

Theoretical Framework

Sustainability Concept, STEAM Education & Outdoor Education



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1. Education for Sustainability

1.1 What is Education for Sustainability?

If sustainability is defined as meeting human needs without compromising the needs of future generations, then education for sustainable development is the approach that seeks to achieve that goal. Education for sustainability (EfS) involves equipping learners of all ages with the relevant knowledge, skills and values that motivate them to become “informed active citizens who take action for a more sustainable future” (Department of Education and Skills, 2014, 7).

1.2. Why Education for Sustainability?

Humanity and the planet face unprecedented environmental challenges. In 2015, as a response to this growing threat, the United Nations General Assembly adopted the 2030 Agenda for Sustainable Development, a plan of action for people, planet, prosperity and peace (United Nations, 2015).

The agenda incorporates 17 integrated and indivisible goals that encompass the three pillars of sustainability: ecological, social and economic.

Countries that have signed on pledge to collaborate and address poverty, promote sustainable consumption and production, take immediate action against climate change and cultivate equitable, inclusive communities, peaceful communities by 2030.



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An arguably ambitious and hopeful action plan, signatory countries work to incorporate the goals of the agenda into their existing institutions, not least of all their education systems.

1.3. Sustainability Competences

The main characteristic of education for sustainability is an internal design to support UNESCO's sustainability competencies (2017) which include:

- Systems thinking: the ability to recognize and understand relationships; to analyze complex systems; to think of how systems are embedded within different domains and different scales; and to deal with uncertainty.
- Anticipatory competency: the ability to understand and evaluate multiple futures – possible, probable and desirable; to create one's own visions for the future; to apply the precautionary principle; to assess the consequences of actions, and to deal with risks and changes.
- Normative competency: the abilities to understand and reflect on the norms and values that underlie one's actions and to negotiate sustainability values, principles, goals, and targets, in a context of conflicts of interest and trade-offs, uncertain knowledge and contradictions.
- Strategic competency: the abilities to collectively develop and implement innovative actions that further sustainability at the local level and further afield.
- Collaboration: the abilities to learn from others; to understand and respect the needs, perspectives and actions of others (empathy); to understand, relate to and be sensitive to others (empathetic leadership); to deal with conflicts in a group; and to facilitate collaborative and participatory problem solving.
- Critical thinking: the ability to question norms, practices and opinions; to reflect on one's own values, perceptions and actions; and to take a position in the sustainability discourse.



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- Self-awareness: the ability to reflect on one's own role in the local community and (global) society; to continually evaluate and further motivate one's actions; and to deal with one's feelings and desires.
- Integrated problem-solving: the overarching ability to apply different problem-solving frameworks to complex sustainability problems and develop viable, inclusive and equitable solutions that promote sustainable development, integrating the other competencies.

1.3. Education for Sustainability in Early Childhood: then and now

Education for sustainability is not a new form of education, quite the opposite, particularly in early childhood education where it has long established roots. In 1924, Steiner observed “for children, everything is one, and they are also one with their surroundings’ suggesting that through his teaching and research, he finds that normative, interpersonal and intrapersonal skills are naturally emerging in young children. During the same era, Montessori states ‘humanity must acquire a new consciousness’ and that, through educating young children, we must ‘radically transform society through education’ (cited in Boyd, 2018, 230) which equally highlights the importance and recognition of what are considered contemporary social, economic and ecological sustainability competencies.

The design of current ECE frameworks lay the foundations for children to develop intellectually, psychologically, emotionally, socially which offers “enormous potential in fostering values, attitudes, skills, and behaviours that support sustainable development” (Samuelson & Kaga, 2008). Moreover, the widespread integration of nature and ecology into teaching practices offers further support to children in refining sustainability competencies (Ernst and Burkak, 2019).

1.4. The challenges in Early Childhood

Incorporating comprehensive early childhood frameworks that emphasize nature and ecological education plays a crucial role in fostering sustainability skills. However, Elliot



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(2019, 5) agrees that such frameworks alone are inadequate in addressing the vastness and intricacy of sustainability. She notes that educators often mistakenly believe that children will effortlessly embrace a sustainable worldview and ethical principles, as well as become proactive sustainability advocates, by solely engaging with nature and ecological practices. Elliot encourages educators to shift from comfortable and well-known pedagogical methods, such as demonstrating care for the natural world, to more demanding approaches that delve into the exploration of worldviews, ethics, and values.

