Project-based learning and innovation in an open school

Practical and theoretical guide to PBL

Søren Peter Dalby Andersen
Anne Katrine Blond
Peter Claudell

Project-based learning and innovation in an open school

Practical and theoretical guide to PBL

Abstract

In 2020, KlimaZirkus published the book “Project-based learning and innovation in an open school” (Andersen, 2020).

This article explains the ideas on learning behind the book, as well as the models that are central to the didactics related to project-based learning (PBL).

Central to this is PBL's competence model, which provides a comprehensive overview of innovation competencies and the associated learning objectives.

The model can function as a formative planning and evaluation tool.

The article also introduces the model “The eight basic elements”, which describes

elements that project-based learning processes must consider (Andersen, 2020).

The focus of the model is a combination of professional knowledge, skills, character, and metacognitive tools.

All models in this article can be found on the website: https://www.klimazirkus.com/english.

Written by:

Søren Peter Dalby Andersen- KlimaZirkus

Anne Katrine Blond- KlimaZirkus

Grafik af Peter Claudell- KlimaZirkus

Introduction

In an age of rapid technological progress, and both local and global societal challenges, there is a need to be able to navigate unpredictable and constantly changing dilemmas and opportunities.

Creative thinking is needed to tackle many of the world's social, economic, and political issues. Creativity promotes a problem-solving mindset, academic achievement, interpersonal skills, and social engagement (Larmer, 2015).

Despite the growing recognition of the importance of creative thinking, there is still an urgent need for both strategic and practical development of learning environments that support the development of children's creativity. As John Dewey points out, our knowledge should be closely linked to our doing, which is also reflected in Bloom's Taxonomy, where levels of learning are described hierarchically from remembering and reproducing to understanding, applying, analyzing, evaluating, and creating (Larmer, 2015).

At KlimaZirkus, we have experienced that project-based learning enables the development of professional knowledge, skills and character that are important for being able to navigate and thrive in our complex world and everyday life.

Once teachers have experimented with a small project or two, the general narrative is that it is challenging to work with new methods, but that PBL allows students to unfold their own ideas, dreams, and free thoughts. Students report that they feel they can make a difference locally, nationally, and globally (Andersen, 2020).

Box 1: Description of KlimaZirkus

KlimaZirkus is the practice-focused player that, in collaboration with schools, public institutions, NGOs and companies, implements a lasting culture of innovation.

We help future generations build professional knowledge, innovation competence and motivation to work with global challenges as outlined in the UN's global goals for sustainable development.

We contribute to the development of learning environments that can enable children to become lifelong, committed, creative, innovative, and curious students. Our starting point is project-based learning with close integration of the STEAM subjects, creativity, 21st-century competencies and innovative perspectives.

The thinking on learning

Learning can be conceived of in many ways, but especially two traditions have been prevalent in recent times. One, illustrated by the acquisition metaphor, has its origins in psychological and cognitive models of learning, and the other, illustrated by the participation metaphor, is based on analyses of ethnographic and anthropological studies (Sølberg, 2015). The two traditions describe learning in radically different ways. The differences centre around the perception of knowledge. The acquisition metaphor considers knowledge as something one can acquire and possess.

The participation metaphor describes knowledge as developmental knowledge and learning that "happens" through active participation in a social practice. The two traditions complement each other. The acquisition metaphor has a focus on concrete "subject-related goals" and the participation metaphor has a focus on more generic goals such as collaboration, independence, communication skills and self-confidence. We do not argue for one or the other metaphor, but rather for the need for both (Sølberg, 2015).

Box 2: Quote by teacher and innovation consultant Elizabeth Gray in connection with the evaluation of the project "Students of Ellehammer".

"Among the teachers there is great enthusiasm because the authentic tasks mean that the students' commitment increases. The commitment is seen in the students' way of working with the task, where they focus on the problem, identify the point, come up with ideas for new solutions and communicate the result to an audience" (Andersen, 2016).

Table 1: Differences in the perception of two metaphors for learning.
We do not argue for one or the other metaphor, but rather for the need for both (Sølberg, 2015).

The acquisition metaphor		The participation metaphor
Personal enrichment	**Goals for learning**	Personal development
The acquisition of something	**Learning**	Learning to be an active participant
Recipient, constructor (consumer)	**Student**	Legitimate peripheral participant
Sender, mediator	**Teacher**	Full participant
Personal property, item	**Knowledge / competence**	Carried by interactions
To possess	**To know something**	To have developed one's possibilities for participation

Four-dimensional education

KlimaZirkus co-creates with primary schools and youth education programmes. A recurring challenge has been to set both clear goals that support the "the acquisition metaphor" and goals that focus on the participation metaphor. To set these goals, we use the four dimensions knowledge, skills, character, and meta-learning – also called "four-dimensional education" (Fadel, 2015). This helps the teachers to create balanced and student-centred learning goals.

Knowledge: What do we know and understand?

Skills: How do we apply what we know?

Character: How do we react and behave when we interact with the outside world?

Meta-learning: How do we reflect and adapt?

Within the four dimensions: knowledge, skills, character, and meta-learning, we can identify the competencies that we want our students to develop.

Thus, four-dimensional education can be used as a basic understanding and conversation framework for identifying didactic focus and common interfaces with potential partners. The following subsections unfold each dimension and our application of them. In addition, a few supportive models are introduced.

