



Guidelines for Teachers

Version 1.0 - January 2023

KidsLab4Sustainability



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1. What is steam?

STEAM can be defined as a holistic, inquiry-based strategy of learning by solving complex, interdisciplinary, real-life problems, in a context which is meaningful for children. Using such an approach to early education we can support children's self-confidence, build their self-efficacy feelings and positive image as learners. We also change the teachers' perspective - putting emphasis on children's intellectual abilities (such as: critical and creative thinking, observing, predicting, comparing, drawing evidence-based conclusions, reflecting on one's own knowledge etc.) rather than on direct reading and writing achievements. In STEAM strategy skills like reading, writing, counting, measuring, etc. become tools for thinking/ habits of mind/ and ways to build the culture of joint learning in a classroom.

The research proves that early STEAM education is not only valuable for developing scientific interests in pre-schoolers, but also crucial factor in preventing or alleviating the "technophobia" or "math anxiety" in children, as well as in supporting their personality, social skills, resilience to react on failures and emotional strength. It is a particularly valuable approach for preventing the gender gap in scientific and technological professions.

2. Why STEAM for sustainability?

To stimulate interest in scientific culture, it is necessary to develop inquiry strategies that enable a deeper understanding of scientific content ([Vilches and Gil, 2007](#)). One of the most important goals of pre-school education is to develop children's intellectual readiness to learn. As recommended by the report [Science Education Now: A Renewed Pedagogy for the Future of Europe](#), a renewal of teaching and learning strategies is required that encourages a positive attitude towards science, and is based on research-based methodologies ([Rocard, et al, 2007](#)). After developing the Kitchen Lab for Kids project aimed at educators from four European countries who wanted to promote STEM skills in children, in light of the climate emergency and the need to integrate science, technology, and society, it is considered appropriate to also include art, and the development of sustainability skills as early as childhood. An added value of this curriculum is to create links between the two critical challenges recognised in EU documents: sustainability as a source of curriculum content and STEAM as a methodology of teaching and learning.

Scientific and artistic knowledge is not presented in a decontextualized manner. By conducting scientific experiments and inquiries, and making observations in the nearest preschool outdoor environment, issues of sustainability can be addressed. The new curriculum aims to raise



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children's and teachers' awareness of environmental and climate change challenges such as the need to save resources, reduce energy usage, develop sustainable consumption habits in our own lives, and foster harmony between technology and nature in our lives so as to achieve a sense of well-being. The concepts of sustainability will be used to structure the resources for teachers and teacher trainers, and to build awareness of important interrelations between the three pillars of sustainability: the environment, society, and the economy.

3. Why outdoor education?

Outdoor education is “education in, about, and for the outdoors”. This definition tells the place, the topic, and the purpose of outdoor education; can occur in any outdoor setting, from a school yard in an industrial neighborhood to a remote wilderness.

Outdoor education takes place on a walk around the block or in a forest, shore, lake, or any other biome. These kinds of locations are ideal for direct experiences, contact with the topic, participant interaction and socialization. Learning occurs through the contest of the outdoors and the subject matter is a holistic combination of the interrelationships of all nature and the human being, attitudes for caring for the planet, and skills for responsible use of the natural resources.

There are six essential characteristics of outdoor education that make it suitable for children's education: it occurs outside (out-of-doors), the participants get directly involved in the activity, it involves interpretation of real objects, defines relationships between different facts, involves as many senses as possible and invites participation.

4. Why STEAM in preschool education?

STEAM education is based on five key components:

- Integration
- The practical dimension of knowledge
- Development of scientific thinking
- Co-operation
- Love of learning



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Integration

Rather than teaching the disciplines of knowledge as independent, isolated subject sets, STEAM activities are project-based workshops, using inquiry-based approaches with a strong emphasis on interdisciplinary learning.

Taking an example of an architect, for them to develop their project it is necessary to use different aspects of knowledge: not only mathematics, but also engineering, technology, broadly understood science or **artistic inspirations**. All the elements necessary to complete the task are not separate from each other but need to be interlinked into practice, intertwined in a practical and seamless way, enabling the architect to design complex buildings.

The practical dimensions of knowledge

STEAM is adapted to the way we work and to solve everyday problems.

It is a unique approach to teaching and learning offering practical applications of knowledge, showing its immediate usefulness in human life.

Look at the child building a cardboard bridge. How many questions does he/she have to answer, how many problems he/she must solve to create a durable structure. What cardboard should I use? How to assemble it? What shape could I design? How can I make the bridge bear the weight? etc. Such plays and activities allow the child to understand the world better.

