Be a STEAMer

STEAM concept

How do we see STEAM?

Petra Weitzer-Sklirou, Franziska Rake, Morris Pettorelli and Maikki Manninen

19.11.2025

Table of contents

Introduction to STEAM

The "Be a STEAMer" project is a KA 210/SCH project, co-financed by Erasmus +, which is based on the 4C model and emphasises the four skills of communication, collaboration, creativity and critical thinking.

There is a consensus that learning that incorporates the 4Cs is seen as the basis for enabling children and young people to participate in society in an increasingly mediatised and digitalised society. It is therefore essential that education must adapt to digital-technological change. STEAM is a response to these demands.

The promotion of STEM (science, technology, engineering and mathematics) has long been called for in the education sector and has been implemented with various projects in both kindergartens and schools.

The "A" stands for Arts and is intended to promote creativity, creative thinking, learning with hands and manual dexterity and to strengthen the judgement and self-confidence of children and young people.

The "Be a STEAMer" project aims to awaken a passion for science and innovation in children and young people in a creative way.

STEAM is an acronym for the following English words:

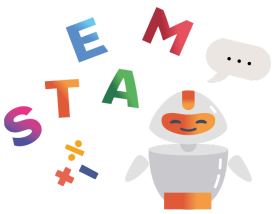
S = Science

T = Technology

E = Engineering

A = Art

M = Mathematics



The core idea of STEAM pedagogy is to integrate these areas into interdisciplinary learning experiences. The goal is to develop students' problem-solving skills, creativity, and collaboration abilities, while strengthening the role of technology and art in education.

STEAM process

The STEAM process is a learning and problem-solving model that progresses step by step and supports interdisciplinary work. The typical stages are:

1. Objective
   Define the learning and project goals. These may relate to themes such as sustainability or transversal skills.
2. Task
   Present the challenge or problem to be solved. At this stage, roles and schedules are also agreed upon.
3. Background Research
   Learners gather information, explore the topic, and formulate questions. The aim is to build a strong knowledge base before ideation.
4. Ideation
   Teams brainstorm as many solutions as possible. Ideas are combined and refined, but evaluation is postponed to maintain creativity.
5. Planning
   Select the best idea and create an implementation plan. This includes considering team members' input and preparing for prototyping.
6. Execution
   Build a prototype or solution, test it, and improve it iteratively. Collect feedback and assess functionality.
7. Sharing and Reflection
   Present the solution to others, reflect on what was learned during the process, and practice pitching. Reflection supports learning and communication skills.

Picture 1: STEAM process

Principle of Use:
The process is applied step by step to prevent learners from jumping straight into execution. Each stage supports creative problem-solving, collaboration, and critical thinking. The model is adaptable to different subjects and projects and can be tailored to age groups and objectives.

Each step of the process is described in more detail below:

Objective

At the center of the process are the learning goals that are set in the planning phase. The goal identifies multidisciplinary knowledge goals and transversal skill goals to which the STEAM implementation is linked to.

Task

At the beginning of the STEAM process, we tune into the activity, define and present the period´s theme and/or problem, which can be very broad or strictly limited. Learners are told the goals defined for the period, what will be done, why and for how long. Activities usually take place in groups, so it is also important to define the roles and responsibilities within the groups during the task phase. For example, different games, sound or videos can be used as ways to tune in to the project.

Background

In the backround phase learners actively function as collectors of the necessary information and as researchers related to the given theme. They get to explore the matter and build the necessary knowledge base. The key is that especially children and young people are taught how to form good questions. At first, we find out what kind of information about the theme and the problem already exists. It is good to ensure that learners find and use a variety of information sources. The observations made by the learners themselves are often used to gather information. In connection with the observation, for example, you can visit the object and interview other people about the theme. As a result of the phase, the learners have a good understanding of the theme or object, possibly the needs of the users and the challenges related to use.

Ideation

In the ideation phase the material collected in the background work phase is utilized. In the groups, we focus on ideation and look for possible solutions related to the task. The goal is to generate a lot of different ideas, so an open attitude towards all ideas is important, and judging them should be avoided in order to maintain a creative and positive mind. By combining ideas, they can often become a completely new solution, and the resulting refined ideas are shared by the group. As a result, the group has developed one or even more solutions, which they take to further development.

Planning

In this phase solution ideas can be initially sketched, for example, on paper, what it would look like or how it would work. The most important thing is to find a design method suitable for your own solution. In planning, it is possible to create so-called light prototypes, which can be used to quickly test the functionality of the solution. The most suitable versions are selected for the next step. We try to look at our own and others' plans through the eyes of the final user. In the planning phase, the so-called "improving", where the group's own solutions develop by learning from the solutions made by others.

Execution

In this phase we make the first more accurate prototype of the solution. At this stage, the right materials and techniques are used to produce the final solutions. When the first version of the solution is completed, it is evaluated and feedback is collected. In the implementation phase, several manufacturing or implementation experiments can be done iteratively until it is concluded that the solution and its production process have been perfected.

Sharing

In the sharing phase the groups present their achievements to the others. In addition to the prototype/solution, the presentation tells what the group has done in the different stages of the process and why. Repetition implemented in this way helps learners to adopt the process even more strongly. Reflecting on one's actions and decisions is also key in the sharing phase. In addition, it is good to practice your own solution, the so-called "pitching". In addition, you can also learn about communication and marketing.

