

# OUTDOOR LEARNING IN ECEC USING EDTECH AND THE STE(A)M APPROACH

Molina Ascanio, M.<sup>1</sup> & Tasiopoulou, E. <sup>1</sup>

(1) European Schoolnet.

## Abstract

Children are growing disconnected from nature. The urbanisation process and the increase in entertainment options indoors and in virtual spaces imply a loss of physical and psychological benefits in the new generations. As an agent of socialisation, school must offer opportunities for students to develop curiosity, respect, and concern for the natural world. This paper aims to bring nature closer to early childhood education and care (ECEC) students. For this, outdoor learning has been valued as a pedagogical method in ECEC and the use of technology has been argued to motivate experiences outside the classroom. The paper aims to serve as theoretical framework that inspire educators to design activities, methodology, and advice that can be easily adapted to the needs of different ECEC centres. The creative use of technology as a tool for outdoor learning makes it possible for children to reconnect with nature, growing their interest in protecting it.

**Keywords:** Early Childhood Education, Nature, Outdoor Education, Learning and Knowledge Technologies, Sustainability

## Introduction

The decline of a particular sensory experience of the environment is likely to cause people to have less and less interest in nature (Soga & Gaston, 2016) with worrying implications for the future.

In his 2010 educational article, Martínez concludes that incorporating experiences in natural environments within the school curriculum is essential and can positively strengthen the development of environmentally responsible citizens with values and attitudes that prevent the deterioration of natural resources.

Being outdoors adds new dimensions: there is more space to play and move, fewer noise restrictions, and more possibilities for self-directed play. Outdoor spaces and gardens,



however small they may be, are resources that integrate with and complete classrooms. These outdoor spaces can become a place for exploration, investigation, observation, debate, manipulation, study, and reconnection with nature through the senses. The idea behind this Scientix Observatory paper is not only to improve the quality of learning, but to consider nature as an ally that supports the attention, motivation, and general involvement of students in their learning.

In an increasingly urban and technological world, the possibilities of entertainment without having to leave the home are endless. Given the presence and easy access that children have to technology, can we use it to improve children's connection with nature?

The coronavirus crisis led to the lockdown of many countries to slow the spread of COVID-19. According to Tonucci (2020), after this time of crisis, we are faced with a unique opportunity to break from the educational structures of the past and create a new school in which young people are inspired to develop their talents and become critical citizens.

In 2015, Hollyhock proposed how the creative use of educational technology can provide the opportunity to carry out many outdoor activities. However, when we think about using technology outdoors for children to learn and play, we are in danger of putting up a new barrier for them. If we focus on the use of the device and not on how it could improve and enrich the experience, we miss the point of our goal. We don't want students to experience the environment through a lens, no matter how good that lens is; we want to enrich the teaching and learning experience in and about nature.

## **Relationship between ECEC and outdoor education**

The European Commission defines early childhood education and care (ECEC) as 'any regulated arrangement that provides education and care for children from birth to compulsory primary school age, which may vary across the EU'<sup>1</sup>.

Although nature is part of the school curriculum in Europe, it has not been studied as a pedagogical method in most of them, nor has it been given the value of enriching the student's learning experience. According to Remmen & Iversen (2022), there is a 'considerable body of empirical research on outdoor education in Sweden, Norway, in some grades in Denmark and to some extent in Finland'. In the United Kingdom, particularly Scotland, educational policies

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<sup>1</sup> <https://education.ec.europa.eu/education-levels/early-childhood-education-and-care/early-childhood-education-and-care-initiatives>

are supporting the effective practice of outdoor learning<sup>2</sup>. According to 2014 research by Klaar & Öhman, we can discover three characteristic objectives in these countries in relation to outdoor activities: (1) personal development and well-being; (2) care of nature; (3) understanding natural phenomena and processes. Romania has recently (2019–2020) included organising outdoor activities in the teaching methods that can be used in ECEC<sup>3</sup>.