While it is today's children who will benefit most from an immediate and considerable change in human behaviour towards sustainability, Elliot's approach of calling on very young children to join and contribute to increasingly worrying worldwide conversations around sustainability requires delicacy and reflection as Sobel (1996, 121) argues that " If we want children to flourish, to become truly empowered, then let us allow them to love the earth before we ask them to save it."

This piece shines a light on the concept of sustainability and its place in early childhood education. It defines sustainability and examines the goals and competencies framework embedded in UNESCO's sustainability action plan. It identifies this action plan as part of the rationale to embrace the discourse around sustainability in the early childhood classroom. Finally, it suggests that while learning to love nature and their fellow man isn't enough to help young children become informed citizens who take a position on the issue of sustainability, it argues that learning to love the planet and to value the lives of others is a reasonable place to start.



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2. STEAM Education

2.1. What is STEAM Education?

STEAM education is the most up-to-date and effective approach to learning and teaching based on the combination of science and humanities, which are crucial for the development of the economy and a healthy and safe society. STEAM is an acronym for five pillars of modern education: Science, Technology, Engineering, Arts and Mathematics and is more than just a combination of the subjects taught in school – it is an integral, holistic approach to teaching, considering its multi- and interdisciplinary nature. Its purpose is to create knowledge as a whole (Morrison 2006), which results from the combination of all the above-mentioned fields that not only coexist but overlap and interact in everyday life. The child naturally constructs knowledge in a holistic way and therefore acts, creates, solves scientific problems, and discovers that the knowledge she or he acquires is useful in practice. For Bybee (2010) STEAM education supports learners to solve real problems in the real world

2.2. The educational process

If a child is empowered to discover the connections between Science, Technology, Engineering, Arts and Mathematics, his or her knowledge will be holistic and more in-depth. If a child discovers that this knowledge is applicable in real life, it will motivate them to learn and encourage them to choose a profession related to STEAM in the future. In this approach, the child knows how to acquire knowledge and is able to use it in practice. Three types of knowledge are taken into account in the educational process: (1) the knowledge about states and relations between them; (2) the knowledge about the ways of mental and observable activity, and (3) the meta-knowledge resulting from reflection on both previous types of knowledge and on oneself (Surma, 2021). Therefore, in STEAM education we refer both to declarative and procedural knowledge. The first one refers to a system of semantic knowledge about



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various facts. It can be easily verbalised and transferred in the same way to others. Procedural knowledge, on the other hand, is a system of knowledge related to the performance of various activities. It is acquired by a person in the form of interiorized procedures, heuristic and algorithmic rules that indicate how to perform physical and mental activities. This kind of knowledge is most often automated and its use is indirect, i.e. by applying the procedure in a specific context. Procedural knowledge is assimilated in the course of action and only in some cases can be transformed into declarative one (Surma, 2021).

2.3. Natural Knowledge versus Scholastic Knowledge

In STEAM education, we refer to natural rather than scholastic knowledge, and pay attention to the conditions in which the student acquires it. Scholastic knowledge is the result of verbal transmission without reference to the subject's own activity and direct and personal contact with the field being studied. Its feature is reproducibility and declarative memorization of information provided solely through verbal transmission. Natural knowledge, on the other hand, grows from the inside, develops in the course of the individual's activities and during its use in various contexts. While knowledge acquired solely through verbal transmission can be verbally reproduced, it is merely superficial without implementing experiential learning. Therefore, when planning children's activities in the STEAM approach, appropriate conditions should be created for experiential learning - for integrating the external, sensorial content with procedural knowledge constructed in action. It is very important that the process of structuring knowledge assumes independent action, discovery, research and solving tasks in accordance with the developmental possibilities of the individual in the cultural context. STEM education is a good example of supporting independent research through experimentation and development of scientific thinking (Zdybel et al. 2020).