Source: STEAM in Oulu -network https://www.steaminoulu.fi/ [25.9.2025]

The 4C skills

The "Be a STEAMer" project raises awareness of the need to change teaching and learning. Engaging with STEAM offers educators the opportunity to prove the quality of their existing pedagogical concepts or to improve them in order to further develop their standards and pedagogical programmes and to expand them with regard to the challenges of learning in the 21st century. The integration of STEAM into pedagogical work offers educators as well as children and young people and their parents a broader understanding of the importance of the 4Cs in the learning process and with regard to the challenges of learning in the 21st century. As designers of early childhood and school pedagogy, educators can enable a more holistic understanding of social participation in an increasingly mediatised and digitalised society. In addition, parents and other educational institutions have the opportunity to raise awareness of the topic.

The 4Cs are:

Collaboration:

STEAM projects often involve teamwork, emphasizing **interaction skills, participation, and co-creation**. These also support **emotional and social skills**, such as empathy and active listening.

Critical thinking:

Students learn to evaluate information, synthesize sources, and approach knowledge analytically. This is emphasized in the *STEAM* and highlights **multiliteracy and information management**.

Communication:

Clear communication is more important than ever, and students need to learn to express their thoughts **understandably** without any obstacles. Regular practice helps them **communicate efficiently** and **keep their audience engaged**.

Creativity:

Creativity is at the heart of **problem solving**. It enhances **wellbeing and learning**. A changing world requires adaptation and innovation. Creativity is a collective force for change.

Art in STEAM

The arts component is not merely an addition to STEM—it brings creativity, visual thinking, cultural understanding, and emotional depth into the learning process.

In participating countries STEAM is seen as a collaborative and experimental learning culture where arts act as a bridge between subjects.

Fuels Creativity and Innovation

- **Science and engineering** require creative thinking to generate new ideas, build prototypes, and solve unfamiliar problems.
- Artists and designers bring **imaginative thinking** that helps in developing **original solutions**—especially important in industries like product design, app development, architecture, and robotics.

Improves Communication and Expression

- Artistic skills (like storytelling, drawing, or music) help scientists and engineers **explain their ideas** clearly and persuasively to others, including non-experts.
- **Data visualization**, for example, is both technical and artistic—it translates complex data into clear, accessible graphics.

Encourages Emotional Intelligence and Empathy

- Art develops the **human side** of problem-solving. It helps innovators consider the **user's perspective**, needs, and emotional responses.
- This leads to more **user-friendly**, inclusive, and thoughtful design in technology and engineering.

Supports Design Thinking

- **Design thinking**—a popular approach in tech and entrepreneurship—relies heavily on both creativity and logic. It emphasizes **empathy**, **ideation**, and **experimentation**, which are all nurtured through art.

- It’s used by companies like Apple, IDEO, and Google to create intuitive, beautiful, and functional products.

Engages More Diverse Learners

- Integrating arts into STEM makes lessons more **engaging** and **accessible**, especially for students who might not naturally gravitate toward math or science.
- It allows for multiple ways of learning and expressing understanding—whether through drawing, music, drama, or design.

What is important when implementing STEAM?

1. Start with a Real-World Problem

- **Do:** Choose a problem or challenge that's relevant to students' lives or the world around them.
- Example: "How can we design a sustainable playground for our community?"

2. Encourage Cross-Disciplinary Thinking

- **Do:** Blend the five STEAM areas—don't treat them as separate subjects.
- Example: Design a water filter using scientific knowledge, engineer the prototype, calculate efficiency (math), use tech for testing, and visually present the results with design tools (arts).

3. Use the Design Thinking Process

- **Design thinking** steps:
  - **Empathize** – Understand the user's needs
  - **Define** – Clearly state the problem
  - **Ideate** – Brainstorm creative solutions
  - **Prototype** – Build a testable version
  - **Test** – Evaluate and refine
- This approach helps keep projects student-centered and iterative.

4. Promote Collaboration and Teamwork

- **Do:** Encourage students to work in diverse groups where they can take on different roles (e.g., coder, designer, researcher).
- Real innovation often happens through **collaboration**, just like in the real world.

5. Integrate the Arts Meaningfully

- **Do:** Let students **visualize, design, or perform** as part of the solution.
- Arts shouldn't be an afterthought. Use it to enhance storytelling, empathy, usability, and aesthetics.

6. Allow for Student Choice and Voice

- **Do:** Let students make decisions about how to approach problems and present solutions.
- This increases **engagement**, builds **ownership**, and allows for **creative diversity**.

7. Emphasize the Process, Not Just the Final Product

- **Do:** Celebrate **iterations**, learning from **failures**, and improvement over time.
- Encourage **reflection**: What worked? What didn't? What would you change next time?

8. Use Real Tools and Technology

- **Do:** Give students access to coding platforms, design software, engineering tools, or art supplies that professionals might use.
- This boosts **practical skills** and connects school to the real world.

9. Connect with Experts or the Community

- **Do:** Involve professionals, guest speakers, or community feedback when possible.
- This adds authenticity and relevance to the work.

10. Showcase the Work

- **Do:** Provide opportunities for students to present, exhibit, or perform their projects publicly.
- Builds **communication skills**, confidence, and pride in their efforts.

Summary

STEAM education emphasizes the integration of these disciplines into interdisciplinary learning experiences. Its importance lies in:

- Fostering critical thinking and problem-solving by encouraging students to apply knowledge across multiple fields.
- Promoting creativity and innovation, especially by including Art alongside technical subjects.
- Preparing students for future careers in a rapidly evolving, technology-driven world.
- Enhancing collaboration and communication skills, which are essential for real-world projects.

The processes emphasize

- Joint development
- Investigating and understanding the theme
- Combining creative and rational thinking
- Bringing ideas to reality
- Failure – learning at its best

The STEAM concept, especially from the perspective of arts, offers a **multidisciplinary and inclusive learning framework** that nurtures **creativity, critical thinking, collaboration, and digital competence**. Arts are not just a visual supplement - they deepen learning and create meaningful connections.