## Outdoor learning

Louv (2008) first described nature-deficit disorder as the human cost of alienation from the natural environment<sup>1</sup>. Louv documented how the modern family has distanced itself from nature and how this influences children. In his work *The Last Child in the Woods*, he highlights mental fatigue, decreased use of the senses, attention difficulties and the appearance of illnesses, both physical and emotional, in children and young people.

The 21st century society, which is characterised by a continuous overexposure to different fleeting stimuli, urbanisation, the degradation of the environment, and long school hours means that children have few opportunities to explore and interact independently in safe spaces.

A couple of years later, Louv found that being able to experience the natural environment, even in the city, can mitigate nature-deficit disorder, develop a greater respect for common spaces, and address environmental inequalities. In 2012, he established ‘fascination’ as the antidote to mental fatigue. This fascination is triggered in an involuntary way in new and spacious situations or places, where we can explore and feel free.

Intuitively, it is logical that collective knowledge affirms that contact with nature promotes healthy development in children (and in people in general): the great outdoors promotes a healthy lifestyle, provides new sensory experiences, enables imagination and creativity, and provides more opportunities to develop our motor skills and autonomy in nature.

In addition, there are multitude studies that have empirically demonstrated this premise. Different authors supporting outdoor education have established arguments for a more prevalent use of it in educational systems, especially in ECEC and primary schools. Due to its great extension and quantity, as benefits of being in contact with the natural environment we highlight the improvement of attention capacity (Taylor & Kuo, 2009), physical activity in people

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<sup>2</sup> <https://education.gov.scot/improvement/learning-resources/a-summary-of-outdoor-learning-resources/>

<sup>3</sup> <https://eurydice.eacea.ec.europa.eu/national-education-systems/romania/educational-guidelines>

regardless of age (De Vries et al., 2011), and pro-environmental attitudes and behaviours (Cheng & Monroe, 2012).

Being in contact with nature not only benefits people, but also the environment. Treasuring experiences in nature before the age of 11 is related to the development of positive environmental attitudes in adulthood, as demonstrated by Wells & Lekies in their 2006 study for the University of Cincinnati (United States).

There is growing research to support these findings from the 1990s and early 21st century. For example, in 2019, Kuo et al. carried out a summary of more than 50 studies where they indicated that outdoor learning promotes changes in perseverance, problem solving, critical thinking, leadership, teamwork, and resilience. They point out that nature plays a key role in the development of pro-environmental behaviour by fostering an emotional connection with the environment. They also highlight how nature can promote learning by improving students' attention, self-discipline, interest, and enjoyment of physical activity, and reducing stress levels. Nature also seems to provide a calmer, quieter, and safer context to learn and play in.

The concept of outdoor learning was introduced in 1993 by the University of Linköping (Sweden). This pedagogical method is understood by Harris (2017) not as a topic or subject, but as a 'tool for learning and teaching'. Gonzalez et al. (2018) define outdoor learning as learning 'through the senses and in interaction with others'. From these definitions, we conclude that it is a methodology that can be applied to various topics at different educational levels, helping holistic development of children.

Based on Bratton et al.'s didactic proposal in 2019 for nursery schools in the United Kingdom, below are some of the benefits of introducing outdoor learning in ECEC:

- All areas of learning can be accomplished outdoors.
- Allows and encourages children to relive their experiences through their most natural channel, movement.
- Provides access to a large space where children better develop motor skills, coordination, balance, body awareness, and sense of direction.
- Provides an opportunity to assess autonomy and risk, children can play and socialise freely and use their own imagination and initiative.
- The environment in which we learn and play affects our emotions. Children will often be less inhibited and more willing to participate in outdoor activities.
- Exercise affects emotions, relaxes, calms, and offers a greater sense of wellbeing.

The ability to learn is maximised when we take advantage of all the stimuli we receive, so considering the natural environment not only as a place but as a learning method will offer more and better development opportunities for the younger students in a new, healthy, and more pleasant environment.

