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UrbSTEAM
Teaching STEAM through Urban Garden Based Learning
in the kindergarten

Manual of best practices on garden-based learning


# Teaching STEAM through Urban Garden Based Learning in the kindergarten UrbSTEAM

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# SECTION I

# Introduction

The following manual is the result of the work of the partners of the project 'UrbSTEAM- Teaching Steam through urban gardens based in the kindergarten'. The partnership members represent five European countries and are: AKATA MAKATA (Greece), EISA(Turkey), KAIROS(Italy), STANDO(Cyprus) & UTOPIA PROJECT (Greece).

## Project aim:

The manual aims to increase the knowledge and skills of professionals working with children in the 0-6 years age group, with respect to the issues of teaching through the STEAM method and outdoor education in green areas and its connection with the various components of pre-school education.

## The Manual consists of 2 sections:

**SECTION I**

The structure of the manual allows the reader to fully understand the theoretical and practical relevance of educational activities in which the STEAM method and outdoor activities come together in a complementary manner. Specifically, the partners through synergetic work have defined permaculture, the STEAM method, urban/ school garden and how these innovative educational methods can be applied in reality. Furthermore, these definitions are juxtaposed with the benefits that each of these educational methods has on children. In fact, through illustrations and explanations, it will be possible to understand how the merge between the STEAM method and garden based activities enables children to gain more skills and knowledge with respect to problem solving, awareness of their role and the world around them.

**SECTION II**

In section two professionals could learn more about the results of the quantitative and qualitative analysis that the partners conducted in the different local contexts. In particular, a total of approximately +125 pre-school professionals were reached through a common questionnaire for each organisation.

Also best practices with respect to the STEAM method and outdoor activities were identified in each local context. Both of these parts will enable pre-school professionals, partnership members and other organisations to understand how well the STEAM method, outdoor activities and permaculture are known and applied in different local contexts.

# Permaculture

## WHAT IS PERMACULTURE?

Permaculture can be understood as the growth of agricultural ecosystems in a self-sufficient and sustainable way. This form of agriculture draws inspiration from nature to develop synergetic farming systems based on crop diversity, resilience, natural productivity, and sustainability.

Although concepts included in permaculture design have been in practice for millennia by various cultures worldwide, the term "permaculture" as it is currently understood was first coined in Tasmania by Bill Mollison and David Holmgren in the mid-1970's (Nabhan, 2013).

Mollison and Holmgren described permaculture as, *"an integrated, evolving system of perennial or self-perpetuating plant and animal species useful to man"* (Mollison & Holmgren, 1978). The use of the word, and scope of the definition, has varied greatly since the 1970's; much like the use of 'sustainability' and 'ecology'.

Holmgren later expanded the definition to, *"consciously designed landscapes which mimic the patterns and relationships found in nature, while yielding an abundance of food, fiber and energy for provision of local needs"* (Holmgren, 2003)

Additional definitions from members of the permaculture community include:

*Permaculture is the conscious design and maintenance of agriculturally productive systems which have the diversity, stability, and resilience of natural ecosystems. It is the harmonious integration of the landscape with people providing their food, energy, shelter and other material and non-material needs in a sustainable way (Bell, 2004).*

# Permaculture

## WHAT IS PERMACULTURE?

Additional definitions from members of the permaculture community include:

*Permaculture is a set of techniques and principles for designing sustainable human settlements... though permaculture practitioners design with plants, animals, buildings and organizations, they focus less on those objects themselves than on the careful design of relationships among them – interconnections – that will create a healthy, sustainable whole (Hemenway, 2001).*

*A permaculture system is a system that resembles nature and is based on natural cycles and ecosystems (Holzer, 2004).*

From the above definitions, it can be seen that permaculture design has evolved beyond food systems to encompass the broader landscape of architecture and human relationships. Joel Glanzberg, regenerative design and ecological restoration expert, emphasized *"it is a holistic design approach for all human needs that works on creating change by shifting underlying patterns"* (Glanzberg, 2013).

A holistic design approach demands a shift in conventional, mechanistic thinking. The theoretical foundations of permaculture will help shed light on this way of thinking.

# What is STEAM?

*"STEAM is an educational approach to learning that uses Science, Technology, Engineering, the Arts and Mathematics as access points for guiding student inquiry, dialogue, and critical thinking. The end results are students who take thoughtful risks, engage in experiential learning, persist in problem-solving, embrace collaboration, and work through the creative process." – IAS definition*

As more aspects of daily life are tied to technology, the need to improve and expand STEAM education across the curriculum will only get more pressing. Without enough STEAM educators, students can't get access to the types of STEAM opportunities that are likely to encourage long-term interest and passion in these fields and beyond. The need to improve and expand STEAM education is considered key to maintain a competitive edge in the 21st century. With more emphasis on STEAM education, a meaningful STEAM curriculum is often introduced to the youngest students, beginning at the preschool level.

Research confirms that exposing students to STEAM experiences at a young age encourages critical thinking skills, increases science literacy, and fosters creative problem solving. These experiences can help establish a long-term passion for STEAM subjects, as well as general academic success across all disciplines.

STEAM plays an important role in our lives and will play in imperative role in the future. Therefore, its integration into the school curriculum, prepares today's generation of students for the requirements of the Scientific and Technological Literacy of the society that they will live in. STEAM in school curriculum also helps students utilize the new Information & Communication Technology as learning tools and demonstrates a significant advantage for students by improving overall learning interest and motivation (Sanders, 2009).