Development of scientific thinking

STEAM education is based on solving complex, meaningful problems that require the ability to perceive, analyze, hypothesize, and verify predictions, observe, and collect data, and draw conclusions. All the above-mentioned elements constitute the core of scientific thinking, which requires logic and precision in formulating judgments related to the observed phenomena. STEAM education also fosters the development of **creative thinking**. When a child faces a challenge (such as building the highest possible tower using only toothpicks and jellybeans) or an open problem which does not have a clear, one-sided answer, he/she gets the chance to exercise the flexibility of thinking. In such activities, one must throw away the stereotypes and well-known schemas of thinking, and allow oneself a moment of "freedom", creativity, researching for new solutions by trial and error.

Co-operation

STEAM education promotes teamwork and communication skills. Important components of teamwork are: assuming the role of a leader and subordinate, selecting and sharing tasks, as



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well as taking responsibility for their implementation. During such activities children learn to communicate, explain their own ideas, share different perspectives of seeing the problem and negotiate the solutions. Look at children carrying out the group project. Each of them is different, with a slightly different approach to solving problems. Yet together, by motivating and supporting each other, they can work out an innovative solution. None of these children would achieve such results by working alone.

Love of learning

In the modern world continuous development and learning are essential to personal and professional success. Therefore, students should leave the school system with a passion for learning. If this does not happen, and children do not want to learn and gain new skills, they will constantly struggle with their work and life. In this context, the education immersed in the STEAM approach is vitally important. The greatest gift we can give to children at an early age is cognitive curiosity, self-efficacy and self-confidence, thirst for knowledge and passion for development. Thanks to such abilities, children will be prepared to meet the challenges of both higher education and the modern world. No matter where their life journey takes them.

5. Why is STEAM for sustainability important in preschool education?

STEAM encourages students to develop solutions to real problems with knowledge and skills of science, technology, engineering, art and mathematics.

Although there are many definitions of STEAM education, the term “interdisciplinary” is one of the commonly used ways to describe theoretical and instructional approach to STEM education.

The concept of STEAM education for sustainability expands the STEAM interdisciplinary education scope for problem-solving to a **multidisciplinary critical-thinking method** and sustainability mindsets.

Complex sustainability-related challenges require disciplinary background, to demonstrate and apply an interconnected, interdisciplinary understanding of the challenges of using STEAM competences.



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6. What should you take into account when implementing STEAM

didactical resources for sustainability?

The resources presented are intended for children 0-6. To start developing them, different aspects must be taken into account that must guarantee both the safety of the children and the consistency of what we propose with the objectives of sustainability. It is also necessary to take into account the characteristics of children and the use and care of the environment.

6.1. Safety rules

The materials and the equipment of the spaces must arouse children's curiosity and must encourage, through play, manipulation, experimentation, creativity, and the discovery of the environment. In no case, however, should we forget the safety regulations that must guarantee the smooth development of the activities and the prevention of accidents. (Branche. et al. (2008)¹

The spaces and materials to be used must be carefully selected to avoid flammability, slipping, falling, risks arising from dangerous substances and the use of sharp or dangerous instruments. It is also necessary to note that the materials to be used are appropriate for children's handling and that they have not expired. In spaces more suitable for adults (kitchens, laboratories, non-adapted exteriors, etc.) provision must be made for the incorporation of supporting adults. The materials must always be adapted to the motor, cognitive and verbal conditions of the creatures to whom they are addressed.

6.2. Sustainable materials and tools

In line with the proposal for sustainability education, through STEAM resources, it is necessary to plan the use of sustainable and natural materials, as well as instruments that are not invasive or destructive to the environment. Following the criterion of promoting the pillars of sustainability, the use of materials and instruments from the environment, recycled, free, or very low cost is planned.

¹ Branche, C., Ozanne-Smith, J., Oyebite, K., & Hyder, A. A. (2008). World report on child injury prevention. <https://books.google.es/books?hl=es&lr=&id=UeXwoNh8sbwC&oi=fnd&pg=PR7&dq=World+report+on+child+injury+prevention&ots=hl5tULav0E&sig=O4dbuaibFpmnGMRrOu8xwXWOGwg#v=onepage&q=World%20report%20on%20child%20injury%20prevention&f=false>



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6.3. Include outdoor education

Also in accordance with the environmental pillar of sustainability, outdoor activities are encouraged whenever and wherever the weather permits. The observation, interpretation, use and care of our environment is encouraged. It is necessary to bet on flexibility when carrying out activities in very different environments, both in terms of climate, landscape and culture.

6.4. Make the children reflect about sustainability problems

One of the mental processes that are intended to be fostered in children is the reflection of what they are experiencing. The aim is to develop systemic, analytical and synthetic thinking, always through dialogue. The questions should lead the children to look for the answers in their minds. The aim is to develop mentally active children. The content of the dialogues must be focused both on the development of cognitive skills, for example demonstrating understanding of the experiment, and on the development of metacognitive skills, for example, encouraging children to make predictions, self-regulate and self-evaluate, throughout their participation in the activities.