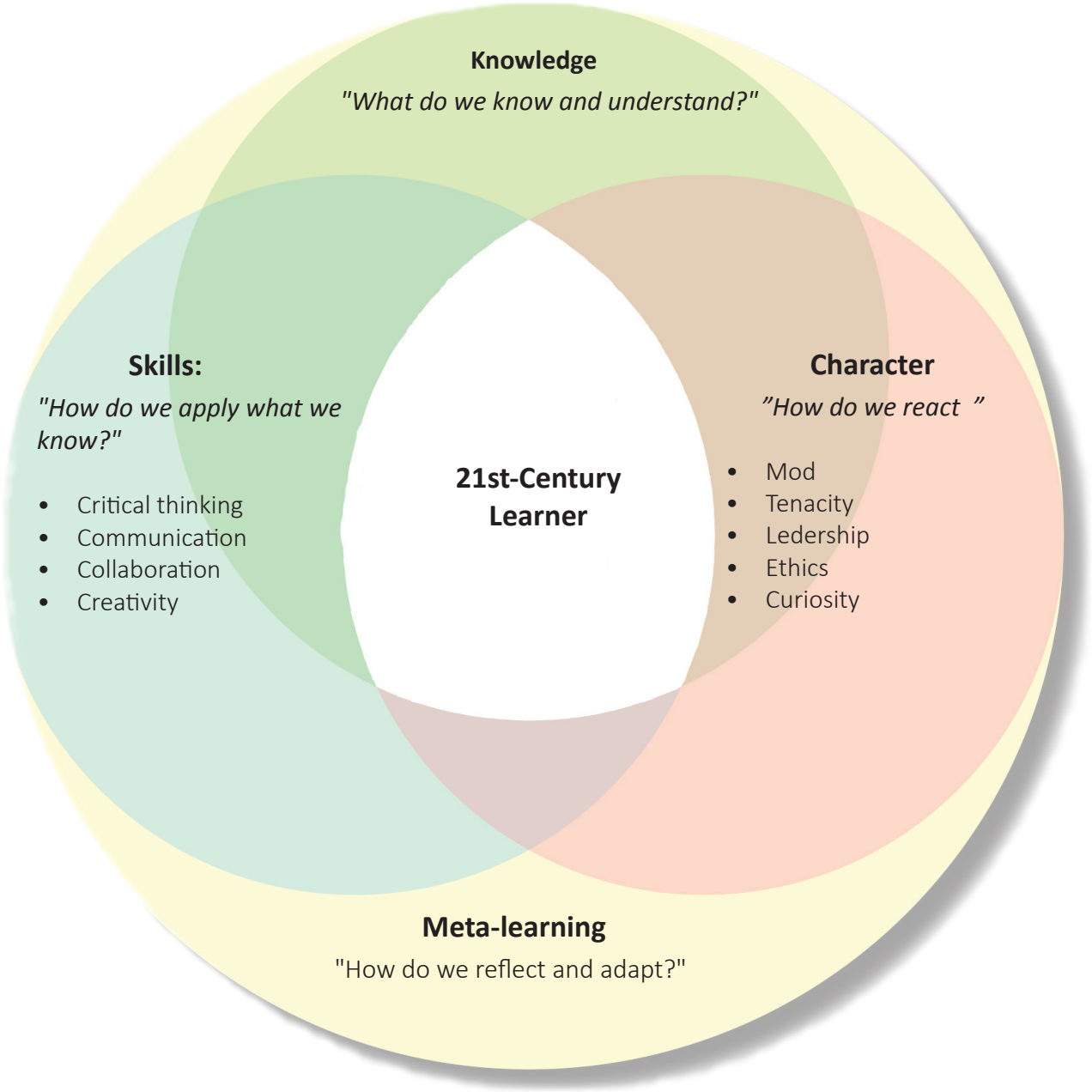


Figure 1: "Four-dimensional education" is a structural framework that, via four dimensions, describes the factors that should be included in the teaching when today's students are to be equipped to navigate the society of this century (Fadel, 2015).

Knowledge

In the knowledge dimension, we work with what we know and understand.

We must therefore relate to:

- -Which subjects must be included in the project?
- - Which academic content must be included?
- - Which professional concepts must be included?
- - Which process concepts must be included?

Most countries have national descriptions of what students should learn in different subjects. In the knowledge dimension, these descriptions are used as a basis for the learning outcome.

Box 2: OECD quote on why creativity should measured and developed.

> Creative thinking is thus more than simply coming up with random ideas.
>
> It is a tangible competence, grounded in knowledge and practice, that supports individuals in achieving better outcomes, oftentimes in constrained and challenging environments. (OECD,2021)

Skills

In the skills dimension, we work with the application of knowledge. The concept 21st-century skills (critical thinking, creativity, communication and collaboration – the 4C compass) is used to describe the dimensions. In our experience, an overview of and a common language for working with the skills of the 21st century is important. We use the 4C compass to create a common language.

The compass contributes to dialogue, reflections and assessments related to 21st-century skills, identification of achieved learning goals and new development opportunities (Andersen, 2020).

The 4C Compass

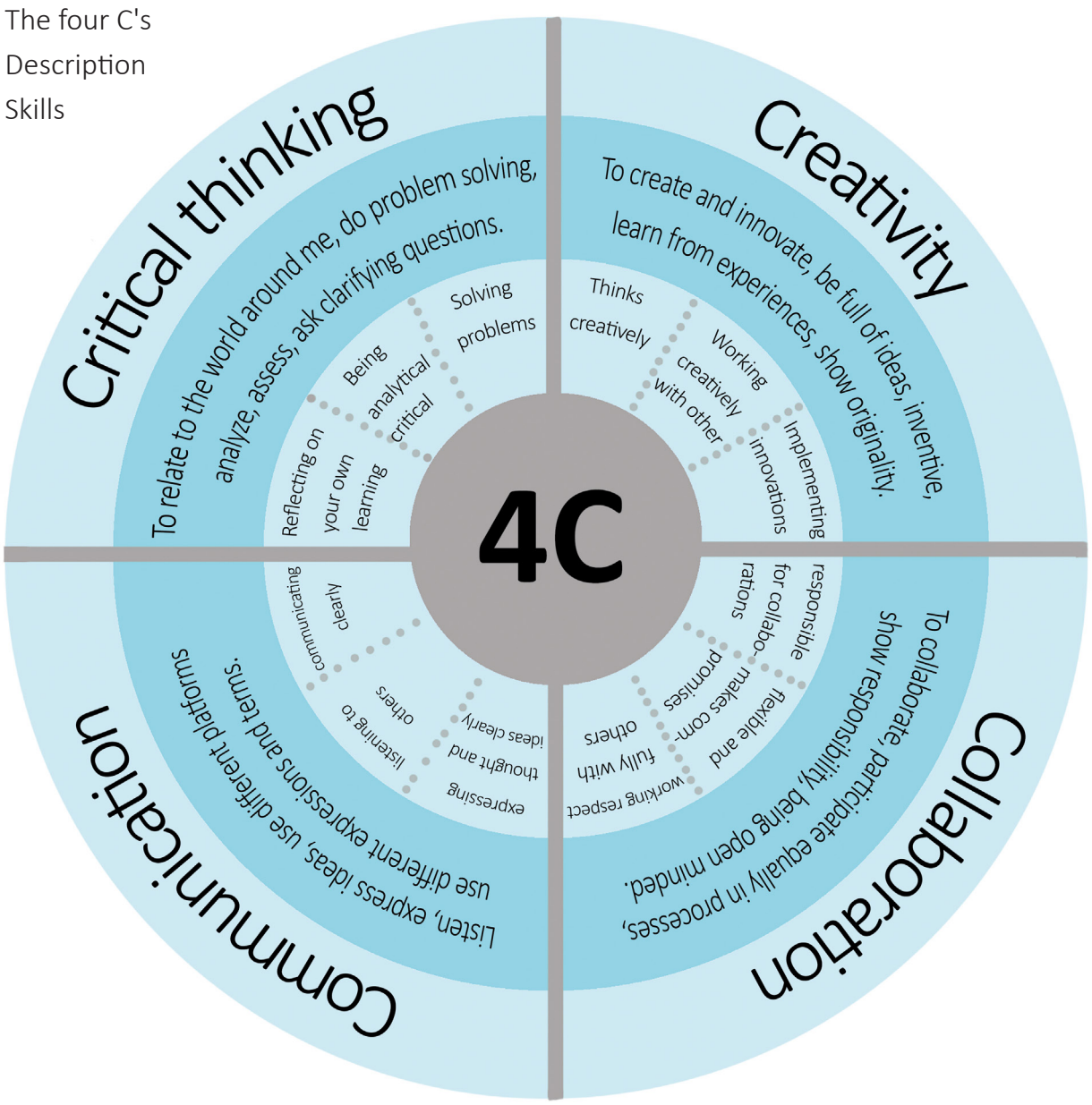
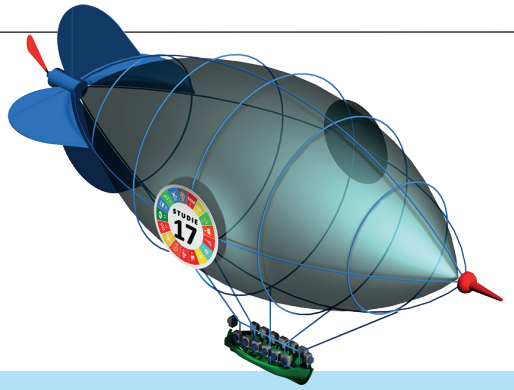


Figure 2: The 4C compass describes the competencies of the 21st-century skills separately, but the four Cs are relationally connected, and they will often be interdependent (Andersen, 2020).