## The use of technology in ECEC

Thanks to discoveries in the field of educational neuroscience, we know more about improving the quality of learning that technology provides. Numerous investigations, including the findings of Bloss et al. in 2011 when studying cognitive functions in the prefrontal cortex, affirmed that the human brain presents plasticity as an essential characteristic. Because of these discoveries, we know that neural networks are modifiable and that this plasticity is at its highest during the stage of life that coincides with a large part of ECEC (aged three to six years).

In 2008, Kalbfleisch concluded that educational intervention causes changes in the structure and organisation of the brain, since it quadruples its dimensions during the first three years of life, reaching 90 % of the adult volume at six years of age, hence the importance of early stimulation (not over stimulation).

The characteristics of today's society and the eruption of new technologies in our day-to-day lives make up the historical paradigm in which children need to function. To adapt to the different learning rhythms and the characteristics of each student, educators need to move away from 'traditional teaching' where the contents are explained by teachers to passive students, whose greatest challenge is memorising the information received.

According to Coll & Martí (2001), the use of information and communication technology (ICT) offers teachers the possibility of 'extending to unsuspected limits the human capacity to process, transmit and share large amounts of information with fewer and fewer limitations of space and time, and at an ever-lower economic cost'.

The educational technology (EdTech) sector guides ICT towards more formative uses to learn more and better (Lozano, 2011). When talking about technology in the classroom, we are not only referring to ensuring mastery of a series of tools, it is also about influencing their possible didactic uses. In 2009, Romero et al. suggested incorporating technology in an invisible way so that it is integrated into educational processes.

In 2015, Hollyhock concluded that personal, social, and emotional development in ECEC is supported using ICT outdoors. Through creative learning and play supported by technology,

children can develop a range of key skills from problem solving, teamwork and responsibility, to observation, listening, and reflection.

When talking about technology and children, it's easy to only think of screens. However, a child's world is filled with technological experiences, from televisions, mobile phones, and digital cameras to road crossings and supermarket checkouts. Wright (2014) states that children are naturally interested in technology by 'pushing buttons and making things happen'. Arnott revised the term 'technology' in 2017, defining it as anything that can create, store, or process data. This includes interactive toys or other devices such as computers or tablets, less tangible forms of technology such as the internet, and 'imaginary technologies' that appear in pretend play. Children incorporate technology into their learning experiences naturally based on what they see around them, in the same way that every child has always done with any other traditional object. Just as children play pretend by imitating their families, they use technology in the same way. For example, walking around the classroom while they talk 'on the phone' or creating a 'restaurant' where they use a 'tablet' to write down the order.

Technology is an indisputably valuable tool that allow learning to be expanded in a more real and effective way. The stimulus-response effect occurs with an immediacy that is not achieved in the analogue world. In addition, its flexibility allows its informal use to be extended in multiple moments and situations. The use of ICT in ECEC also allows educators to adapt more easily to the characteristics of the students, incorporate different tools, create and share resources, and organise the teaching and learning processes.

## Basic principles for selecting age-appropriate technology

Incorporating learning technologies in outdoor learning spaces also requires decision-making regarding the materials that teachers and students are going to use. It is important to follow the basic principles for selecting the technology to be used for young learners<sup>4</sup>. Some examples are ensuring active and not passive engagement, the role of teachers and families to model behaviours and set boundaries, facilitating social interaction, and protecting children's privacy.

To introduce technology into outdoor learning spaces, it is interesting to start with a tool that both teachers and children are familiar with. The best technology in this case needs to be intuitive (i.e. a digital camera for students to take photos of their favourite place in the open air, which could be printed for an open debate for improving the design of the outdoor setting).

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<sup>4</sup> <https://tech.ed.gov/earlylearning/principles/>

Other affordable resources with infinite possibilities are devices that no longer work, such as laptops, keyboards, mice, microphones, mobile phones, remote controls, printers, typewriters, hair dryers, etc. These items are great resources for pretend play, but it's important that teachers regularly check to see if they're in good condition and don't have any loose pieces that are too small for the younger students.

