INTEGRATED PROJECT-BASED LEARNING

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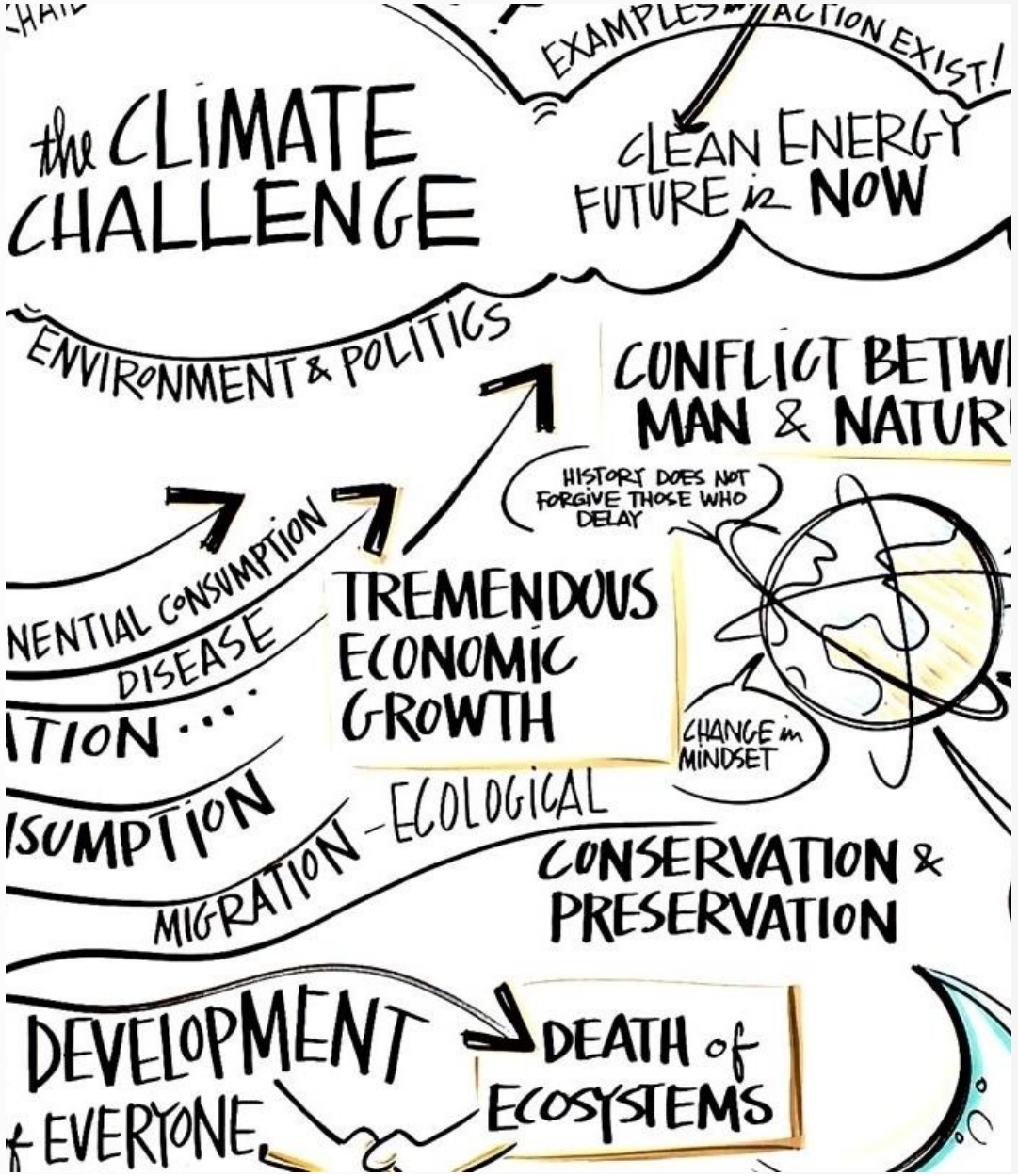
WHY INTEGRATE EDUCATION?