The 4C compass can help to:

- Develop a common language on 21st century skills
- Reflect on and assess students' skills
- Track student progress over time
- Identify learning outcomes achieved and identify new development opportunities
- Create a dialogue on how students can best develop 4K competences

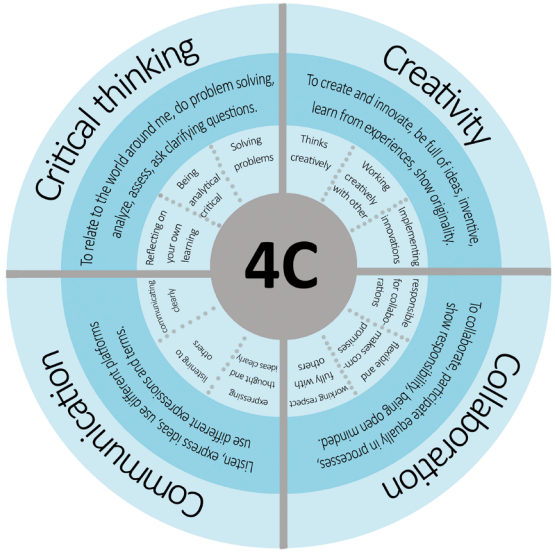


Table 2: The table explains the text in the 4C compass.

I can think critically To relate to the world around me, do problem solving, analyse, assess, ask clarifying questions.	**Skills** • Reflecting on your own learning • Being analytically critical • Solving problems
I am creative To create and innovate, be full of ideas, inventive, learn from experiences, show originality.	**Skills** • Think creatively • Working creatively with others • Implementing innovations
I can collaborate To collaborate, participate equally in processes, show responsibility, being open minded.	**Skills** • Responsible for collaborations • Being flexible and making compromises • Working respectfully with others
I can communicate Listen, express ideas, use different platforms, use different expressions and terms.	**Skill** • Expressing thoughts and ideas clearly • Listening to others' knowledge and intentions • Communicating clearly

Character

In the character dimension, we work with how we react and behave when we interact with the outside world.

To operationalize the dimension, we use the model "The Character Wheel", which via four habits and twelve sub-habits provides the opportunity to focus student conversations and design teaching that address the development of students' character (Andersen, 2020).

The Character Wheel is an extension of Bill Lucas and Ellen Spencer's tenacity model (Lucas, 2018). The core principles of the model centre on how we can strengthen students' development in relation to:

- believingin their own abilities
- controlling themselves
- being committed
- creating competencies to activate and expand networks

Among other things, the model can also contribute to awareness of when students' character is brought into play, and the model can track development over time and help to develop the language across the school community (Andersen, 2020).

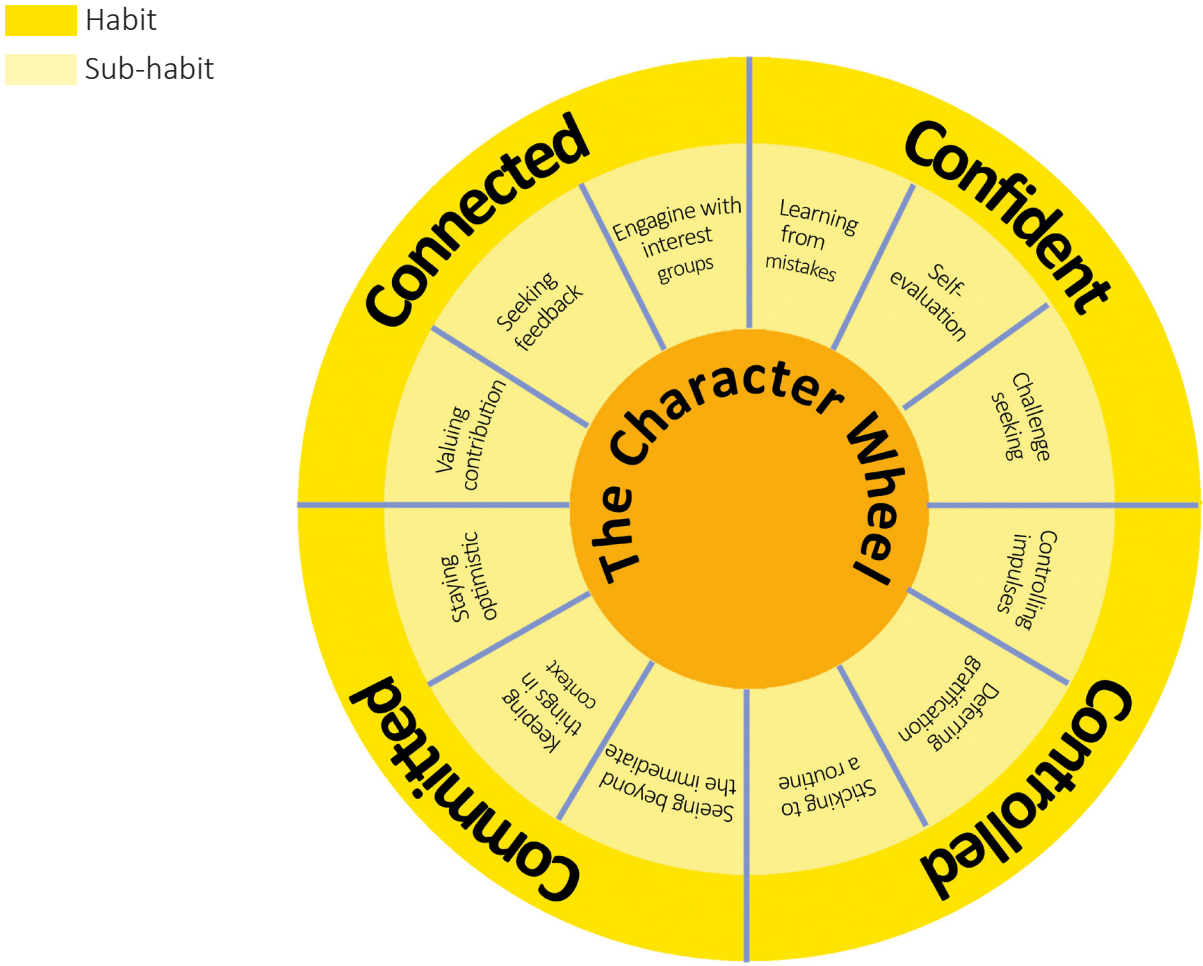


Figure 3: The character wheel is a didactic planning tool that gives the teaching team a clear description of what character a tenacious student has. The wheel consists of four habits and twelve sub-habits (Andersen, 2020).

"If parents want to give their children a gift, the best thing they can do is to teach their children to love challenges, be intrigued by mistakes, enjoy effort, and keep on learning. That way, their children don't have to be slaves of praise. They will have a lifelong way to build and repair their own confidence."

Carol S. Dweck

Habit

Sub-habit

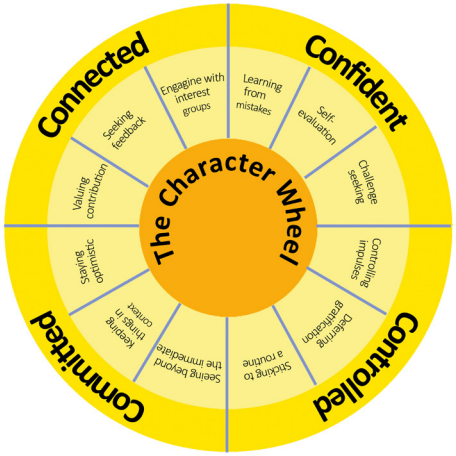


Table 3: Explaining the text in "The Character Wheel."