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2.4. STEAM and Inquiry Based Science Education (IBSE)

Shaping the competences of the 21st century, functional shaping of concepts and referring to the knowledge and experiences of children requires cognitive activation, which should be preceded by emotional activation and internal motivation. It has been proven that the use of reasoning and inquiry-based methods to develop children's interest in STEAM as early as at the preschool stage is desirable and possible. STEAM education is a strategy partly based on scientific inquiry (IBSE and IBL) and project-based learning. Its main advantage is arousing the child's cognitive curiosity, love and true passion for learning, cooperation with others, the joy of being with them and discovering oneself and the world. Inquiry Based Science Education (IBSE) and Inquiry Based Learning (IBL) belong to the group of problem-based methods that are used in both STEAM education (Szewczuk, 2021), and education for sustainable development. In order to apply the IBSE method, Model 5E (Engagement, Explore, Explain, Elaborate, Evaluate) is adopted (IBSE_Modello_5E.pdf. 2021).

The first stage is ENGAGEMENT which involves children confronting a proposed phenomenon, for example air pollution, climate change, technology and water as a source of life. The selection of content can refer to scientific phenomena (e.g. What is carbon dioxide?), but also to the assumptions of education for sustainable development (What is justice? What rights does a child have? What are ecosystems and what is their meaning for man and the world? what is involved in the construction of a sewage treatment plant?). Children organise their knowledge by freely expressing their opinions and observations. They answer the question: What do we already know? This stage is designed to attract children's attention, stimulate their curiosity and desire to explore knowledge, and evoke intrinsic motivation in them.

From this phase, we move on to EXPLORATION, which means formulating research questions and hypotheses, planning activities and methods of verifying hypotheses, conducting experiments and collecting results and their initial analysis. We are looking for answers to the questions: What do we



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want to know and how to do it? At this stage, the teacher supports the initiative of children who conduct experiments and other activities by themselves.

From this phase, we move on to EXPLANATION, an attempt to discuss the results obtained during the previous stage. It is required here to refer to the theoretical assumptions that will allow for the contextualization of what emerged from the preliminary research. On this basis, we move on to ELABORATION of the newly acquired knowledge. During this stage conclusions and doubts that may become an inspiration to pose new research problems are formulated.

The EVALUATION stage (the assessment) concerns both the feedback of the experience/activity itself and self-assessment. Such a learning process shapes the four key competences of the 21st century: Creativity, Collaboration, Critical thinking and Communication. However, the most important thing is to induce a passion and love for learning. A young child is characterised by curiosity and inquisitiveness that lead to discovery and learning. STEAM education allows to awaken this scientific curiosity, but also shapes a child's sense of dignity and faith in his or her abilities.

3. Outdoor Education

3.1. Introducing Outdoor Education

The concept of outdoor education refers to a wide range of educational practices in which the common denominator is the enhancement of the outdoor environment in its different configurations, adopted as an educational environment. Thus, the main characteristic that distinguishes outdoor education from other educational programs is the physical setting; natural environments became the primary educational location (Farné & Agostini, 2014).

The pedagogical orientation behind the outdoor education does not prescribe any specific activities or learning pathway, as well as it does not define any specific goals that are possible to achieve through



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the implementation of the outdoor education. Goals and activities strongly depend on the specificity of the educational context (i.e., school context or extra-curricular contexts) and the choices of educators. However, it is well-known that the outdoor settings increase the learning opportunities as it implies that children will use and apply specific skills (e.g., manipulation skills) more frequently and with greater intensity than they are likely to do in indoor settings (Brymer & Renshaw, 2010).

To sum up, outdoor education is not a new form of education and it is not completely different from traditional education. Instead, it represents the pedagogical discovery of all the potentialities that environmental settings can bring to education. It is a different way of teaching, recognizing the times of learning with those of experience, taking the “external” environment as a normal-natural learning environment in connection and continuity with the “internal” environment (Gilbertson et al., 2022).

3.2. The main characteristics and the benefits of Outdoor Education

According to Ford (1986), the philosophy of outdoor education comes down to 4 main premises: 1. The human commitment and responsibility for stewardship of the land; 2. Belief in the importance of the interrelationship of all facets of the ecosystem; 3. Knowledge of the natural environment as a medium for leisure; 4. Acknowledgment that outdoor education is a continual educational experience.