Other options are disposable cameras, programmable toys, robots, sensors, calculators, magnifying glasses, binoculars, compasses, hourglasses, interactive books, whistles, other instruments, etc.

In addition, there are more and more learning technologies designed for learning outdoors, such as GPS devices, digital weather stations, different types of torches, metal detectors, recorders, wireless speakers, step counting bracelets, and cameras with motion sensors.

## Education for sustainable development in ECEC

As described above, nature-deficit disorder can have negative consequences for people's attitudes towards the environment (Pyle, 1993). In our society we are affected by a great variety of environmental problems, and great technological advances have not been able to solve them, but, on the contrary, the new generations are increasingly disconnected from nature due to the lack of experience in the natural environment. Although spending time learning outdoors has been linked to a multitude of benefits, several studies emphasise a decline in young children's engagement in outdoor learning.

UNESCO (2019) recognises that education for sustainable development (ESD) is 'an integral part of the Sustainable Development Goals (SDGs) related to quality education, as well as a key catalyst for the other SDGs'.

At school, we learn values, attitudes, and behaviours that stay with us for the rest of our lives. Developing an ESD program in ECEC is essential for fostering a connection with nature, critical thinking, and the autonomy of future generations. In 2021, Fester highlighted the need for all teachers to realise that they do not need to be science experts to include ESD in the classroom, as it can be integrated into all subjects and at all stages.

ECEC has a great tradition of curricular integration and commitment to the environment and participation, which are key elements of ESD. However, this field has very little research. This needs to be changed to build good practices on an empirical basis of criticism, reflection, and creativity (Siraj-Blatchford et al., 2010).

Fronza & Gras-Velazquez (2020) establish sustainability and education as 'the two fundamental values for resilience and the development of skills in a 21st century characterized by social, economic and environmental uncertainty'.

## False dichotomy between EdTech and ESD

The disconnection, sometimes even the opposition, between outdoor learning and technology is a cultural and educational thinking issue that can and should be rejected (Siskind et al. 2020). Children are now so familiar with electronic devices that the outdoors can seem like the last refuge away from screens. However, technology can offer new perspectives on learning and play.

There is a large body of research on how children learn and develop while using technology or while playing outdoors, but the literature on how to balance both learning experiences is still limited (Siskind et al. 2020). This lack of frameworks and resources for teachers to optimally integrate both approaches into the curriculum highlights the false dichotomy between technology and environmental education. However, there are many reasons why the union of EdTech and ESD should be able to modify the way in which human beings behave and relate to their environment (Fronza & Gras-Velazquez, 2020).

By including technology in ESD, we do not merely use attractive and innovative materials, but rather educational technologies are conceived as cognitive tools that are an integral part of the reflection process that involves the way in which the contents are presented and how they are related to students' needs and interests (Carvalho de Sousa et al., 2012). For instance, the variety of mobile applications that develop citizen science means there is a great opportunity for children to get closer to scientific research. Using this or any other type of outdoor resource offers great potential for meaningful learning.

Despite the best efforts to make classroom learning exciting, children who are confined indoors for long hours often experience anxiety or boredom (Tidal, 2015), which can be alleviated by just 20 minutes outdoors.

In 1998, Csikszentmihalyi suggested that striking the right balance between skill and challenge can bring about a state of flow, where a sense of purpose and timelessness is experienced (described as an optimal learning zone). He also suggested that getting the design or balance of learning wrong can lead to boredom or increased anxiety and consequent disengagement from the task.

The use of EdTech greatly improves the potential of outdoor learning as a teaching tool (Pardo-García et al., 2014). With the advent of mobile technologies, it is possible to extend classrooms

beyond the traditional four walls of the school. Expanding technology infrastructure systems, combined with the growing number of software and applications, has enabled and expanded what and how students can learn.

Outdoor learning based on the use of EdTech tends to improve the climate and culture of learning (Kinash, 2015), allowing new ideas, learning possibilities, and unique ways to activate knowledge. Kinash's research results show that the natural environment has a positive effect on retention and recall because information tends to be easily stored and retrieved when associated with unique physical settings. Outdoor 'classrooms' encourage this flexibility and novelty to create associated memories and encourage meaningful learning.