Connected A connected student understands the importance of engaging with other people and dares to seek out knowledge outside the classroom. The student acknowledges that he / she can develop through interaction with others, but at the same time believes that his / her own actions and opinions have value.	**Sub-habits** ● Valuing own contribution ● Seeking feedback ● Engaging with interest groups
Confident Students with faith in their own abilities are learning oriented and not performance oriented. They actively seek opportunities to learn through challenges, mistakes, and self-evaluation.	**Sub-habits** ● Learning from mistakes ● Self-evaluation ● Challenge seeking
Controlled Controlled students work diligently and tolerate short-term boredom, even when confronted with less interesting aspects of a challenge.	**Sub-habits** ● Controlling one's impulses ● Deferring gratification ● Sticking to a routine
Committed Committed students can overcome difficulties because they can see the value of overcoming a problem in order to achieve success. They have insight into the process and try to plan themselves out of predictable challenges.	**Sub-habits** ● Seeing beyond the immediate ● Keeping things in context ● Staying optimistic

Meta-learning

Meta-learning focuses on the student's reflection, adaptation of learning methods, and understanding of process. The goal for students is to become aware of, and increasingly able to correct and reflect on, their learning process. This cognitive process takes place continuously and happens in interaction with the other three dimensions, (Fadel, 2015).

To set goals related to meta-learning, we developed the PBL Competencies Model (Figure 5), which is based on the model “The five innovation competencies” (Figure 4). Both models were developed to address the need for a formative assessment tool.

The description of innovation competencies focuses on the students’ ability to act in the process rather than on the students' products. When assessing students' innovation competencies, it is therefore not necessarily important to look at whether the products or ideas that the students develop are innovative. On the other hand, it is essential to look at how students act and work with issues or challenges from a field of practice.

Thus, a student can be competent in innovation, even if the student's ideas or solution proposals are not new (Sølberg, 2015).

If the core in the concept of innovation related to learning is that the students can use relevant professional knowledge to come up with proposals that can improve a practice and create value for a recipient, then innovation competencies can be defined as follows (Nielsen, 2015):

A student has innovation competencies if the student, alone or together with others, can:

- generate ideas for solutions to a problem from an existing practice based on relevant knowledge.
- evaluate these ideas in terms of their usefulness, feasibility and potential value creation and use this assessment in the selection and execution of ideas.
- convey these ideas to different recipients.

Figure 4: The figure illustrates the understanding of the overall concept of innovation competencies. Innovation competencies contain five basic innovation competencies, which in connection with iterative processes and other teaching can be used to formulate learning goals or be seen as signs of learning (Andersen, 2020).

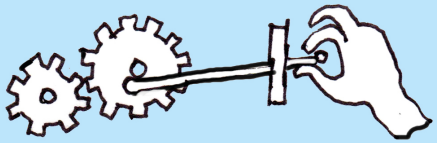
Collaboration competence

The ability to collaborate, be embracing and consciously take on different roles during the process.

- Works effectively and respectfully
- Acts flexible and helpful
- Gives and receives feedback

Implementation competence

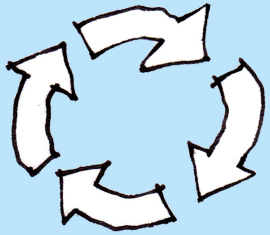
The ability to make things happen and the courage to take risks.



- Thinks and acts differently
- Accepts unsecurity
- Dares to fail

Navigation competence

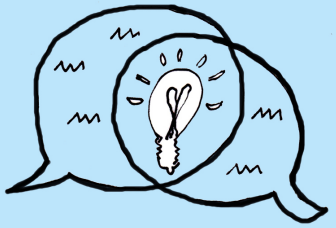
The ability to see what kind of knowledge to gather to solve a task.



- Reflects critically
- Uses processes
- Delves deeply into the matter

Communication competence

The ability to communicate the end product in a convincing manner.



- Listens effectively
- Communicates clearly
- Formulates thoughts and ideas

Creative competence

The ability to interpret an assignment independently, develop ideas and pick and choose the best ones.

- Explores and investigates
- Plays with different opportunities
- Connects ideas

PBL Competencies Model

The five innovation competencies
Sub-competencies
Signs of learning

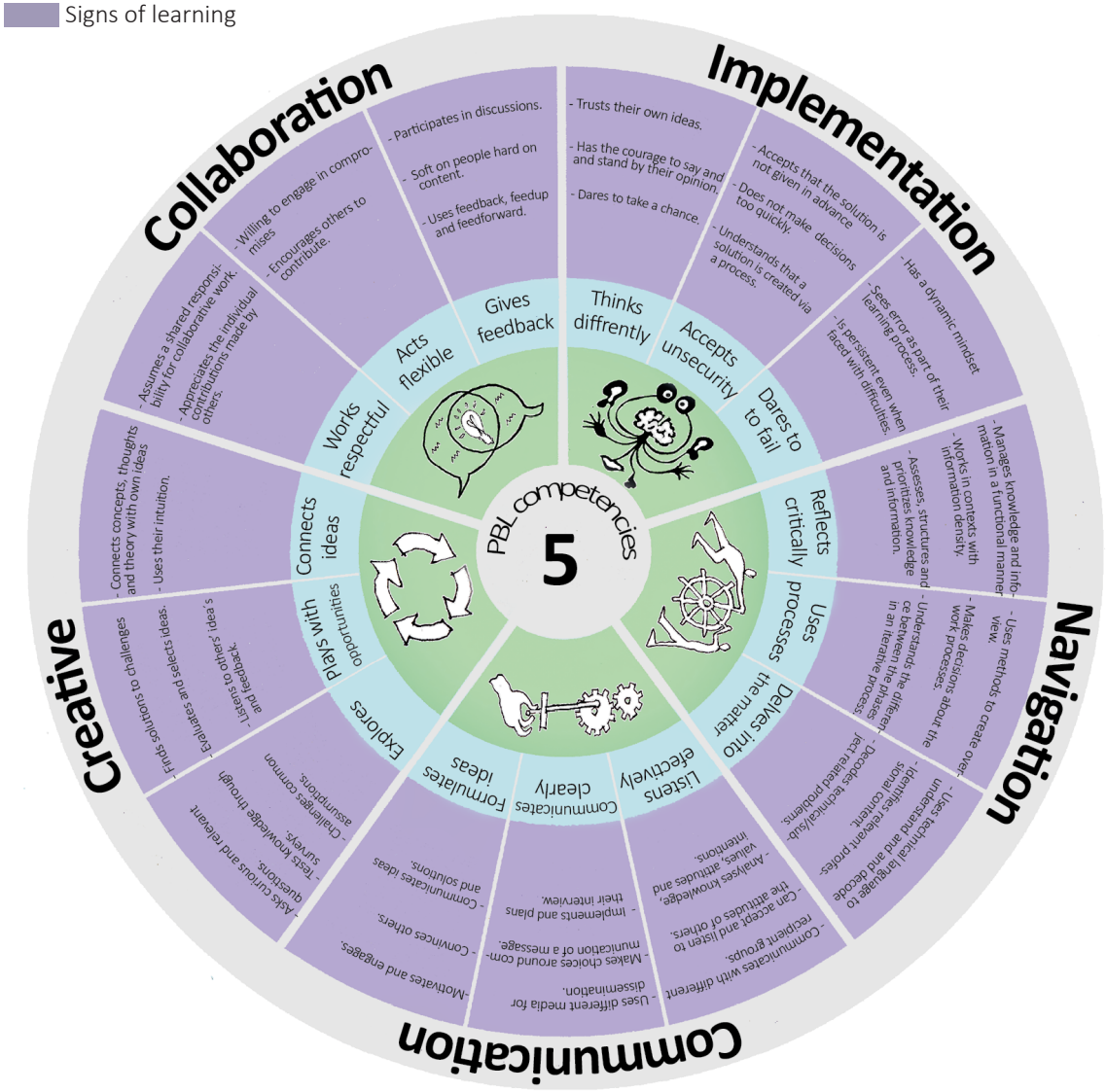


Figure 5: In a broad learning perspective, the PBL Competencies Model can be used to assess and develop students' innovation competencies (Andersen, 2020).