Besides, it develops the 21st century skills ('OECD - Education', 2016) Communication, Problem Solving, Critical Thinking, Cooperation, Creativity, Self-guided Learning, Innovation.

## STEAM in Early Childhood Education

Unfortunately, due to the rapid developments experienced, the vast majority of teachers and especially pre-primary teachers feel illiterate in modern science and technology because they cannot keep up with the current trends of Information and Communications Technology (ICT).

The pedagogical and didactic knowledge and experience of teachers, and particularly of pre-primary teachers, coupled with a technological training as recognized in the literature, does not provide them with a sense of full knowledge and provision of ICT implementation in general (Jimoyiannis & Komis, 2007).

Research shows that STEAM support should start early: children in disadvantaged circumstances, especially, start elementary school lacking the foundation for that success. A 2016 study examined learning experiences in more than 7,750 children from kindergarten entry to the end of eighth grade, and found that early acquisition of knowledge about the world was correlated with later science success. Among children who entered kindergarten with low levels of general knowledge, 62% were struggling in science in third grade and 54% were still struggling in eighth grade.

It is widely agreed that solutions to the challenges that the world faces today will require a new multidisciplinary scientific workforce equipped with a skill set of new technology and interdisciplinary thinking that may “require the integration of multiple STEM concepts to solve them” (Wang, Moore, Roehrig, & Park, 2011, p. 1).

It is also widely agreed that there is an imperative to train and prepare a diverse STEM-literate workforce with the capability to understand and comprehend the technological world (Merchant & Khanbilvardi, 2011).

## STEAM's role in achieving the SDGs

The United Nations' 2030 Agenda for Sustainable Development, entitled "Transforming our World", established 17 Sustainable Development Goals (SDGs) to tackle global issues such as poverty, climate change, food shortage, the protection of the planet; and to ensure that all individuals enjoy peace, prosperity and a quality of life for all.



Education, and particularly Science, Technology, Engineering and Mathematics (STEM) education, plays a crucial role in achieving the SDGs. STEM/STEAM education seeks to elaborate and provide innovative solutions to solve global issues, in particular those that are directly related to:

- SDG 2 (Zero Hunger);
- SDG 3 (Good Health and Well-Being); SDG 6 (Clean Water and Sanitation); SDG 7 (Affordable and Clean Energy); SDG 9 (Industry, Innovation and Infrastructure);
- SDG 12 (Responsible Consumption and Production);
- SDG 13 (Climate Action);
- SDG 14 (Life Below Water);
- SDG 15 (Life on Land). Moreover, SDG 8 (Decent Work and Economic Growth) SDG 11 (Sustainable Cities and Communities)

are heavily dependent on progress that can be made within the fields of STEAM.
It is widely agreed that solutions to the challenges that the world faces today will require a new multidisciplinary scientific workforce equipped with a skill set of new technology and interdisciplinary thinking that may "require the integration of multiple STEM concepts to solve them" (Wang, Moore, Roehrig, & Park, 2011, p. 1).

It is also widely agreed that there is an imperative to train and prepare a diverse STEM-literate workforce with the capability to understand and comprehend the technological world (Merchant & Khanbilvardi, 2011).

# What is urban agriculture?

Urban agriculture may seem like an oxymoron. And that's because agriculture usually refers us to fields in the countryside and peasant farmers. We can hardly imagine city dwellers cultivating the land and harvesting agricultural produce in and around the urban fabric. Much more so in Europe, where many cities lack even this aesthetic green, recreational parks, school gardens and generally lack open and uncovered spaces.

However, very recently and on the occasion of the economic crisis, agriculture - in the form of small vegetable gardens - is making its appearance on balconies, roofs, yards and in general in Europe free spaces in many small and large cities, sometimes as citizen initiatives (individuals and movements city) and sometimes as local government initiatives integrated into a framework and program planning.

**Defining Urban Agriculture (AG)**

Urban agriculture - a term widely used by international organizations such as FAO - the Food and Agriculture Organization of the UN - can soon be defined as "the growing plants and/or raising animals within the urban fabric or on the fringes' (FAO 1999). What differentiates urban agriculture from open field agriculture (in rural areas) is that urban agriculture is practiced by city dwellers (mainly for home consumption of fresh produce) using natural resources of the city (eg land resources), while its products and services are also addressed to the city. In other words, urban agriculture is embedded and interacts with the city's ecological system and urban economy (Pothukuchi and Kaufman 1999).

**Historical data**

People's "education" informally began from their contact with the natural environment and his attempt to survive within it. In the course of their development "nature" was always connected with people's education. Aristotle believed that the factors that play a primary role in the education of man are nature, ethos and reason. Aristotle's "Peripatetic school" is perhaps the first school to connect learning with nature.

After the industrial revolution, most students' contact with the natural environment was limited to the school garden. In Europe the need to install gardens in schools began in 1811, they were established by law in 1869 and were considered suitable for teaching natural sciences, agriculture and vocational training. Today, apart from its pedagogical importance, it is considered that it can also contribute to the "greening" of the city.

# Garden-Philosophical Dimension:

Many questions have been raised about what garden is. What is its meaning for people?

The garden reveals the relationship between human existence and the world. At the same time, it includes not only interdependence of human endeavour with the natural world, but a deep relationship of the world and ourselves. It is a revelation, in other words, of man's relationship to the mystery of existence.