The use of devices has been shown to have positive impacts on multiple domains of development and school performance. However, researchers, educators, and paediatricians acknowledge that these benefits do not come solely from technology, but as a result of (Siskind et al., 2020):

- The role of adults in scaffolding, supporting, and interacting with children while using digital devices.
- Educational, interactive, and appropriate content for their development.
- The notion of technology as a tool for teaching and learning and not as a replacement for classroom planning or real-life experiences.
- Using technology intentionally: promoting learning, collaboration, interest, and positive experiences.
- Limiting screen use to one hour per day (American Academy of Paediatrics, 2016; Donohue & Schomburg, 2017).

Linking outdoor activities with technological elements can be a very good way to legitimise ESD in ECEC.

## **Holistic learning and the STE(A)M approach**

Today, we find ourselves in a complex framework that leads us to question an educational system based on the historical separation between science and humanities. As we have previously mentioned, education and sustainability require a multidisciplinary approach that connects various concepts and knowledge. Outdoor learning is a method that brings children closer to the complexity of the reality that surrounds them, together with the motivation provoked by the change of space that breaks with the monotony of everyday life (Farias, 2005).

All these premises lead us to consider the acronym STE(A)M, created by the Rhode Island School of Design (United States of America) in 2010 to promote the learning of science linked

to creativity and art. STE(A)M is a comprehensive educational model that better prepares future generations to compete in the 21st century innovation economy.

This model gives rise to a holistic approach in which all the areas that make up STE(A)M are made available for learning any curricular content. This approach is based on and makes the most sense in ECEC, since a multitude of theories support multidisciplinary, holistic, and globalised teaching from an early age. Let's think about the centres of interest and the pedagogical principle of 'globalisation' created by Decroly in 1987 when studying how the child. It is based on her perceptions and these are based on the child, encompassing syncretism. The student's curiosity leads them to investigate and discover the parts of the whole, reaching a certain analysis.

STE(A)M for young children falls under the umbrella of inquiry instruction. Inquiry instruction encourages active (often hands-on) experiences that support building understanding and vocabulary, critical thinking, problem solving, communication, and reflection. All these elements are also supported by outdoor activities. As explored by Delia Voicu et al. in 2022, STE(A)M can make STEM more attractive to girls and children with disabilities, help with gender inequality issues, and in young ages, it can contribute to the development of children's vocabulary and creative expression.

Many concepts of the previously exposed theories coincide and help us to understand how human beings learn through constructivism, the reference pedagogical current of educational knowledge. In this paper, we start from the premise that learning is a dynamic and active process in which prior knowledge, the zone of proximal development (ZPD), and social interactions are involved. When talking about the ZPD introduced by Vygotsky, we refer to what the student can do on their own and what they are capable of with the help of an adult or a play partner.

The STE(A)M approach responds to the characteristics of learning in ECEC, it can be experienced outdoors, and, in addition, it can be improved thanks to the introduction of EdTech.

## **The value of risky play in nature**

Playing in natural settings can be especially beneficial because it is filled with loose materials (i.e., sand, sticks, water, mud) that students can use to let their imagination run wild, and let their creativity shape their play.

Schools' outdoor learning spaces need to be safe, but still allow for risk and challenge. It is critical that children can assess and make decisions for themselves, have opportunities to

assess their limits, and are able to gain confidence and self-esteem through these independent decisions (Bratton et al., 2019).

As suggested in the risk prevention NGO Parachute (2022), teachers 'need to focus on managing hazards, while allowing children to explore risks'. A hazard is an object or situation where the source of the damage is not obvious to the student (for example, a broken railing). Risk is a situation in which the learner can recognise and assess the challenge and decide on a course of action (for example, climb a tree).

