education Sciences, 8(2), 67.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