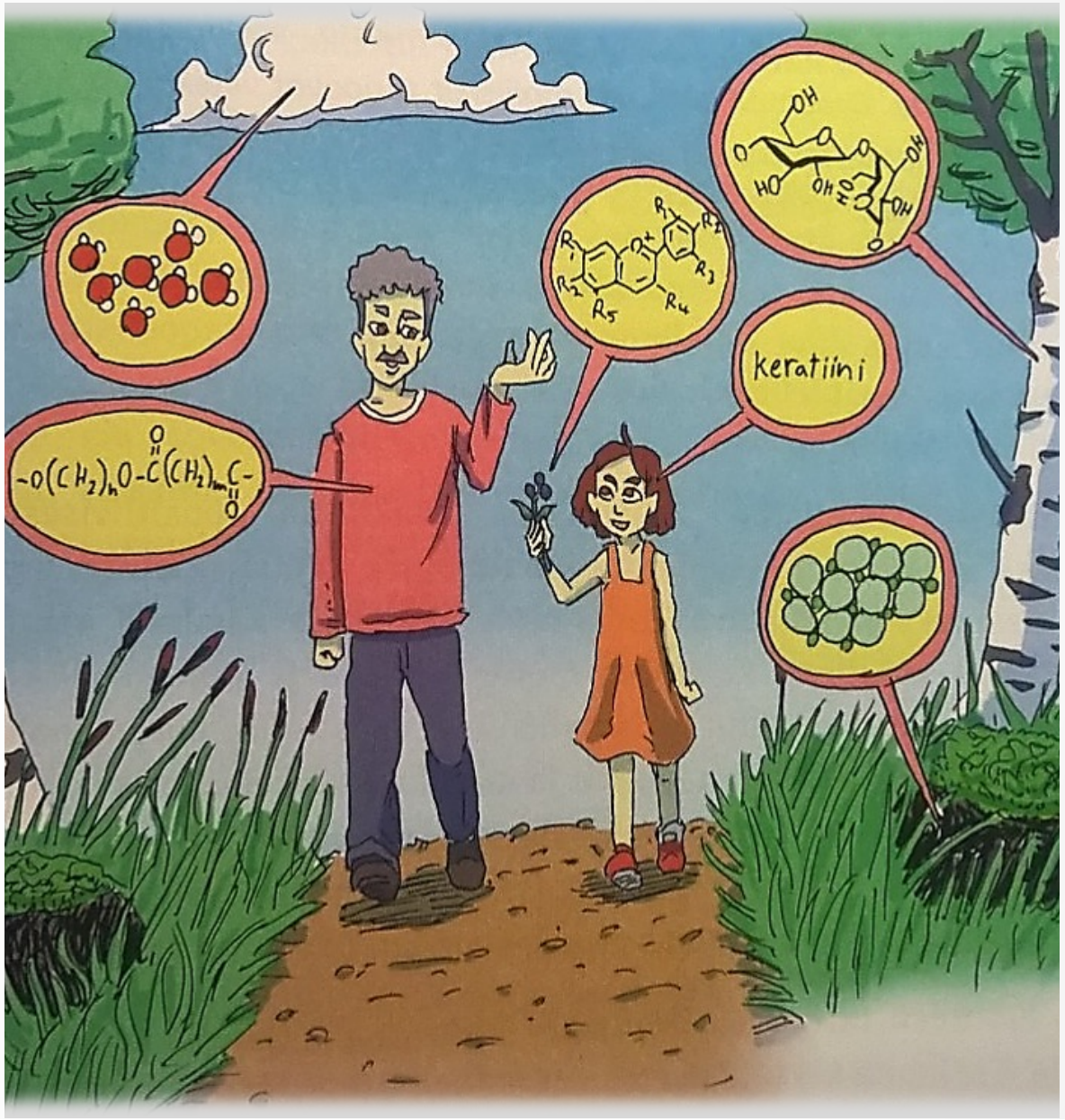
- Understanding and solving global issues: ”wicked problems”, SDGs
- 21st century skills
- Experts in science, mathematics and technology needed, but students are not interested in science careers or studies



INTEGRATED EDUCATION

An effort to organize or integrate science curriculum content into a meaningful whole by a constructive and context-based approach that crosses subject boundaries and links learning to real world.

(Beane, 1997; Czerniak & Johnson, 2014)



MEANINGFUL – WHAT DOES IT MEAN IN SCHOOL CONTEXT?

Based on Dewey's (1902; 1915) concepts of **school as a small society** where learning is based on everyday life and activities, and it aims at learning skills and knowledge relevant to the learners as individuals and members of society.

Related to interest and **relevance:**

"Science learning becomes relevant education whenever learning will have (positive) consequences for the student's life" (Stuckey et al., 2013, p. 19).