The school garden makes its appearance in European countries as early as the beginning of the 19th century. In 1869 the term "school garden" was included in the legislation of Austria and Sweden, while Belgium and France followed a few years later.

One of the pioneers of school gardens is considered to be the German educator Friedrich Frebel, founder of the first kindergarten, which he called "Kindergarten". F. Frebel loving nature and believing in hands-on learning used the garden as an educational tool where children could play, plant, cultivate and interact with nature. In the following years John Dewey, Maria Montessori and many others pointed out the importance of school gardens in terms of the skills that children develop.

*Children are like flowers: they are different and need care, but each one is beautiful in its own right and shines when seen in the community of its peers*
*F. Frebel (1782-1852)*

In 1869 in Austria-Hungary, within the framework of the new education law, which made schooling compulsory for children aged 6-14, the foundations were laid for the creation of school gardens. Among other things, this law defined the following: 'The teachers should be given a small piece of land for "agricultural work". Any teacher tending such a garden would have to be properly trained. "Arena" colleges compulsorily taught agricultural crops with special reference to soil conditions.

In this way, practical lessons in vegetable growing, arboriculture, floriculture and beekeeping were held in every school. Of course, one of the goals of school gardens at that time was agricultural education and the development of primary production.

# Garden-Philosophical Dimension:

In USA, the school garden spread and functioned as a key part of education from the 1890s to the 1920s. In addition to the contact with nature and professional skills that children mastered, school gardens were also used as a way to integrate children of immigrants in American culture.

Later, school gardens were used to "teach" civic education as through cultivation students were taught private care of public property, the dignity of work, self-government, and economy as the produce of the garden was marketed.

After the 1st and especially the 2nd World War, the institution of the school garden began to take a back seat. Only in some countries were school gardens maintained as one of the "plans" to fight poverty and hunger.

Since the 1990s, the school garden began to concern the educational community again, and indeed in the light of ecology and a more natural way of life. In addition, the view began to be expressed that children who grow up away from the natural environment lack the sensory stimulation and imagination development that only nature can give them (David Orr).


In addition, the school garden began to be linked to children's nutritional education through the "soil gardens".

The school garden can be a place of special creativity and engagement of children with nature.

# What is a school garden?

Nowadays, the contribution of the school garden to the formation of children's character and skills is now known and recognized. In fact, there are not a few countries that use organized and integrated school garden programs in their educational systems.

In modern times the needs have of course changed and the school garden does not have the main goal of learning about crops in order to preserve agriculture. The Modern School Garden should be treated as an auxiliary tool for the application, learning and consolidation of various subjects.

In the garden, students of all grades have the opportunity to understand the relationship of cause and effect. They develop their observational skills by observing the growth of plants, climatic phenomena, plant enemies, etc. They also develop teamwork, cooperation, sociability and their emotions. They gain self-esteem but also respect for nature and life. They can still understand concepts of biology, physics, mathematics, art and literature.

# Advantages

The advantages of a school garden are the following;

## nutritional education

Strengthens children's nutritional education. It encourages them to try and eat more fruits and vegetables while at the same time they can learn about their nutritional value.

## physical activity

Promotes physical activity. Children will need to walk, dig, plant, weed, carry materials. In addition, they should use small tools and coordinate their movements.

## STEAM

Children will need to count, calculate, plant in rows and distances, group and much more. Through these processes they will realize the importance but the application of mathematical concepts and physical laws taught in the classroom.

## entertainment

the school garden is not strictly a place of learning and education. School garden is simultaneously a space for self-expression, experimentation and entertainment.

## observation- consentration

Strengthen their observation and concentration. They will see and record plant growth, weather changes, water value, flowering, fruiting, insects, etc.

## connect with nature

Children will connect with nature and the cycle of life and thus experientially learn to respect the environment and life.

## sociability

Children will work together, strengthening their teamwork, sociability and emotional development.

## responsibility

Children will take care of the plants as well as the garden area and of course they will be rewarded by the production. They are taught responsibility and strengthen their self-respect and self-confidence.

# What is the purpose of a school garden?

**The main purpose of combined applications to teach STEAM through Garden Based applications should be;**

1. to establish a relationship between concepts and to enable children to recognize STEAM disciplines,
2. to allow children to recognize STEAM disciplines in social and cultural context,
3. to create an educational environment based on creative, critical thinking, collaborative and communication for children to understand STEAM fields,
4. to increase children's interest in STEAM disciplines (Akgündüz vd., 2015; Tank vd., 2013).

It is recommended that all these goals should be included in children's life experiences, starting from pre-school education (DeJarnette, 2018).