Based on the five innovation competencies, we have developed the PBL Competencies Model (Fig. 5), which is a formative planning tool. The model provides an overall overview of the innovation competencies and associated learning goals. It should be regarded as a dialogue tool for a constructive didactic conversation about students' innovation competencies

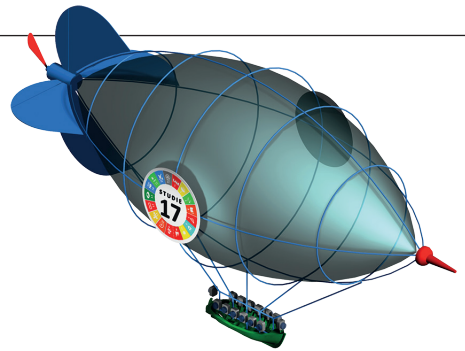


Table 4: The table clarifies the text from the PBL Competencies Model (Fig. 5) (Andersen, 2020).

As mentioned earlier, the concept of innovation competencies can be described through five basic competencies. The five competencies can be broken down into three sub-competencies.
The sub-competencies provide a direct description of the innovative student's actions. For each of the 15 sub-competencies, the PBL Competencies Model indicates several suggestions for signs of learning.

In our experience, the PBL Competencies Model can help teachers to become aware of when students' innovative competencies are brought into play.

We have used the model to:

- Reflect on and assess students' innovative competencies
- Track student progress over time
- Identify achieved learning goals and set new learning goals.

	Collaboration competence	**Implementation competence**	**Navigation competence**	**Communication competence**	**Creative competence**
Sub-competencies	**Works efficiently and respectfully** - Assumes a shared responsibility for collaborative work. - Appreciates the individual contributions made by others.	**Thinking and acting differently** - Trusts their own ideas. - Has the courage to say and stand by their opinion. - Dares to take a chance.	**Reflects critically** - Manages knowledge and information in a functional manner. - Works in contexts with information density. - Assesses, structures and prioritizes knowledge.	**Listens effectively** - Communicates with different recipient groups. - Can accept and listen to the attitudes of others. - Analyses knowledge, values, attitudes and intentions.	**Explores and investigates.** - Asks curious and relevant questions. - Tests knowledge through surveys. - Challenges common assumptions.
	Acts flexibly and helpful - Willing to engage in compromises. - Encourages others to contribute. - Willing to further develop others' ideas.	**Accepts uncertainty** - Accepts that the solution is not is given in advance. - Does not make decisions too quickly. - Understands that a solution is created via a process.	**Uses processes** - Uses methods to create overview. - Makes decisions about the work processes. - Understands the difference between the phases in an iterative process.	**Communicates clearly** - Uses different media for dissemination. - Makes choices around communication of a message. - Implements and plans their Interview.	**Plays with different opportunities** - Finds solutions to challenges. - Evaluates and selects ideas. - Listens to others' ideas and feedback.
	Gives and receives feedback - Participates in discussions. - Soft on people hard on content. - Uses feedback, feedup and feedforward.	**Dares to fail** - Has a dynamic mindset. - Sees error as part of their learning process. - Is persistent even when faced with difficulties.	**Delves deeply into the matter** - Uses technical language to understand and decode issues. - Identifies relevant professional content. - Decodes technical/subject-related problems.	**Formulates thoughts and ideas** - Motivates and engages. - Convinces others. - Communicates ideas / solutions.	**Connects ideas** - Connects concepts, thoughts and theory with own ideas. - Uses their intuition.

What fields of practice should students work with?

Students' desire to learn is higher when they are involved in relevant activities that involve senses and creative elements, when the students are met respectfully, and when they have a say what field of practice the teaching addresses.

When choosing a field of practice, it can be useful to use the following list of universals- a universal is an aspect of life that concerns all humans (Corneliussen, 2018).

When a field of practice has been selected, it can be combined with one or more of the following points:

- a question or challenge from a company (the challenge must be real and derive from the company's daily life)
- a local or global problem that students can address or solve (the problem must be relevant to students' daily lives)
- a product the student would like to create (it could be a plant boxes, a seed bomb, or a photo book about local insect diversity)
- an existing project that the student would like to implement in their local community (there is a myriad of different projects that can serve as inspiration)

Box 3 Universals- from the Spiral Project 2018 (Corneliussen, 2018).

Housing - *e.g., architecture and anthropology*

Community - *e.g., politics and economics*

Everyday life - *e.g., playing, and personal finances*

The individual - *e.g., abilities, interests, and strengths*

Communication - *e.g., foreign languages and literature*

Body - *e.g., anatomy, movement, and food*

Art - *e.g., music, drama, and visual arts*

The Earth - *e.g., geography and geology*

Nature - *e.g., biology, physics, astronomy, and chemistry*

Care - *e.g., ethics, human rights, and sustainability*

Psychology - *e.g., cognition and emotions*

Technology- *e.g., computer science, engineering, and crafts*

How can an iterative process be implemented?

New forms of teaching, such as project-based learning and iterative processes can be experienced as confusing and incoherent the first few times they are used. Project-based learning involves a new working process, new technical terms, and new method cards (Andersen, 2016). This can create cognitive overload, which is a situation where students must deal with more information or more tasks than they can manage (Sweller, 1988).
To address this, we have developed the Sprouting Process, which is a step-by-step introduction to iterative process work.

We have based the Sprouting Process on experiences from proven iteration models from IDEO, Design to Improve Life and the model from the Engineering in danish Schools project.
Based on the structure of the Sprouting Process, iterative work processes can be adapted to the ***Seed step*** (beginners), the ***Sprout step*** (students with some experience) and ***Flower step*** (experienced students), so that cognitive overload is avoided. xWhen you use the Sprouting Process, the first step is to choose which step your PBL project should be based on. It is important not to choose on the basis of the student's schoolyear level but on the basis than a student from the ninth grade.

Figure 6 The Sprouting Process is used to adapt iterative work processes to beginners (Seed), students with some experience (Sprout) and experienced students (Flower). It should therefore not be seen as a new type of innovation process with different work tasks and methods, but as a meta-model, or illustration of how to break down existing iteration models into three introductory steps. The intention is to prevent cognitive overload and frustration for both students and teachers (Andersen, 2020).