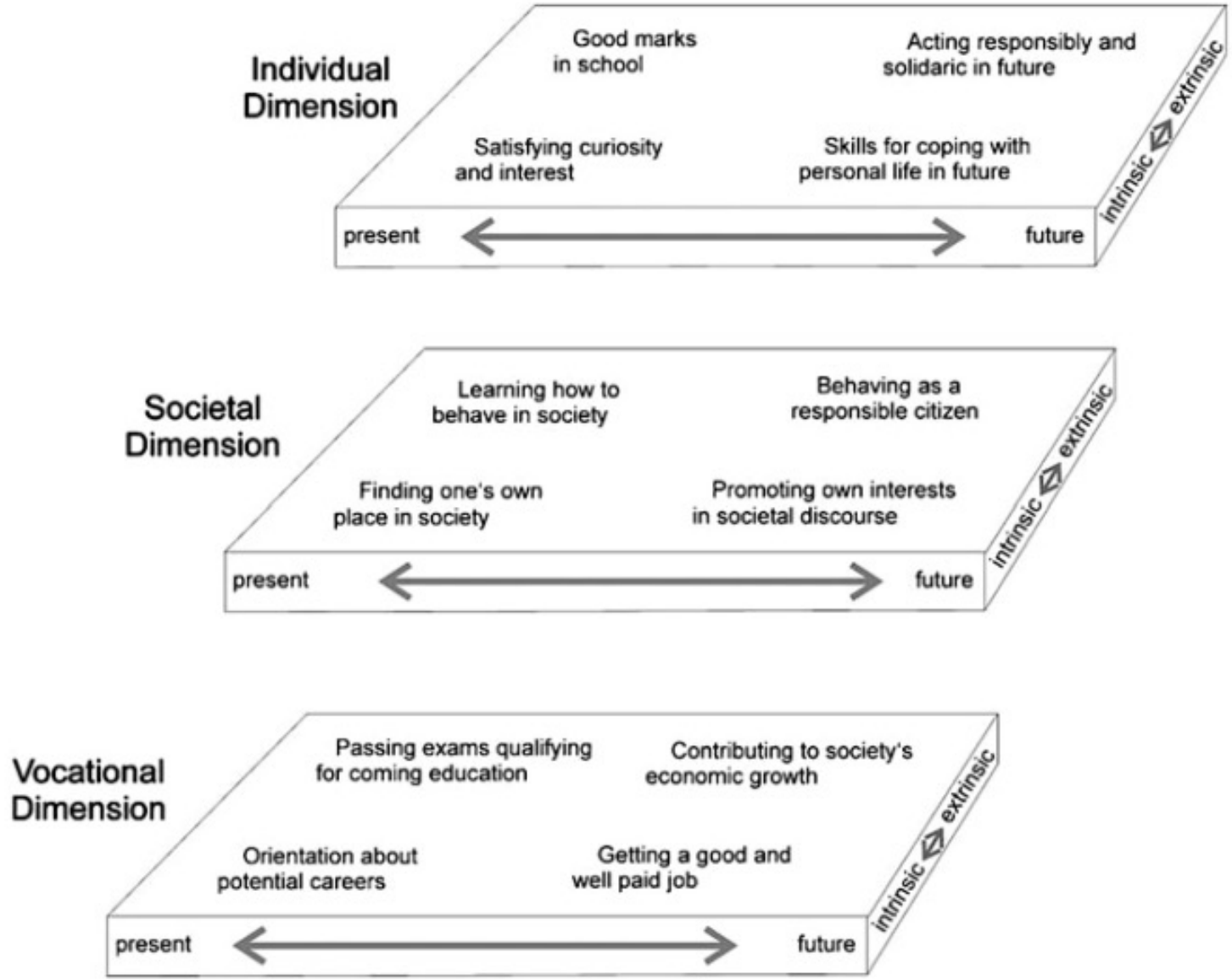


Figure 1. A model of the three dimensions of relevance with examples of aspects allocated in the span of both the present–future and the intrinsic–extrinsic-range.

Marc Stuckey , Avi Hofstein , Rachel Mamlok-Naaman & Ingo Eilks (2013) The meaning of 'relevance' in science education and its implications for the science curriculum, Studies in Science Education, 49:1, p. 19, DOI: 10.1080/03057267.2013.802463

Intrinsic relevance encompasses student's personal interests and motives that are always motivating and meaningful. For example, personal curiosity about an issue or potential career aspirations.

Extrinsic relevance includes ethically justified expectations that are defined by other stakeholders such as scientists and teachers or by mass media and the surrounding environment. For example, the demand for transversal competenties needed to function as an active citizen in the 21st century or the needs of trade and industry for science professionals

Topics students are interested in?

- A clear pattern is that topics that are close to what is often found in science curricula and textbooks have low scores on the rating of interest among young learners from Europe and other well developed countries

- Research suggest that students are interested in learning about things they perceive as connected with their personal life, such as health, food, and socio-scientific issues such as sustainable development

- Youth barometers indicate that youth is increasingly interested in social activism and incorporating this into science education could engage students in learning.

- Read more on findings on the relevance on science education (ROSE project): Microsoft Word - ROSE-overview_Sjoberg_Schreiner_2010.docx (roseproject.no)