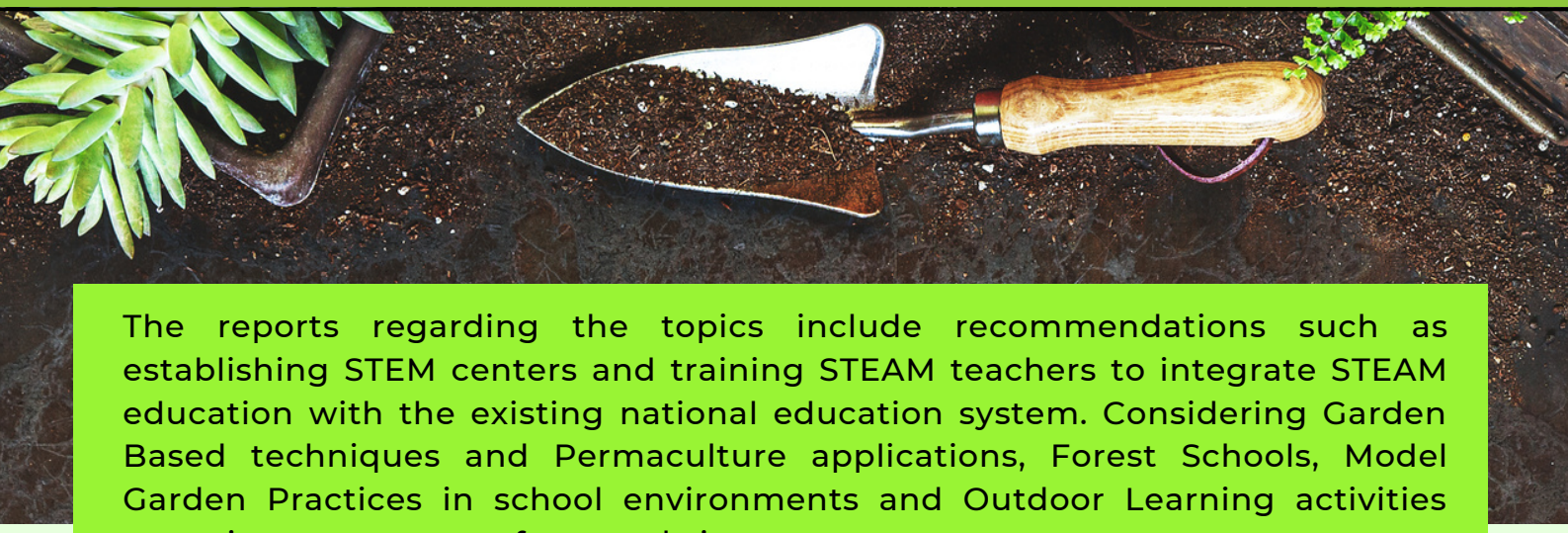
In the STEAM education approach in preschool education, there are four basic learning skills:
a) knowing/understanding,
b) skills,
c) creating and
d) emotions (Katz, 2010).

Children often use these skills to explore new concepts they encounter in their daily lives and to understand/explore their environment. (DeJarnette, 2018; Katz, 2010; Lindeman vd., 2014; Soylu, 2016).

In addition to these skills in preschool education, the following objectives should be included in the STEAM approach. These purposes are;

1. To encourage children for **cognitive** pursuits,
2. To encourage children to **interact** (communication, discussion, exchange of information, to put forward opinions, to plan studies),
3. To enable children to **gain experiences** to discover their **interests**, to enrich their world of knowledge and meaning, and to **explore** their own environment. Creating an environment for them to continue to explore,
4. Enabling children to accept their **responsibilities** for the issues they need to strive for,
5. Supporting children's **problem-solving skills** and increasing their self-confidence by overcoming difficulties,
6. Making children realize their own mental strength

# HOW COULD WE USE IT ?



The reports regarding the topics include recommendations such as establishing STEM centers and training STEAM teachers to integrate STEAM education with the existing national education system. Considering Garden Based techniques and Permaculture applications, Forest Schools, Model Garden Practices in school environments and Outdoor Learning activities come into appearance frequently in recent years.

While applying these practices, we should focus on;

1. how the context should be in terms of physical capacity and teacher competencies required for STEAM through Garden Based applications in pre-school.
2. the development of the educational program for the implementation of STEAM in preschool and the problems that may arise in the application as well as the solution of these problems
3. in the third stage, preschool teachers' skills in developing STEAM activities, applying them in real classroom / life environments and managing processes. In addition, the effects of activities developed in accordance with the STEAM education approach on students' cognitive process, social product creation, teamwork and presentation skills should also be investigated.

# HOW COULD WE USE IT ?

When STEAM teaching through garden-based education and its connection with various components of pre-school education are examined, the centers that we use primarily as school or out-of-class learning environment are forest areas, coastal areas, zoos, botanical gardens and school gardens.

School gardens offer a strong experimental learning environment where students interact physically with their immediate environment. Students have first-hand experiences by doing and living in such an environment, and they can suggest solutions by seeing the problems on the spot. (Maloof, 2006). By designing a school garden, students who create their own learning spaces and obtain products from this environment can cope with current life problems more easily and produce solutions (Bakırcı, Artun ve Deniz, 2018).

It has been determined that students who can create such an environment and benefit from this environment are raised as individuals who can take responsibility, self-confident, can make decisions on their own, can express themselves, have high communication skills, think critically and produce solutions to problems (damon, 2001; lownds, 2000).
It is claimed that gardening practices are the most appropriate studies especially for pre-school and primary education periods. (thrive, 2006).

It is known that this period is the most workable period especially for the development of personality and some high-level skills. A student who participates in school garden practices during these periods discovers something new every day and develops some attitudes and skills in the face of what he discovers. (Thrive, 2006).

# HOW COULD WE USE IT ?

According to many studies school garden practices are effective not only in the formation of attitudes and skills, but also in the academic success of students and the development of their environmental awareness levels. It is stated that especially school garden practices provide an interdisciplinary learning environment for courses such as science, mathematics, literary arts, health, agriculture and environment, and students' attitudes towards the relevant courses increase positively in these learning environments.