7. What are STEAM for sustainability challenges?

The STEAM challenges for sustainability are a collection of experiences that are offered to children so that, alone or with the help of adults, they develop the skills linked to the observation, interpretation, management and conservation of the environment. The common method proposed is the solving of complex, interdisciplinary, real and open-ended problems for which there is no 1 "appropriate" or "correct" or "ready-to-use" answer, but rather the problem situation is intended to provoke a process of individual or collective reflection aimed at achieving the planned learning outcomes. Unlike experiments or workshops, a STEAM Challenge:

- Includes general instructions for activities to follow, but allows for multiple approaches. Among other guidelines, the objective is explained, what is the expected learning outcome and how it should be assessed;
- The same indications of the steps to follow, determine the restrictions for the action. For example, the materials to be used, the spaces, time required, etc.



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- Requires participants to be flexible and original in their thinking, not allowing reference to ready answers or patterns of action;
- Requires understanding the proposals, making anticipations, checks and reflections throughout the entire procedure of the experience;
- Introduces elements of competition, fun and language use as a non-standard task structure that does not include answering the questions: "How should we do it?" or "Could you explain?";
- Encourages intrigue and interest, enlivens and brings a lot of positive emotions that accompany the game
- Allows for different and original solutions: each response/design is unique and contextualization in various environments is encouraged;
- And most importantly: it brings joy to learning!

A STEAM challenge usually includes the following stages of activities:

1. **Planning:** Understanding and interpreting demand. For example preparing the material, verbalizing the understanding, etc.
2. **Development of the experiment,** through the construction of the instruments - with the use of available materials and tools;
3. **Present solutions by the children:** compare and test the different results;
4. **Document and reflect:** children should describe their experiences in any form they choose, take pictures, reflect on their solution and its effectiveness;
5. **Summarize the discussion** - What have we learned? What proved to be the most difficult and why? What was the most fun?
6. **Complement with other resources** to complete the learning pathway and thus develop activities linked to the three pillars of sustainability.

8. What is a learning pathway?

A learning pathway is a variety of learning options linked in a structure for learners to permit Investigate, Develop, and Innovate. This means that activities permit children to investigate and discover, through developing abilities for finding innovative solutions or innovative thinking. Learning pathways include a sequence of resources that are grouped and logically ordered to



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allow children to master a particular topic, scientific concept or skill/competence. It is designed as a route for a learner to progress from preconceptions and commonsense knowledge to scientific reasoning. Learning Pathways is a flexible tool for teachers to perceive STEAM education as a long term process rather than a single or isolated event.

9. Why learning pathways instead of a single activity?

Because learning pathways give specific attention to the importance of science process skills, the need to connect experiences using a central concept, and the roles of mathematics, communication, and literacy in a science-based learning approach

<https://www.sciencedirect.com/science/article/abs/pii/S0885200604000110>

The STEAM Cross-Curricular Pathway focuses on ways to incorporate Science, Technology, Engineering, Art and/or Mathematics into the teaching practice in an holistic way including, (whenever possible), the three pillars of sustainability (economic, social and environmental) or stress a particular one. Exploring sustainable development goals, literacy and more, this pathway helps educators discover the interrelationships of all subjects while focusing on tools to approach inquiry, critical thinking and problem-solving.

10. What types of learning pathways are designed in our Project?

There are two types of learning pathways:

- 🍊 Learning pathways based on the **spheres of nature**: biosphere, hydrosphere, geosphere or atmosphere
- 🍊 Learning pathways based on the **seasons of the year**: Autumn, Winter, Spring and Summer

11. How to use the Project website?

We invite you to develop sustainable habits and competences in young children through STEAM and outdoor education approaches. You can use it in several ways: in KidsLab4Sust you will find basic information about sustainability in preschool education, the STEAM approach and outdoor education, and the ways to combine them in your classes. You will be given detailed resources on how to implement it with preschool children in a simple way and with simple



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materials and tools. Most of all, however, you will find here tips on how to conduct sustainability education in a preschool and at home in a way interesting for both children and adults. You can use ready-made scenarios for sustainability workshops in five languages. You can also use ideas for entire learning pathways that include activities linked by a common denominator: the seasons of the year and the spheres of nature. If you like our proposals, you can join the KidsLab4 Sustainability as its co-creator - commenting on our proposals and creating your own ideas - activities and educational pathways. Enjoy sustainability!

12. How to design your own learning pathway?

1. Use a search engine and find a keyword you are interested in (season of the year; sphere of nature; scientific concept, ecosystem etc.
2. Search for the resources on the project website: <https://kidslab4sustainability.eu/>
3. Choose the resources you think are related with the keyword and might fulfill your expectations
4. Design your own Learning Pathway using the following [link](#);
5. Create a video description of the Pathway activities using [this template](#);
6. Publish and share your pathways with others on the project website;
7. Conduct your Learning Pathway with children and share the results with us using the [Monitoring Grid](#).



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Website

For further and updated information about this project please see:

<http://kidslab4sustainability.eu>

Social media

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