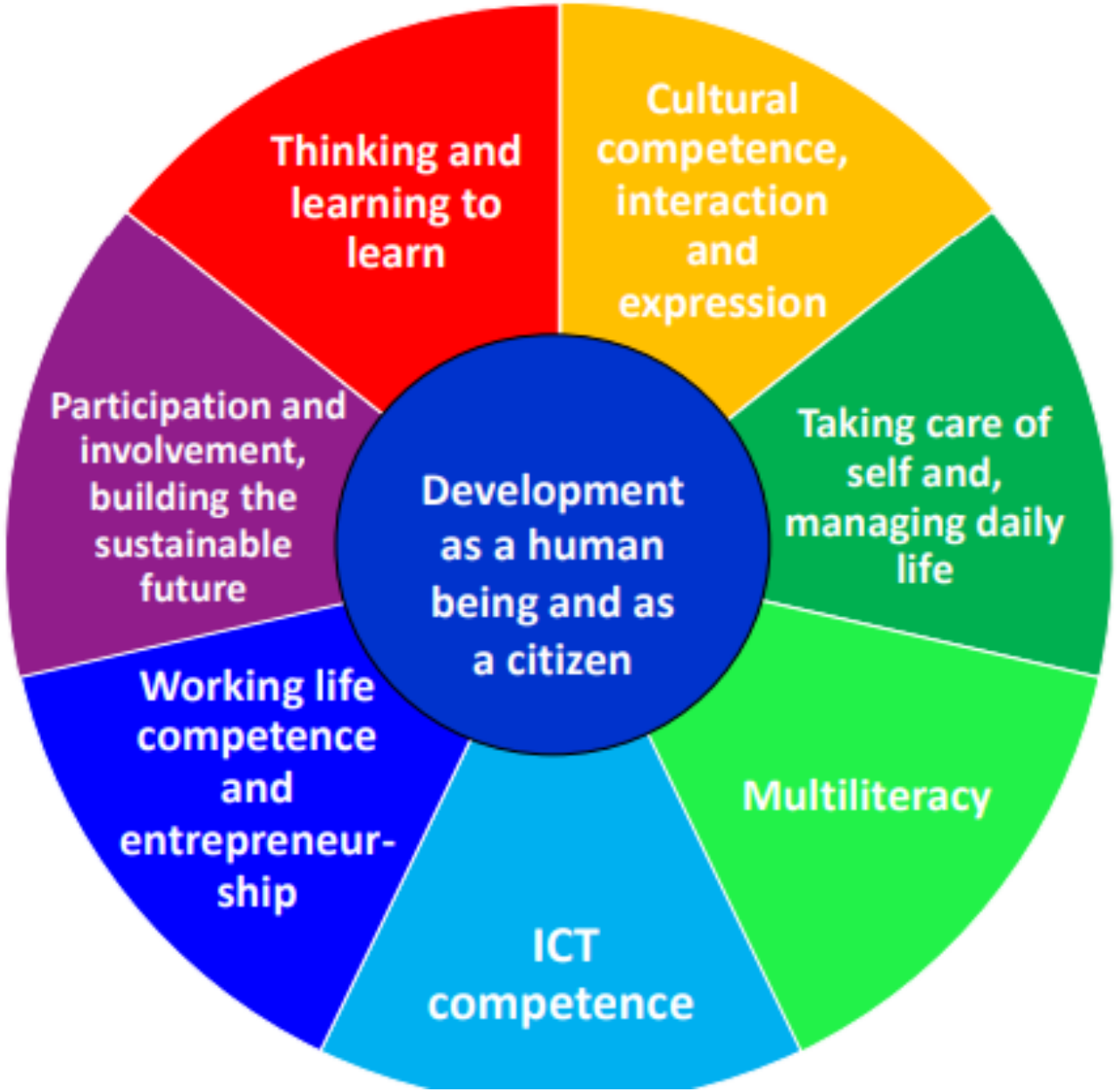
EXAMPLE: FINNISH NATIONAL CORE CURRICULUM

- Focus on school culture and integrative approach
- Learning of transversal competencies through multidisciplinary modules that increase dialogue between subjects
- Learning to learn in dialogue with others, importance of feelings, experiences and ideas and their joy of learning