In addition, it has been observed that the active use of family participation in the school garden implementation process and the expert support provided in the process provide advantages for students to adopt the school, minimize disciplinary problems and increase their career awareness.

**Pre-school education and steam teaching in Turkey;**

Turkey, and especially the province of Antalya, has a rich infrastructure in terms of school gardens, forests, coastal areas, botanical and zoo gardens. With the physical changes to be made in the fields of education and teachers going through a training process in which examples of good practices in the world are examined and analyzed, steam teaching studies can be easily implemented, dissemination studies can be carried out in cooperation with NGOs and other government institutions.

# SUMMARY

STEAM is a strategy developed with the aim of improving national competitiveness and innovation capacity, and the concept itself has the effect of raising awareness of the importance of education in the covered areas. STEAM workshops have only found their application in early and preschool education in the last few years and are characterised by numerous advantages. It is especially important how they present children with tasks that encourage the combination of all previous knowledge, critical thinking, detailed analysis, logical thinking, learning through try and error, do-it-yourself principle, practical work, argumentative discussion, knowledge of scientific methods etc. It is precisely the skills that are developed through the STEAM concept; innovation, cooperation and creativity with critical thinking, that will be important, and we can encourage their adoption with this concept that enables today's children to be ready to create jobs in the future (Čeliković, 2020).

We are trying to bring readers, teachers, professors and educators closer to how we can bring STEAM activities closer to preschool children. STEAM is all around us, while children play, they develop STEAM skills, explore and deepen their awareness and knowledge of the environment that surrounds them. Many of the activities children do involve STEAM skills even though we don't think of these activities in that way. STEAM learning happens naturally everyday.

Nature, as an important part of the environment, provides one of the best surroundings for spontaneous play, exploration, and learning. For a child, a place is associated with security, activity and freedom. It means that a child's cognitive development is influenced by his social and emotional environment. Therefore, we must ensure a quality environment and growth in which the child will develop. Unstructured playtime in the natural world contributes to STEAM learning in many ways. The outdoors provides a wide variety of sensory experiences. Relevant studies have shown that STEAM education in the early education stage plays a positive role in improving student creativity, innovation, engagement, problem-solving skills, and other cognitive benefits (Root-Bernstein, 2015).

This manual presents various examples of good practices of preschool children who, through urban gardening and permaculture, develop and nurture the main features of STEAM, which will be of great importance for their future. In this way, even from an early age, children naturally come to solutions and answers, develop their investigative spirit and open up opportunities for various new knowledge and insights.

UrbSTEAM
Teaching STEAM through Urban Garden Based Learning in the kindergarten

# SECTION II

# Results analysis report

As part of the implementation of the European program Erasmus + Teaching STEAM through Urban Garden Based Learning in the kindergarten - UrbSTEAM (2021-1-EL01-KA220-SCH-000034476), the project team/consortium, consisting of schools and organizations based in Greece, Croatia, Turkey, Italy and Cyprus has prepared a Manual of best practices on garden-based learning.
In this manual it will be presented a shorter version of the report analysis and the long version can be found in the project website.

In the context of the research for the development of our manual, the consortium has explored the views of kindergarten/pre-school/creche teachers on the current situation in each country related to garden-based learning, outdoor learning, urban gardening, and STEAM.

In order to explore the views of the pre-primary teachers a questionnaire was made and distributed in all partner countries. The questionnaire has 16 questions.

It includes some demographic questions such as age, gender, country, level of education and the organisation that they represent. It also includes close-ended questions, question types that ask respondents to choose from a distinct set of predefined responses, such as “yes/no”. Specifically six of them are dichotomous questions (close ended questions that are indicative questions and can be answered in a, “yes” or “no”).

The questionnaire also includes three open-ended questions related to the good practices that the educators apply when they teach STEAM and the methods they know. There is also an open-ended question related to the good practices in each partner's country on teaching STEAM through garden based learning.

Open-ended questions motivate the respondents to put their feedback into words without restricting their thoughts. They aren’t as objective and dominant as close-ended questions.

132 educators responded to this questionnaire (20 from Italy, 20 from Cyprus, 21 from Turkey, 25 from Greece and 46 from Croatia). The majority of respondents to the questionnaire are female, and mainly work in public or private preschools and kindergartens. Most of our respondents hold at least a bachelor’s degree or a master’s degree.

# Results analysis report

According to what emerges from the analysis of the research of the questionnaires, most of the respondents were familiar with garden-based learning. In Italy, the majority of respondents amounting to 85% are familiar with garden-based learning. In Cyprus most of the participants (70%) are familiar with garden-based learning.

Although in most countries the majority of educators use garden-based learning, in Croatia 43,5% actually use this practice in preschools. This shows that this project will benefit a lot of teachers in improving their lessons and incorporating garden-based learning in their lessons.

In Croatia, most of the participants (69,6%) are familiar with garden-based learning. In Turkey 57% are familiar and in Greece 52%.

The majority of the participants use garden-based learning according to their responses. Considering the results from the question about whether educators are familiar with garden-based learning or not it looks like they are familiar with it but that they are also able to use it. This means that most pre-primary teachers are using garden-based learning already as part of their lessons and they know how to incorporate it.

Specifically, 56% of educators in Greece use 60% of teachers in Cyprus, 61% in Turkey and 65% in Italy.

The analysis also shows that there is general knowledge on STEAM and some educators use STEAM in their everyday practice. In Croatia 67,4% of the respondents answered that they use STEAM and in Greece 68% of the educators use STEAM.