This type of risky play is defined as exiting play, where children are not sure of the outcome, and which promote risk management skills. The risk changes over time, as the child progresses in development and gains more experience. What is risky at one age becomes minimal or zero risk at another age. It also varies for each student, depending on their abilities and interests. Taking a walk with friends in the bushes for a teenager could mean getting lost for a young child.

It is important to trust the abilities of children, no matter how young they are, and let them see how far they can go on their own, develop their muscles, test their coordination system, balance, etc. It is not about letting students take risks that are dangerous to their integrity or learning to live on the edge. Educators must explain the necessary precautions, discuss the possible consequences, and always accompany students, but without transmitting insecurity.

It is interesting to actively involve students in the process of evaluating risks and benefits in outdoor settings. For example, in the playground, children can learn to identify potential hazards and contribute to the development of playground rules.

## Using EdTech to improve outdoor learning

Today, families have few opportunities to be in contact with the environment and children spend much of their time playing in built environments. Since most children spend long hours at school, the school must have outdoor learning spaces that allow them safe and immediate access to green spaces.

Nature is essential for a healthy life. The natural environment invites children to move, supports creativity and problem solving, improves cognitive ability and academic performance, stimulates the senses, reduces stress, and improves self-discipline and social relationships.

At the same time, children are naturally drawn to the technological world, which is inevitably part of everyday life. The immediacy and motivation factor offered by technology can and should be used to promote learning in and about nature. So, what better than using EdTech in outdoor learning to reconnect with nature?

## Conclusion

There is growing concern about the disconnection children have with nature and the little time they spend playing spontaneously outdoors. The need to correct this aspect and promote learning in ECEC about and in the natural environment is the driving force behind this paper. There is a need to assess outdoor learning as a pedagogical method in ECEC. For this, many studies clearly demonstrate the benefits for learning and personal development of students outside the classroom. This theoretical framework argues the use of technology to motivate outdoor learning experiences, exposing the false dichotomy between outdoor learning and the use of EdTech. This theoretical framework should be integrated in ECEC centres in the shape of a guide with activities that can be easily adapted to the needs of different ECEC curricula in Europe, considering how to facilitate the transition from routines inside the classroom to outside.

Nature is a huge playground, full of things to discover, obstacle courses, and life. In nature, the body feels good, motor skills develop, we move spontaneously, and our brains learn a lot. Learning outside the classroom means improving student learning through an organised and powerful methodological approach, in which direct experience is of paramount importance.

Nature is fun and magical; it is a tool for promoting all kinds of learning. In the same way, technology is also an invisible and transversal tool that helps educators to reinforce all areas of learning. EdTech can easily be used in the outdoor learning experience in ECEC.

By linking technology to organised learning outside of the classroom, we provide children with new, real-world experiences and spark their curiosity, equipping them with the skills they need to become active and responsible citizens. The extensive bibliography consulted shows how children who know nature when they are young enjoy it and care about it when they are adults. What, then, are the next steps?

The first step is to recognise that EdTech in education must connect with nature and the outdoors, knowing that children need learning that expands their world and doesn't create disjunction. The second step is to unleash the power of EdTech: technology doesn't need to be inside the classroom. This freedom, to this day, still requires creativity, adaptations, and much more research and development.

We must be clear that technology is a tool, and not our teacher. If we misuse it, we will be building another barrier between the child and the environment. Instead, if used effectively, it can enhance, deepen, and enrich outdoor learning experiences.

Ultimately, it is not just about what we learn, but more importantly, how, and where we learn. It is about enhancing children's understanding, skills, values, personal and social development and using nature and technology as vehicles to develop students' ability and motivation to learn.

Learning in the real world brings together the benefits of formal and informal education and reinforces what the best educators have always known: that the most meaningful learning occurs through the acquisition of knowledge and skills through real-life, hands-on activities.

However, it is necessary that this paradigm shift occurs at all levels since innovation at an isolated level fails in transforming the school culture. Leaving the four walls of the classroom can also be interpreted as leaving the comfort zone and making solid, ethical, and educational decisions.

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