One of the most “famous” definitions comes from Priest (1986), who defined outdoor education as an umbrella (figure 1) that includes all the forms of education about the outdoors (e.g., adventure education).

He pointed out six main points / characteristics of outdoor education: 1. It is a method of learning; 2. It is experiential; 3. It takes place primarily outdoors; 4. It requires the use of senses; 5. It is about the relationship between people and natural environments and resources; 6. It is holistic: the self, the others and nature are interrelated.



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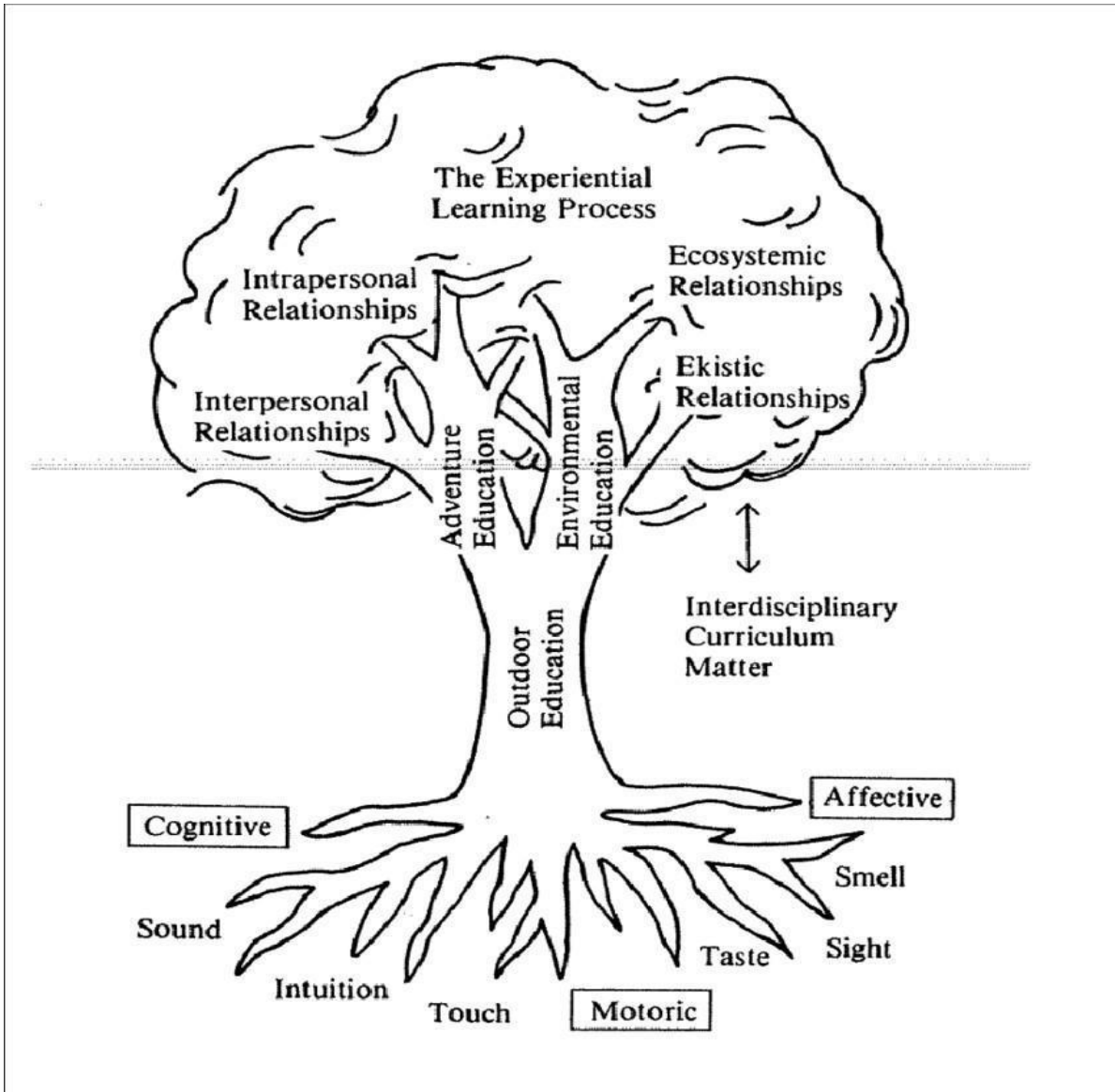


Figure 1. Priest's (1986) model of outdoor education.