Even though in some countries the educators don't STEAM as much as in other countries. Specifically in Italy only 10% of the respondents use STEAM in their work, in Turkey 43% of the respondents use STEAM, while in Cyprus 45% of them use STEAM during their teaching.

As a conclusion, we can say that the use of STEAM as an educational approach in kindergarten, is not equally popular in all countries, nor is it used the same by all.

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# Results analysis report

It is also interesting to explore whether educators understand and use the principles of STEAM in their practice or not. STEAM is designed to integrate STEM subjects into various relevant education disciplines. STEAM programs add art to the STEM curriculum by drawing on design principles and encouraging creative solutions.

True STEAM experiences involve two or more standards from Science, Technology, Engineering, Math and the Arts to be taught and assessed in and through each other. Cyprus's findings show that most educators associate STEAM with Robotics and Mathematics.

A small percentage included group work as well which shows that none of the participants is really utilising all disciplines of STEAM in their lesson. This project will give them a great chance to understand the approach of STEAM especially in the Urban Gardening area and provide best practices and methods on how to apply it in schools.

Our findings reveal that technology, mathematics and overall experiments (science) are the most popular methods that educators know and use when teaching STEAM.

This means that there is a great room for improvement in Arts and Engineering, which most of our participants do not use or they did not mention as part of STEAM teaching.
Most of the respondents are familiar with outdoor education.

But at the question whether they have combined garden based learning with STEAM and outdoor education, the majority of the respondents stated that they have not combined them in their practice.

This shows that there is great room for improvement in incorporating STEAM and garden-based teaching. Nevertheless, educators are aware of some good practices and teaching methods of both STEAM and garden-based learning.

It is necessary to note educators' knowledge of these educational methods and the presence of best practices on the territory that represent virtuous examples in the application of the STEAM method, outdoor activities and the two methods. In addition, it is evident that almost all respondents are interested in increasing their knowledge and then applying it in the work context.

# Results analysis report

There is an extensive list with the answers for the good practices that the educators apply when teaching STEAM.

There is also an extensive list about the other methods that the educators know about STEAM learning.

**What good practice activities do you apply when teaching STEAM? (name one or two)**

Most of the educators mentioned a variety of activities that they apply when teaching STEAM such as activities with robots, coding, experiments, mathematics (geometry, embodied mathematics), engineering (construction activities), sensory play, nature- centred activities, activities with the use of digital tools and technology in general.

Some educators mentioned that activities are focused on learning through the "trial" and "error" method, the "do-it-yourself" principle, combining knowledge that the child has mastered at a certain age.

Also, educators pointed innovation, adaptability and critical thinking as important factors for the activities applied when teaching STEAM. Cooperative work, inquiry learning and experiment were referred by the educators.

Some of them are the above mentioned; Snail Pedagogy, Steiner, Montessori method, cooperative learning, brainstorming, learning by doing, problem based learning, constructivism, gamification, cooperative learning, inquiry-based learning, model 5e, CLIL method, learning through art, digital technology, various experiments, 5N Technique.

It can be underlined that most of the teachers are aware of Outdoor Learning, Garden Based Learning and STEAM practices and they are trying to use them in their classes.
But, when it comes to combining those techniques together in classroom practices, it seems that they do not have enough knowledge or experience in that and they need to be supported to improve their Professional skills.

# Results analysis report

Our findings reveal that the majority of teachers would like to participate in EU Trainings that have to do with Garden based learning and STEAM.

This project is a great opportunity to put knowledge into action and apply it in everyday lessons and work.

The final question before presenting the best practices is: *Are there any good practices in your country on teaching STEAM through garden based learning? If yes, can you describe us here ? (this is the actual list from the educators replies)*

- Going to the mountains, walking, exploring the surroundings
- https://www.sumskavila.com/ https://www.etwinning.net/hr/pub/get-inspired/kits/kit.cfm?id=1361
- https://www.laboratorijzabave.hr/kampovi-laboratorija-zabave-ekologija-za-djecu/
- Planting various plants, vegetables, fruits in the kindergarten yard, consuming and using these same fruits, etc.
- Steam camps, learning about nature through stay and activities in a natural environment (forest)
- https://korakdoznanosti.com/category/steam-za-djecu/ https://www.vrtic-bjelovar.hr/razigrani-vrt/ https://vrticiosijek.hr/vrtic-u-prirodi/
- https://korakdoznanosti.com/wp-content/uploads/2021/03/SUMAIVRT1600x800.jpg http://korakdoznanosti.com/
- Celebrating days of Kindergarten “More” through STEAM workshops with children. Tinker Rijeka.
- With the entire content, implementation and activities in POR, children learn through experiential learning and experiences. There are a handful of examples.
- An education program for sustainable development that uses all resources for children's experiential learning.
- Urban gardens
- Sustainable development
- Forest Kindergarten
- maintaining a continuity e.g. from the seed to the plant
- I do not know
- My School gardens
- Do not know. I imagine they exist, but I have never dealt with this item.
- Composting with the principles of steam education, local environmental education network DIPE of Western Attica
- Coccinelle Cooperatives, Regio Children, Stripes, percorsi 0-6