Rethinking competences

National Goals for Basic Education and Transversal Competences

- knowledge
- skills
- values
- attitudes
- will

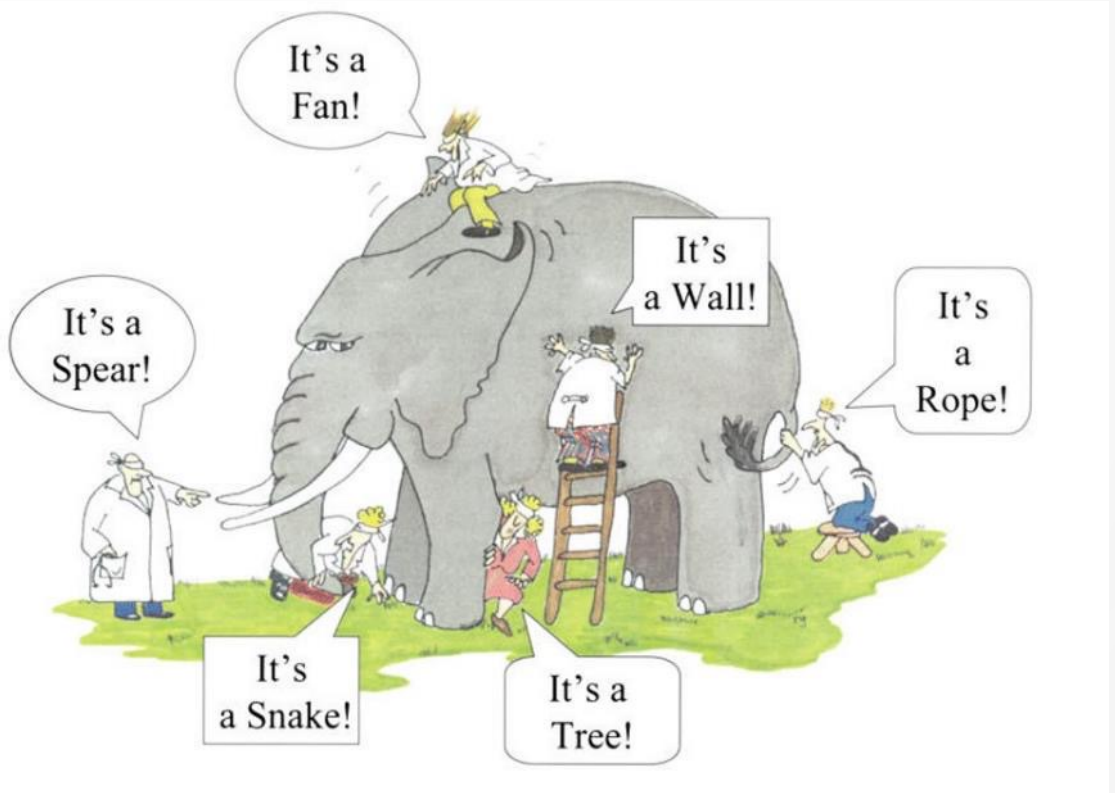


INTEGRATED MEANINGFUL WHOLE?

When planning integrated education, please note:

- Integrating subject contents does not automatically lead to integrated understanding
- Transfer of knowledge does not happen automatically

→ Teachers' role is to guide and support



HOW TO SUPPORT LEARNING AS A TEACHER?

Scaffolding instruction: any method or a resource used by teachers to help learners to accomplish more difficult tasks than they otherwise are capable of completing on their own.

Two key elements of scaffolding:

1. scaffolds need to be tailored to a student's current level of understanding
2. scaffolds should be faded over time as students learn to apply their new knowledge or skills on their own

For example:

- Diversifying learning assignments and project tasks
- Giving theory lessons related to the project topic or guiding towards a source of information (books, online material, experts)
- Setting the project phases and a clear schedule and checking the progress accordingly
- Providing a suitable learning environment with needed resources
- Asking guiding questions
- Making it possible for students to help each other and ask questions

EXAMPLES
AMAZING HUMANBEING PRACTICE

Early Childhood Education (Taipalsaari Kirkonkylän koulu) and vocational school (LAB ammattikorkeakoulu) collaboration, Finland. (2020)

"*The Learning Together project arose from the need to give nursing students more skills to work with children. The aim of the project was to create real interaction situations and increase understanding of the nursing student's way of thinking, acting or caring for fears related to nursing situations*."

More information:
https://start.luma.fi/en/materials/the-best-of-start-2020/best-practice-2020/ihmeellinen-ihminen-opitaan-yhdessa-yhteistyo/

PROJECT-BASED LEARNING

- A model that organizes learning around projects
- Authentic and interdisciplinary phenomenon – linked to daily life
- Constructive approach that has potential to engage students
- Adaptable to different types of learners and learning situations

PROJECT-BASED LEARNING

Two essential components of project working:

1. They require **a driving question** or problem that serves to organize the project activities
2. The activities should result in **artifacts** that culminate in a final product that addresses the driving question.

DRIVING QUESTIONS BY CHILDREN AND YOUTH

Why do we have mirrors? Why are there mirrors in cars? Are there mirrors in space? Can I spy with mirrors? What can we use as a mirror? (Preschool)

How could we make the Finnish high schools more carbon neutral? (High school)

Why is the slide wet in the morning? Where did this waterdrop come from? Why does breathing steam on a cold morning? (Early Childhood Education)

How can we make a toy move? (Primary school)

What does water have to do with physics? How does clean water come into my drinking glass? (4th grage)

What ways can I wash and dye fabrics environmentally friendly without consuming nature?
How do different decompresants effect/change fabrics? (Middle school)

PROJECT ARTIFACTS

Brochures, booklets, nature trails or experiences, posters, written reports or portfolios, crafts, pastries, constructions (electronics), videos, survey, song, play or similar performance, workshop for other pupils, exhibition for parents

EXAMPLES

An Action Plan to Save the Moldy Books

- Project: An Action Plan to Save the Moldy Books in Yunhai School Library, China. (2020)
- Why this topic: “One day when we went to the library, we came across a book in the corner, with a strong musty smell and some mildews at a closer look. Later, we learned from the librarian that many books in the library grew mildews.”
- Project diary: https://start.luma.fi/wp-content/uploads/2020/04/moldy-books-project-diary-1.pdf
- Video: https://youtu.be/TuFIloRX0XI