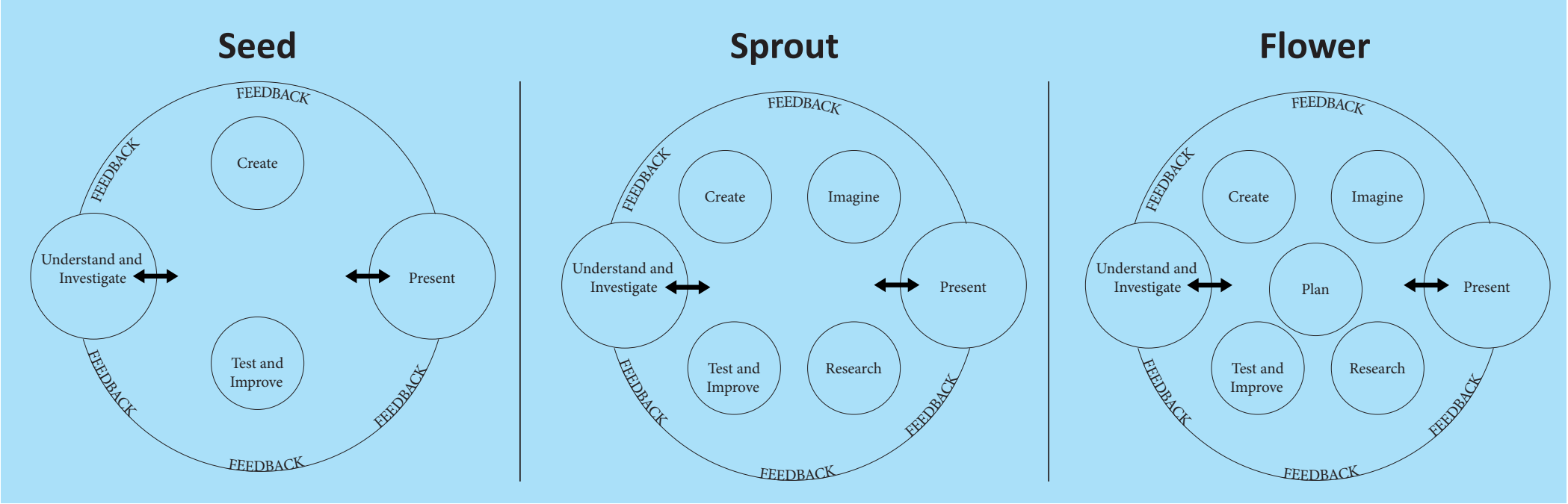


Table 5 The Sprouting Process should be considered as a metamodel that can decompose existing iteration models into three introductory steps. The intention is to prevent cognitive overload and frustration for both students and teachers. Below are the process steps described. The table below describes the purpose of the individual phases that the Sprouting Process consists of, and also describes the product of the phase and the role of the students / teachers.

Purpose of phase	Product	Responsibility
Understand and Investigate: The students examine the challenge they are given. They plan the process they are facing.	**The product:** The students' brainstorms and studies of the challenge. A group contract may be prepared for the project	**Teacher**: Presents the challenge. **Students**: Examine the challenge through dialogue about the narrative, but small texts can be read, or small experiments carried out.
Imagine The student groups generate, develop, and select the idea they want to work with.	**The product:** An idea that the group agrees to work on.	**Teacher:** Facilitates the process and might provide sparring across groups. **Students:** No final ideas are worked on- just rapid prototypes. In connection with other phases, e.g., "Research" or "Create", students will become more specific about their solution.
Research The students describe their persona, map relevant knowledge.	**The product:** students acquire knowledge through reading, interviews, experiments, and observations. Based on this knowledge, persona mapping and knowledge mapping are carried out.	**Teacher:** Supports systematic collection of knowledge by supervising relevant literature, experiments, and observations. Focuses on ensuring the students make a precise persona description. **Students:** Map relevant knowledge, read, experiment, investigate similar existing solutions, observe, interview.
Plan Students plan the upcoming process and distribute the assignments. They outline, select materials and become more specific about their product / idea.	**The product:** A work plan that describes the division of work, deadlines, list of materials, tools, etc.	**Teacher:** Supports the students' processes and instructs about, if necessary, methods to support students' creativity. **Students:** Draw sketches or make small models and negotiate how the solution proposal can be realized. They discuss and test the choice of materials and work processes.
Create Students build prototypes and realize their idea.	**The product:** Working drawings or sketches of the prototype / prototypes	**Teacher:** Helps solve practical problems in procuring materials and finding work tools. **Students:** Turn their idea into a concrete first proposal for a solution.
Test and Improve The students test, evaluate and improve the prototype. The students will 'jump' between improving and testing over several rounds.	**The product:** Prototype that can be tested and improved.	**Teacher:** Focuses on supervision in relation to test procedures and maintains the students' focus on requirements for prototypes. **Students:** Test and assess whether their test method works and whether their solution is useful or needs to be improved. They may end up having to reject their idea and find another.
Present Students present their solution and considerations about the design process.	**The product:** Tested prototype and possibly test results comparable to the specifications of the original challenge.	**Teacher:** Must focus on asking what choices the group has made during the process. The teacher focuses on what students have learned from their mistakes and challenges. **Students:** Present and explain their solution to the 'users'. The students present the knowledge they have gained about technical and subject-related issues and collaboration. Students must remember to present and evaluate the process the group has been through on.

What is the foundation of the project?

It can be tricky to design a PBL project and keep focus on what is important in the project.
To maintain this focus when designing a PBL project, KlimaZirkus uses the model “The 8 basic elements”. Regardless of whether a project contains iterations or not, a qualitative PBL project must consider several of the basic elements (Andersen, 2020). The eight elements connect the relation between aims and goal, skills, knowledge, character of work competences and meta-learning.

The model “The 8 basic elements” was developed in collaboration with “Studie 17” at Dansborgskolen in Hvidovre, Denmark. Studie 17 is a specialized PBL learning environment that supports teachers' work with PBL.

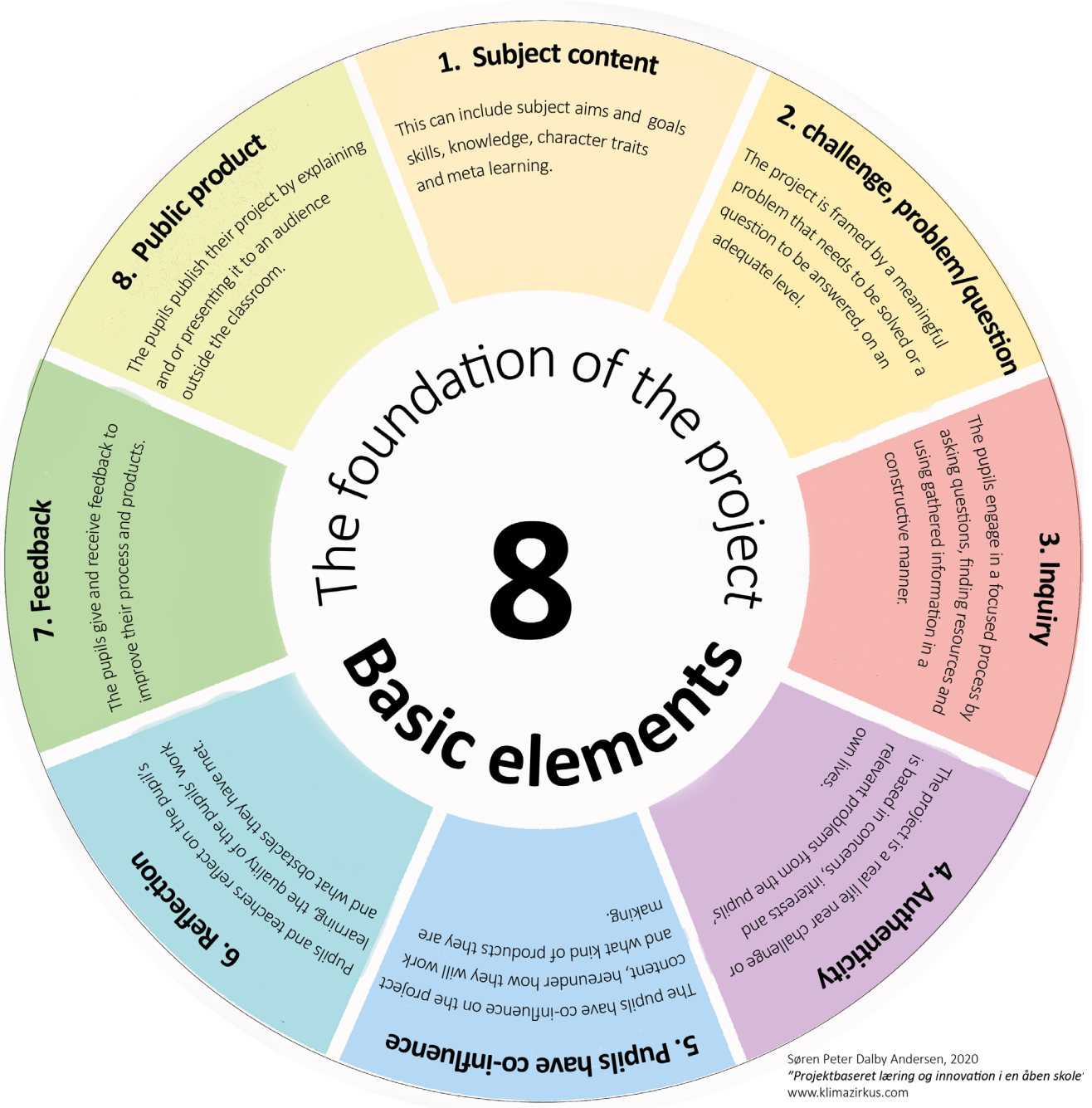


Figure 7: The figure describes eight elements that can be considered for inclusion in a PBL project (Andersen, 2020)

The eight elements.