UrbSTEAM
Teaching STEAM through Urban Garden Based Learning in the kindergarten

# GOOD PRACTICES

# Good Practices

| Good Practice | |
|---|---|
| Title of the practice | Educational workshops in the Cascina: A Noah's Ark in danger(Un'Arca di Noe' in pericolo) and little big, little(piccolo grande piccolo). |
| URL of the practice (if existed) | https://consorziokairos.it/en/homepage-english/ |
| Location /geographical coverage | Italia, Piemonte, Torino |
| Brief description of the practice | There were a total of 6 workshop meetings for Little Big Little and 11 for A Noah's Ark in Danger. The first meetings were mainly based on the thing link method and the second on cooperative learning. The total experience includes: knowledge tour of the Cascina spaces (from the barn to the vegetable garden), workshop, snack. In all meetings the children were welcomed by two educators from the organization who also collaborated with the teachers in carrying out the activities. After a brief presentation of the educators and the spaces in which the children were located, the activities began. Those related to the first workshop concerned the children's being confronted with hypotheses with respect to colors of objects (Do you think this flower is only yellow?). After that the minors directly verified the activities through the use of an object (magnifying glass/telescope) that they had to figure out for themselves how to use. Of course, the educators as well as the teachers were always present to support them in their research, but not to give them the answer. Finally, through direct comparison it was checked whether the hypotheses were right or wrong. Instead, the activities of the second workshop were based on the children's search for the place settings of cans, scattered by the educators, in the garden of the Cascina. In these place settings a picture of an extinct, endangered, non-endangered animal had previously been attached on one side and a QR code on the other side. Once the jar lids were found, the children were divided into groups of 5 and assigned a tablet, through which they read the QR code and came into contact, through voice resources, with the sounds and history of those animals. This not giving each child a tablet is done on purpose, as you want to enhance as well as their skills (perhaps child more inclined to technology, while another to observe and or present work, etc.). Children are accompanied in the discussion and comparison about extinct, endangered and non-endangered animals through the traffic light which is green (not endangered), yellow(endangered) or red(endangered) depending on the situation of the animal on the jar.This made it possible to develop an informed reflection on the real situation where many animals are in danger of extinction, while others have instincts (example dodo that instincts left children without words) due to global warming, human intervention, etc. |
| Institution/ Organisation/ Service provider/ Implementing agency | LIBERITUTTI SCS, KAIROS, Metropolitan city of Turin |
| Target Group(s)/ Beneficiaries | Children range 0-6 in preschools/kindergarten in the metropolitan city of Turin |
| Main points / areas | Cascina Falchera, the intervention area where the workshops were held, is located in the Falchera district of Turin, an area where most people live in a condition of economic and social disadvantage. The laboratory activities in Cascina Falchera aim not only to increase the skills of children through an innovative learning experience, but to involve children who live in these areas, but at the same time to bring children who live in other areas closer together. of Turin to the Falchera district. |
| Is the practice suitable for local, regional or national implementation? | Yes, the practice is suitable for local, regional and national implementation. In addition, the participation of new governmental and nongovernmental actors would allow for temporal and economic sustainability, as well as an increase in the quality and quantity of services delivered and target group exponents reached. |
| Should be used as a source in the learning materials for preschool/kindergarten teachers? | It could be used as a source of materials for pre-childhood / kindergarten teachers. The methods used are particularly interesting, as they combine outdoor activities with the STEAM method. |

# Good Practices

| Good Practice | |
|---|---|
| Title of the practice | Planting flowers |
| URL of the practice (if existed) | https://www.facebook.com/djecjivrticmore/posts/pfbid023QfamL6LtrEXG4nqKFQW3cWjkDatG8GxzCER5DPMChNY921oN69aC6FC8Jfs4F2wl |
| Location /geographical coverage | Rijeka, Croatia |
| Brief description of the practice | Together with the children, the educators decided to plant flowers in the kindergarten yard. Parents donated soil, fertilizer, bulbs and seeds. First, they chose the places where they will place the tires. Then they made drainage, filled tires with soil and fertilizer for flowers, planted bulbs, sowed seeds. In addition to flower seeds, they planted plants that they prepared themselves for planting and sowed chamomile and herbs. In the end, they watered everything well.Since then, they take care of the plants every day. |
| Institution/ Organisation/ Service provider/ Implementing agency | Kindergarten "More" |
| Target Group(s)/ Beneficiaries | Teachers, students, children |
| Main points / areas | Children are like sponges, they absorb everything they see, and the adults who surround them provide them with a pattern of behavior. The best way for a child to connect with nature is gardening. The child gets an experiential knowledge of the need to take care of nature and be responsible. |
| Is the practice suitable for local, regional or national implementation? | Yes |
| Should be used as a source in the learning materials for preschool/kindergarten teachers? | Yes |

# Good Practices

| Good Practice | |
|---|---|
| Title of the practice | STEAM activities for children |
| URL of the practice (if existed) | https://tinkerlabs.hr/ |
| Location /geographical coverage | Croatia |
| Brief description of the practice | Tinker Labs offers a unique STEAM approach that includes science, technology, engineering, art and math experiments and hands-on learning essential to every child's future success. |
| Institution/ Organisation/ Service provider/ Implementing agency | |
| Target Group(s)/ Beneficiaries | Children |
| Main points / areas | Children's natural curiosity still does not find suitable programs in schools.With an individual approach in small groups, we enable every child to discover their potential and become interested in the professions of the future. |
| Is the practice suitable for local, regional or national implementation? | Yes |
| Should be used as a source in the learning materials for preschool/kindergarten teachers? | Yes |