EXAMPLES
Kalevala Goes Science

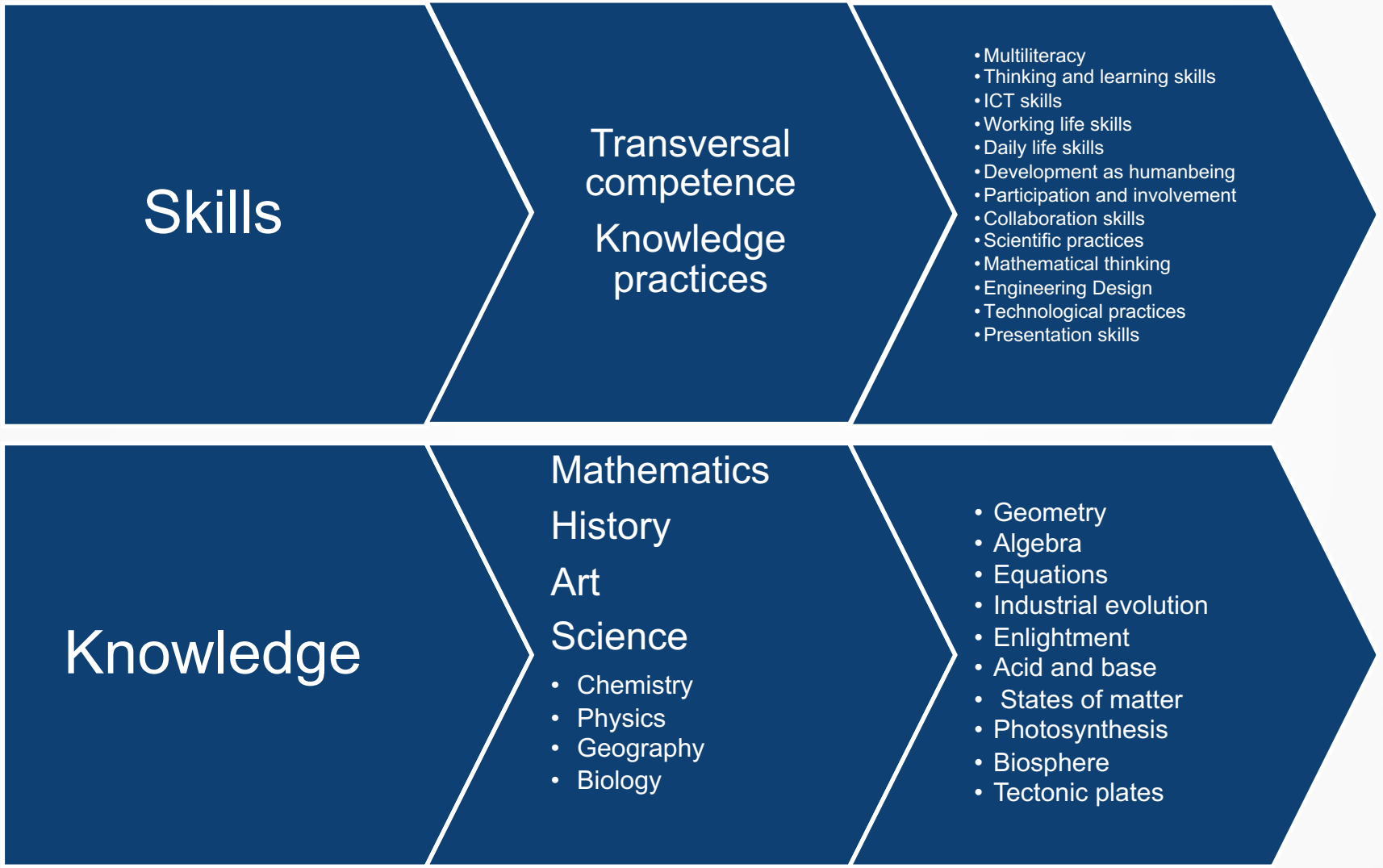
- Project: Kalevala Goes Science –project by Joutsan yhtenäiskoulu, 9th graders, Finland (2019)
- Integrating language lessons and science by intestigating the myths written in the national epos
-
- Website as an artifact: https://sites.google.com/edu.joutsa.fi/kalevala-goes-science?pli=1
- Video: https://youtu.be/IjCOUVJtbhU