1. Subject content

This can include subject aims and goals, skills, knowledge, character, and meta-learning.

2. A challenge, problem, or question

The project is framed by a meaningful problem that needs to be solved or a question to be answered, at an adequate level.

3. Inquiry

The students engage in a focused process by asking questions, finding resources, and using gathered information in a constructive manner.

4. Authenticity

The project is a real-life challenge or is based on concerns, interests, and relevant problems from the students' own lives.

5. Students have co-influence

The students have co-influence on the project content, including influence on how they will work and what kind of products they will make.

6. Reflection

Students and teachers reflect on the students' learning, the quality of the students' work and what obstacles they have met.

7. Feedback

The students give and receive feedback to improve their process and products.

8. Public product

The students publish their project by explaining and or presenting it to an audience outside the classroom.

All projects do not necessarily have to contain all eight elements. It is far more important that teacher teams and students work on a project that matches both the teacher team's and the students' level of development, interests and opportunities. However, it is important to be didactically aware of why a given element is either included or omitted.

Implementation of PBL

KlimaZirkus often meet teachers, school heads and consultants who are excited about PBL and eager to jump in and implement PBL after a half-day workshop on project-based learning and innovation.

But remember that meaningful cultural change will always require an investment in time, resources, and passion. Our experience is that perfect implementation processes can be difficult to design, and you will meet challenges and need to be ready for the unexpected. To guide schools through the implementation process, we have developed the models "The Leader's PBL Strategy" (Figure 8) and "The PBL Temperature" (Figure 9). They describe simple elements that should be included in the planning of implementation of PBL.

The leader's PBL strategy.

Which schools are successful in implementing PBL in their learning culture? There is a big difference in schools' culture, finances, student base, physical environment, etc. Successful implementation can take place in schools with old buildings, with limited budgets, and a sceptical teaching staff; implementation challenges can be experienced in schools with new buildings, good budgets and a teaching staff that are generally positive towards PBL. The key to successful implementation lies in the leadership of the school's culture (Andersen, 2020).

Schools that thrive with PBL have leaders and staff who focus on culture and are ready to do things differently. Leaders who are successful in changing a learning culture understand and embrace the process and are aware that PBL (and other teaching methods) are not a quick fix for the students' well-being and achieving high marks in the final exams (Andersen, 2020).

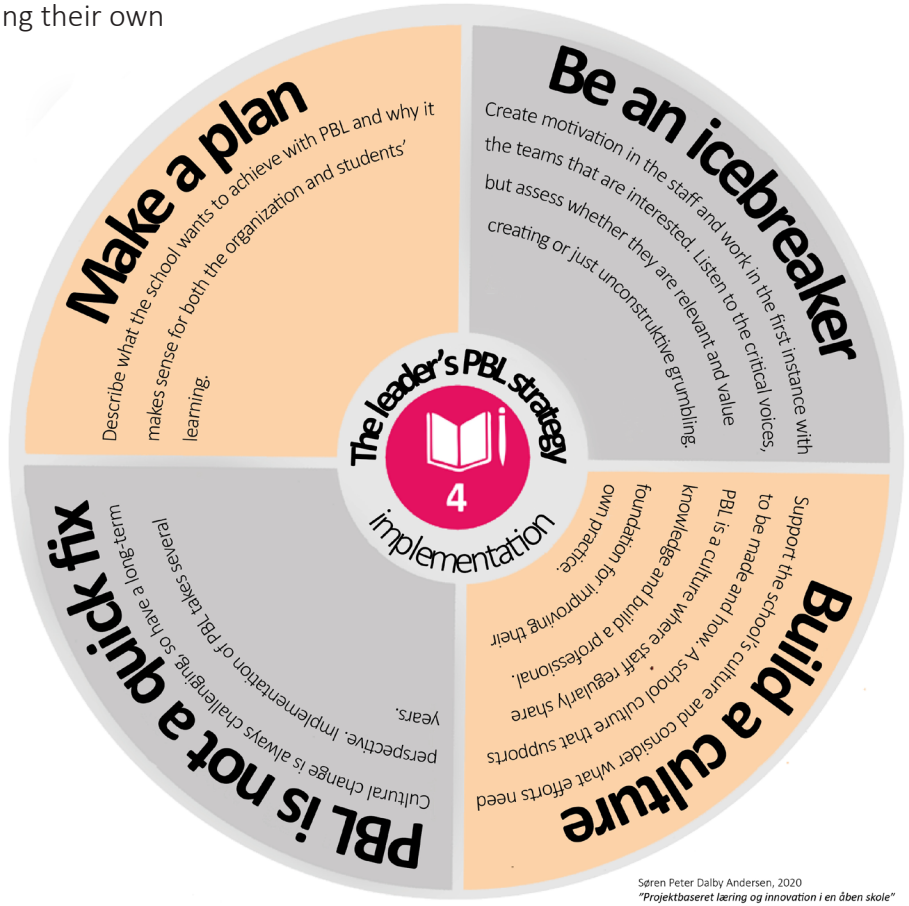
Make a plan: Describe what the school wants to achieve with PBL and why it makes sense for both the organization and students' learning.

Be an icebreaker: Create motivation in the staff and work in the first instance with the teams that are interested. Listen to the critical voices but assess whether they are relevant and value creating, or just unconstructive grumbling.

Build a learning culture: Support the school's culture and consider what efforts need to be made and how. A school culture that supports PBL is a culture where staff regularly share knowledge and build a professional foundation for improving their own practice.

PBL is not a quick fix: Cultural change is always challenging, so have a long-term perspective. Implementation of PBL takes several years

Figure 8: "The Leader's PBL Strategy" describes a helpful guideline for a leader's 'mindset' that can be used when a school plans to implement PBL (Andersen, 2020).



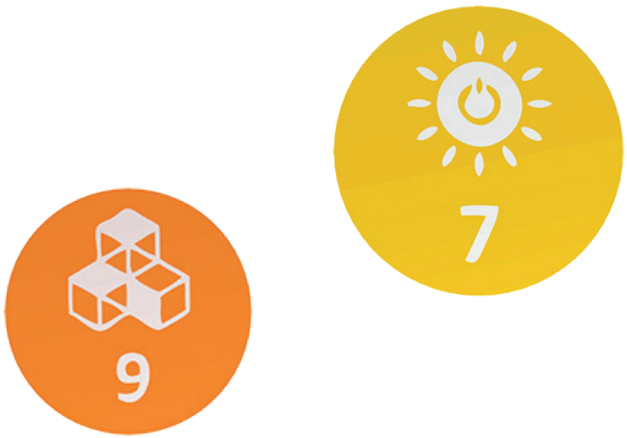
The PBL Temperature.

The Leader´s PBL Strategy should have helped you to find your why – not just a “why” … but your passionate reason for implementing PBL.
To support and implement the “why”, you need knowledge about the school's learning culture and the support of the staff.

When KlimaZirkus set the stage for the staff to succeed with PBL, we include them in the vision and strategy process.