# Good Practices

| Good Practice | |
|---|---|
| Title of the practice | The entertainment laboratory |
| URL of the practice (if existed) | https://www.laboratorijzabave.hr/kampovi-laboratorija-zabave-ekologija-za-djecu/ |
| Location /geographical coverage | Zagreb, Croatia |
| Brief description of the practice | The entertainment laboratory - an association for the promotion of the culture of storytelling, was founded with the aim of promoting, developing and improving the culture and art of storytelling.The activities of the Association are: work on designing, creating entertainment with an emphasis on storytelling and stage performance, work on the creative development of storytelling, promoting the art of storytelling, holding stimulating workshops for children and adults with the aim of developing creativity, encouraging the mastery and adoption of storytelling skills, and the creation and creation of works suitable for storytelling, which includes creative writing, development of international cooperation programs and involvement in the work of other associations, organizations and individuals in a similar or related field, publication of books, magazines, electronic records and creation of websites, blogs from their activities, strengthening cooperation with related organizations in Croatia and abroad, creation of educational content for children and adults. |
| Institution/ Organisation/ Service provider/ Implementing agency | |
| Target Group(s)/ Beneficiaries | Children, parents |
| Main points / areas | The independence provided to children in thinking and working on the task. Creative, logical, critical and positive way of thinking, analyzing and acting. |
| Is the practice suitable for local, regional or national implementation? | Local, regional implementation |
| Should be used as a source in the learning materials for preschool/kindergarten teachers? | Yes |

# Good Practices

| Good Practice | |
|---|---|
| Title of the practice | Planning the Summer Garden |
| URL of the practice (if existed) | https://www.schoolgardenproject.org/download/planning-summer-garden/ |
| Location /geographical coverage | |
| Brief description of the practice | During this lesson students will learn about the seasonality of plants in connection to their climate. Students will mimic diverse plant lifecycles through a game, plant summer crops and survey the garden for different plant lifecycle stages. |
| Institution/ Organisation/ Service provider/ Implementing agency | |
| Target Group(s)/ Beneficiaries | Teachers / Students |
| Main points / areas | By observing the seasonality of crops, students can plan and plant gardens with appropriate species. Too much sun is not always the best for tender greens such as spinach and lettuce, however, without the blasting summer heat, corn and tomatoes would not be possible. By gaining an understanding of cool season vs. warm season crops, students can expand their knowledge of plants and their lifecycles, taste a greater diversity of foods, and improve soil health and habitat within their garden. |
| Is the practice suitable for local, regional or national implementation? | Local / Regional Implementation |
| Should be used as a source in the learning materials for preschool/kindergarten teachers? | YES |

# Good Practices

| Good Practice | |
|---|---|
| Title of the practice | ANCESTRAL SEED |
| URL of the practice (if existed) | https://www.instagram.com/p/CgpfZY-Npuv/?igshid=MDJmNzVkMjY= |
| Location /geographical coverage | TÜRKİYE /ANTALYA |
| Brief description of the practice | Do you know where vegetables come from us?Have you seen how a vegetable is grown?Video about the transformation of a seed into a vegetable is transmitted to children.For the formation of a vegetable, it needs seeds, water, soil and air. Our ancestors, who learned this, started to grow vegetables. Well guys, if these are necessary to grow vegetables, how can we do this in our school garden? Find Possible Solutions and Choose the Best. Example application, students are given cardboard egg boxes, soil, water and seeds. They plant seeds by experimenting with them Each group tells the other group about the product. The product is evaluated and the better one is considered. What can we do to plant more crops?Incoming ideas are evaluated. A greenhouse area is created in the school garden. then students began to cultivate vegetables by planting ancestral seeds they brought from their homes in this region. |
| Institution/ Organisation/ Service provider/ Implementing agency | 15 Temmuz Şehitler Anaokulu Antalya |
| Target Group(s)/ Beneficiaries | Preschool education students(5-6 age) |
| Main points / areas | Students learn how to grow the vegetables they will consume and gain skills in vegetable growing. |
| Is the practice suitable for local, regional or national implementation? | Application in accordance with local, regional or national practice |
| Should be used as a source in the learning materials for preschool/kindergarten teachers? | Yes, it should be used. |

# Good Practices

| Good Practice | |
|---|---|
| Title of the practice | MY WOODEN TOY |
| URL of the practice (if existed) | |
| Location /geographical coverage | TÜRKİYE /ANTALYA |
| Brief description of the practice | Do you want to design your own toy?How and with what we can do this in nature?We convey the images with wooden toys to the children. we learned how wooden toys look and what materials we need. For an example work, students are given pieces of string and wood and they make a toy, then they introduce this product to each other. Then now, do you want to make your toy by collecting these materials from nature? Students who gain the skill of making their own toys start to produce new toys by changing the material list. |
| Institution/ Organisation/ Service provider/ Implementing agency | Antalya Barosu Mesleki ve Teknik Anadolu Lisesi Uygulama Anasınıfı |
| Target Group(s)/ Beneficiaries | Preschool education students(5-6 age) |
| Main points / areas | To gain the ability to produce simple toys for themselves using materials from nature. |
| Is the practice suitable for local, regional or national implementation? | Application in accordance with local, regional or national practice |
| Should be used as a source in the learning materials for preschool/kindergarten teachers? | Yes, it should be used. |

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in the kindergarten

## PROJECT NEWS

NAME -----  ->website

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