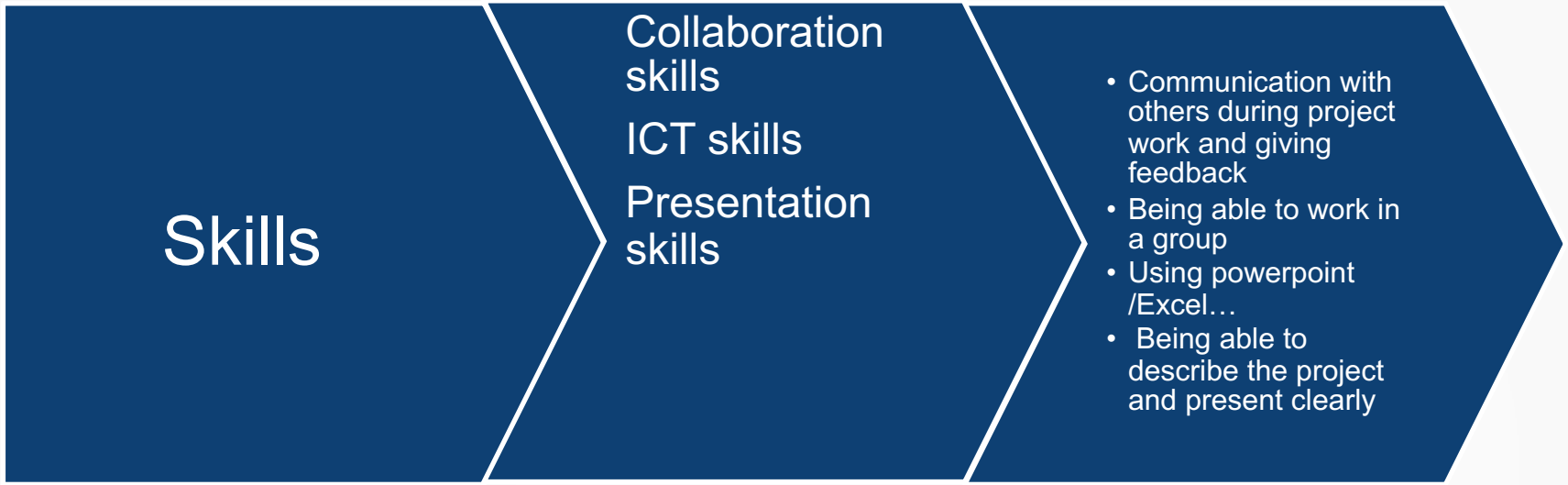
PROJECT-BASED LEARNING

Essential elements of PBL and examples on how to implement them:

Haatainen, O., & Aksela, M. (2021). Project-based learning in integrated science education: Active teachers' perceptions and practices. LUMAT: International Journal on Math, Science and Technology Education, 9(1), 149–173. https://doi.org/10.31129/LUMAT.9.1.1392

Student learning goals
Centrality of the project
Contextual
Project artefact
Collaborative learning
Constructive
Student engagement
Scaffolding instruction
Assessment
Publicity


Skills
Transversal competence
Knowledge practices
• Multiliteracy
• Thinking and learning skills
• ICT skills
• Working life skills
• Daily life skills
• Development as humanbeing
• Participation and involvement
• Collaboration skills
• Scientific practices
• Mathematical thinking
• Engineering Design
• Technological practices
• Presentation skills
Knowledge
Mathematics
History
Art
Science
• Chemistry
• Physics
• Geography
• Biology
• Geometry
• Algebra
• Equations
• Industrial evolution
• Enlightment
• Acid and base
• States of matter
• Photosynthesis
• Biosphere
• Tectonic plates



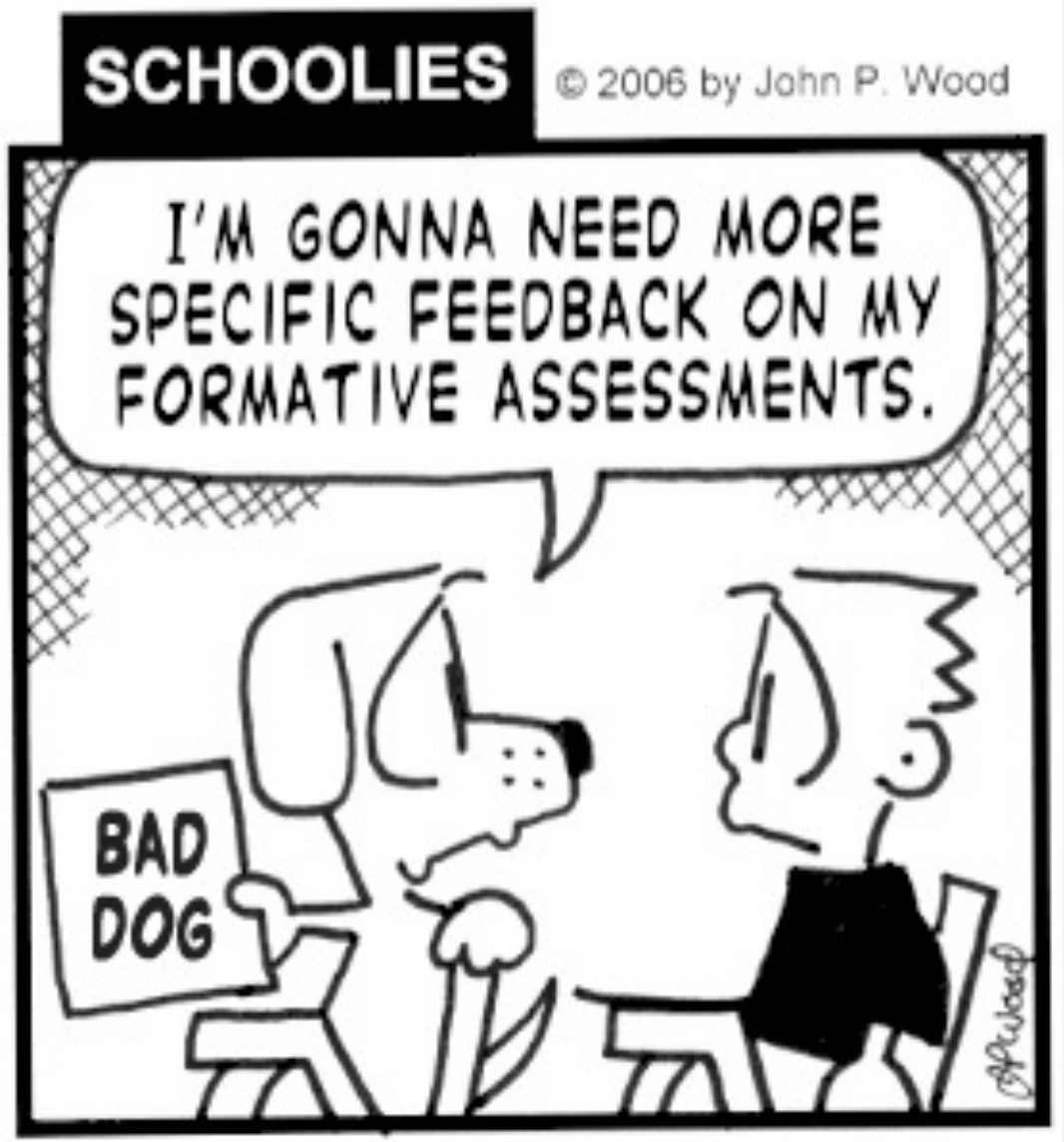
Think and refine your learning goals:

- Do not add all that you can
- Focus on the essential few and make sure to include all of these in the assessed items
- Communicate clearly to students what the essential and assessed aims are

Think on versatile methods to assess these goals

ASSESSING STUDENT PROJECTS

- Emphasis should be on formative assessment that aims at supporting student learning i.e. feedback
- Utilize versatile assessment methods during the whole project process
- Engage students in assessment
- Assessment should include a specific end-of-project phase that ensures reflection on what was learned (as well as the creation of a project artifact)
- Assess the essential learning goals



<table>
<tr><th></th><th>Where the learner is going</th><th>Where the learner is right now</th><th>How to get there</th></tr>
<tr><td>Teacher</td><td rowspan="3">1 Clarifying learning intentions and criteria for success</td><td>2 Engineering effective classroom discussions and other learning tasks that elicit evidence of student understanding</td><td>3 Providing feedback that moves learners forward</td></tr>
<tr><td>Peer</td><td>Understanding and sharing learning intentions and criteria for success</td><td colspan="2">4 Activating students as instructional resources for one another</td></tr>
<tr><td>Learner</td><td>Understanding learning intentions and criteria for success</td><td colspan="2">5 Activating students as the owners of their own learning</td></tr>
</table>

Fig. 1 Aspects of formative assessment

Black, P., & William, D. (2009). Developing the Theory of Formative Assessment. Educational Assessment, Evaluation and Accountability, 21, 5-31.
https://doi.org/10.1007/s11092-008-9068-5

WHAT CAN BE ASSESSED?

BY TEACHER

- Students working (groupwork, engagement)
- Project schedule
- Project artifact
- Student presetations (communication skills)
- Subject content knowledge
  - Learning diary
  - Summarizing test

BY STUDENT (self/peer)

- Own project working skills
- Motivation to work
- Group working skills
- Learning subject content knowledge
- As an opponent:
  - Presentations
  - Project artifact

EXAMPLES
FOR ”YOU” – SUSTAINABEE

Name of the learning community: Ari private schools, *Turkey*
StarT theme: *Sustainable development*
School state: *Middle school*

What subjects have been used in the project: The school have benefited from their Informational Technology lesson in the process of preparing the questionnaires, analyzing the data, preparing the brochures and posters with awareness-raising content, and designing the 3D Waste Collection box, which they prepared to collect data for our project, which they mainly conduct at science lesson.

Briefly: In this project, where the students mainly deal with the production of soft soap from vegetable waste oils, they aimed to increase the awareness of people about “upcycling and recycling”.

EXAMPLES
UPPER SECONDARY STUDENTS' CLIMATE CALCULATOR FOR GREENHOUSE GAS EMISSIONS

Name of the learning community: Haukiputaan lukio, Finland
StarT theme: *Sustainable development*
School state: *High school*
What subjects have been used in the project: *Mathematics, Physics, Social Studies, Computer Science, Geography*

Briefly: The high schoolers wanted to give young people an easy tool to make climate actions with. They came up with the idea of a climate calculator, where you could mark your climate actions and get points for them. In the project, an app was designed and programmed by students.

Project Diary:
https://sites.google.com/view/ilmastolaskuri/diary?authuser=0