More recently, research shows that outdoor education reduces levels of anxiety, encourages pro-social behaviour (Campos et al., 2004; Sameroff & Fiese, 2000) and enhances communication and collaboration skills (Fiskum and Jacobsen, 2012). Moreover, children who have access to outdoor education have good physical health, increased self efficacy and resilience (Ewert and Sibthorp, 2014).



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3.3. A brief overview of the history of outdoor education

Several pedagogues have shown the importance of the natural environment in the educational process, starting from Romanticism, when the model of urban society broke the connection between human life and the natural environment. Jan Jacques Rousseau believed that the outdoor setting was the most suitable environment for the development of children because it allows the experience of freedom and responsibility, the acquisition of cognitive abilities through direct exercise, and the stimulation of all the senses (Cambi, 2011). The thoughts of Rousseau inspired the pedagogical model of Friedrich Froebel (1782-1852), who developed the "Childhood Gardens", where children took care of gardens and plants, learning to take responsibilities while playing in contact with nature. In his pedagogical philosophy, Froebel (1782-1852), foresaw 3 types of activities: 1. Playing with inanimate objects; 2. Playing with other children; 3. Gardening and caring for animals to induce a sympathy for plants and animals. After Froebel's death, his outdoor school model was implemented in schools in Northern Europe, America and Japan, paving the way to the concept of outdoor education.

3.4. Outdoor in practice: the example of kindergarten in woods

The foundational design of the Kindergarten in the Woods is rooted in five fundamental principles:

1. Emphasising the outdoor space as a prime educational setting.
2. Prioritising the educator-child relationship.
3. Valuing direct experience as the cornerstone of instruction.
4. Recognising the significance of emotions.
5. Employing "play" as the favoured teaching method and most prevalent communication tool.

This educational approach offers multiple benefits. Firstly, it enables children (and educators) to acquire knowledge through hands-on observations and firsthand experiences in authentic situations (Crudelli et al., 2012).



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Kindergartens in the woods are a great example of how it is possible to educate children through nature, which offers child-friendly space and time. Moreover, learning within and by nature increases sustainable rather than exploitative attitudes and behaviours in children (Belvedere, 2013). Essentially, Kindergartens in the woods take the form of an educational strategy that is based on the quality of experiences, in direct contact with the environment and its real phenomena, and that stimulates cognitive aspects through sensory-motor action. Moreover, equal importance is assigned to the "connection between outdoor education and the need of the new child generations to recover the centrality of their bodies, the need for movement, spontaneous play and psycho-physical wellbeing" (Ceciliani, 2014).

3.5. Outdoor education and STEAM approach

In today's world, there is a growing emphasis on nurturing abilities in STEAM fields (Science, Technology, Engineering, Arts, and Mathematics). As such, it is crucial for educational institutions, starting from kindergartens, to incorporate activities based on real-world scenarios. This approach strengthens students' competencies and enables them to better comprehend and actively engage with their surroundings. In this context, a significant link can be observed between outdoor education and the implementation of the STEAM approach. According to Kendell et al. (2006), any designed outdoor educational activities might be considered as learning STEAM strategy. Indeed, these educational activities provide direct experiences with the real world and foresee a strong connection between children and the environment in which they live, challenging them with a real-world issue (Haas et al., 2021). Outdoor education provides several (natural) elements that might be used as "tools" to improve STEAM skills in pupils. For example, staying in natural environments allows children to engage with natural light, air, water and habitat systems, to reimagine a playground, to empirical observation, to hypothesise and directly test their hypotheses, and



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so on. In this context, children might enhance their STEAM abilities within a sustainable development (Keane & Keane, 2016).

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Website

For further and updated information about this project please see:

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