In KlimaZirkus we use the model “The PBL Temperature” as a framework for a hands-on workshop that maps the school’s:

- Practice
- Prerequisites
- Culture



In any process of change, you will find that challenges can come from any of the above three areas in the PBL Temperature Model.

This means that when a challenge appears, the first step is to examine whether the challenge relates to practice, prerequisites or culture:

- Teaching does not meet our subject objectives
  - It is a ***practice*** challenge.
- Not enough time for planning
  - It is an ***prerequisites*** challenge.
- Problems learning from our experiences
  - It is a ***culture*** challenge.

Based on your work with “The Leader's PBL Strategy” and “The PBL Temperature” you now have the knowledge and guidance to fine tune the school’s vision and strategy and plan the implementation of PBL in the learning culture.
A word of advice is to be patient. Change will take time, but adjusting expectations to a longer time frame can avoid frustration, discouragement, and the risk of abandoning PBL.

Figure 9 KlimaZirkus uses the model “The PBL Temperature” to map a school’s foundation for working with PBL. It is printed as a poster, and the workshop participants use Post-its to fill out the poster. It is important to focus on all three elements at the same time- since change in one of the elements will influence the other two elements.

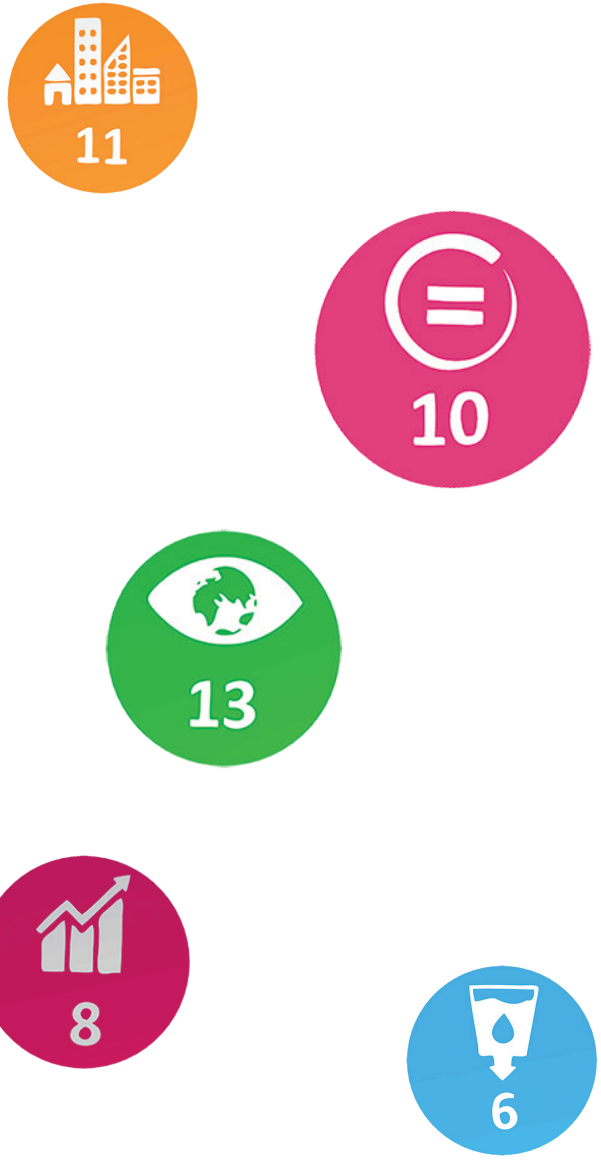
Perspectives

It can be difficult to copy a successful practice and trust that it will have the same effect in a different context. Pedagogical and didactic processes constitute a complexity rather than a complicated process. For example, it is complicated to send a satellite into orbit around the Earth, but if you have once been successful with it, and if you repeat the exercise exactly as before, it is overwhelmingly likely that the exercise will succeed again. This is not the case in pedagogical and didactic processes.

Pedagogy and didactics are not rocket science. They are much more complex, and therefore it is useful to have developed an overall mindset that makes it possible to interpret and navigate their complexity- and thus have a basis for discussing and changing practice if it does not work as intended.

Oskar Negt and Aleksander Kluge wrote with a somewhat polemical undertone in their book Geschichte und Eigensinn' (Negt og Kluge, 1993) that practice is when things succeed, but one cannot necessarily explain why one succeeds. Theory is the explanation for why things do not work out. Theoretical development, with its inherent weakness, is only necessary when things fail and no one has an explanation for why things have failed. When one looks beyond the polemical element, Kluge and Negt's ideas imply that if things work for you, theory seems almost superfluous - 'If it works- why fix it?' But as soon as you encounter resistance or unforeseen negative side effects in your practice (which will certainly happen sooner or later) you will need an orientation and navigation instrument that is related to practice and yet is independent of practice.

There is much that does not work in traditional classroom technology and the education system does not respond effectively to the challenges of the 21st century (OECD, 2019). International forums such as the OECD, UNESCO, ASEM and the EU, which work within the pedagogical and didactic discourse, have struggled with the challenge of developing new paths in the form of political recommendations – but these forums are isolated from practice.



With the models presented in this article, we have tried to link effective practice to a long, strong, and rich theoretical tradition that spans American pragmatism from the beginning of the 20th century (with John Dewey as distinguished representative), German reform pedagogy, Jena Plan, and more dynamic curriculum development in the form of 4D learning in Charles Fadel's contribution and not least the newer approach to creativity and innovation, which Jan Alexis Nielsen represents. This article provides a snapshot, because in the next round, both practice and theory must move forward. The theoretical tradition we present can help to maintain the long-term goals and fundamental values that PBL should be based on.

References

Andersen, S.P. (2016). ClimateZircus. Innovation in an open school. KlimaZirkus- Building Workshop.

Andersen, S.P., Claudell, P., Blond, A. K. (2020). Projektbaseret læring og innovation i en åben skole. Frederikshavn: KlimaZirkus- Building Workshop.

Corneliussen, C., Fabricius, M., Klinge, L., Krull, P. (2018). Det gode skoleliv. Århus: Aarhus Universitetsforlag.

Fadel, C., Bialik, M. og Trilling, B. (2015). Four-Dimensional Education: The Competencies Learners Need to Succeed. Boston: The Center for Curriculum Redesign.

Godec, S., King, H. & Archer, L. (2017). The Science Capital Teaching Approach: engaging students with science, promoting social justice. London: University College London.

Larmer, J. , Mergendollier, J., Boss, S. (2015). Setting the Standard for Project Based Learning: A Proven Approach to Rigorous Classroom Instruction. Alexandria: Buck Institute for Education, ASCD

Lucas, B., Spencer, E. (2018). Developing Tenacity. Teaching learners how to persevere in the face of difficulty. Cornwall: Crown House Publishing Limited.

Nielsen, J. A. (2015). Evaluering af projektet Gymnasiet tænkt forfra 2012-2015. Institut for Naturfagenes Didaktik, Københavns Universitet.

OECD (2019), OECD Future of Education and Skills 2030 OECD Learning Compass 2030. OECD Publishing

OECD (2021), Pisa 2021 Creative Thinking Framework. OECD Publishing

Negt O., Kluge A. (1993). Geschichte und Eigensinn. Frankfurt am Main: Suhrkamp

Sweller, J. (1988). Cognitive Load During Problem Solving: Effects on Learning. Cognitive Science, Volume 12, Issue 2, 257-285.

Sølberg, J., Waaddegaard, N. H., Hansen, F. L., Trolle, O., Elmeskov, D. C., Johannsen, B. F., & Nielsen, J. A. (2015). Innovation, Science og Inklusion 2015: Slutrapport af ISI 2015. Institut for Naturfagenes Didaktik, Københavns Universitet.