



PREPARING FUTURE EDUCATORS !

Digital Handbook on Robotics and Environmental Education

Preparing Future Educators: a Digital Handbook on Robotics and Environmental Education

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Introduction

The world today is experiencing a complex set of environmental problems. Global environmental challenges such as climate change affect the world, manifesting in extreme weather conditions, heat waves, droughts, floods, declining natural productivity, etc.

These growing problems have an increasing impact on people, animals, bacteria, fungi, plants, etc., and recognising that this is a problem for society requires that these issues be raised in the early years.

Alongside pressing global environmental challenges, the world around us is technology-driven and moving further and further away from nature. Living in such an environment, people undeniably need the skills to work with, develop, and solve even mundane problems related to digital technologies. The project partners have focused on how to combine the need to develop high-level thinking skills and the need to get closer to nature and its understanding in the most advantageous way.

Therefore, in order to provide a quality education in the early years that seeks to create awareness of environmental protection and global environmental issues, while also strengthening computational thinking and inquiry skills, the project “Building an Eco-Friendly Future with Robots”, also known as GREENCODE aims to offer materials for preschool teaching departments in higher education institutions (preschool pre-service teachers), preschool organisations and preschool teachers to equip them with the necessary knowledge and materials.

Project Overview and Goals

The Erasmus+ project GREENCODE aims to enhance the skills and training of future and current preschool teachers, equipping them to empower children to engage with tomorrow’s world and adopt environmentally friendly behaviours. It seeks to build the education sector’s capacity to provide high-quality teaching in environmental education and algorithmic thinking teaching using educational robotics at the preschool level in partner countries.

The main goal of GREENCODE is to provide preschool and pre-service preschool teachers with materials to develop their knowledge and skills to design lessons that inspire children’s interest and respect for the world around them and environmental awareness. The project takes place between 01/09/2023 and 31/08/2025, during which the project partners, in close collaboration, have developed not only this Handbook, but also other supporting materials – the Higher Education Curriculum, as well as Lesson Plans, Activity Book, Card Game, and Video Tutorials.

GREENCODE is funded by the ERASMUS+ program of the European Union. It is a joint project, carried out by seven project partners from the European Union. The project coordinator is the University of Latvia. The project partners are:

- University of Mannheim, Germany;
- Instituto Politécnico de Viseu, Portugal;
- University of Rijeka, Croatia;
- Scuola di Robotica, Italy;
- Mellis, Turkey;
- Early Years, Ireland.

Project Results Overview

The Digital Handbook is connected thematically to the Higher Education Curriculum developed in the GREENCODE project.

This Digital Handbook, combined with the Higher Education Curriculum, aims to support preservice teachers to gain an understanding of environmentally friendly practices and the use of educational robotics in Early Childhood Education.

How to use it: The Digital Handbook alongside the Higher Education Curriculum are developed for preschool teaching departments, to be integrated into the study programmes of partner universities. Additionally, the programme can be adapted by education authorities for in-service training of current preschool teachers, allowing for country-specific modifications based on local needs. This flexible approach ensures that both future and existing teachers are equipped to foster environmental awareness and digital literacy in young children.

Who is it for: The project specifically focuses on preservice preschool teachers, as well as current preschool and ICT teachers, with an emphasis on implementation in targeted countries.

Structure: The Digital Handbook is structured into four chapters.

Digital Handbook Overview

The Digital Handbook was developed based on workshop reports from all partner countries, as well as literature reviews.

The Digital Handbook includes:

- General information about eco-friendly practices.

- Short explanations about good practices regarding carbon footprint reduction, local and healthy food consumption, reducing, reusing, and recycling.
- Inquiry-based learning model structure.
- Importance of increasing environmental awareness starting from the early years.
- How to use robotics to promote eco-friendly attitudes and behaviours.

As part of the project, consultation workshops were held in each partner country, allowing preschool teachers, management, and experts to share their opinions about the titles and content of the handbook chapters. All suggestions were considered, and the following content was developed as a result:

- **Chapter 1 “Increasing Environmental Awareness from the Early Years”** is about the importance of increasing environmental awareness starting from the early years and addressing environmental subjects from a holistic point of view for ECE.
- **Chapter 2 “From Policy to Practice: Environmental Initiatives and Reflection in Early Childhood Education”** is about good practices regarding carbon footprint reduction, local and healthy food consumption, reducing, reusing, and recycling.
- **Chapter 3 “Eco-friendly Practices in Early Childhood Education”** offers a look at various examples of good practice, providing an understanding of bringing theory into practice, and offering teachers ideas and inspiration for developing their own lessons.
- **Chapter 4 “Educational Robotics and Eco-friendly Attitudes and Behaviours”** is about the use of robotics to promote eco-friendly attitudes and behaviours.

Educational robotics in early childhood education uses programmable robots to teach problem-solving, creativity, and critical thinking. These robots help children learn computational thinking concepts like decomposition, pattern recognition, abstraction, and algorithm design through interactive, hands-on activities. Beyond technical skills, educational robotics foster collaboration and teamwork, encouraging curiosity and innovative problem-solving. By integrating robotics with subjects like maths, science, and environmental studies, teachers create a multidisciplinary learning environment.

A strong emphasis on linking technology with nature highlights the importance of integrating outdoor activities and eco-friendly practices into early childhood education. This approach ensures that children not only develop technical skills but also begin to foster a deep appreciation for the natural world. By using educational robotics in outdoor settings or bringing nature into the classroom, children can engage in hands-on learning experiences that connect coding and robotics with real-world environmental challenges. Examples of successful implementation of educational robotics in early childhood settings include **activities where robots are used to simulate natural processes**, such as the life cycle of plants or the behaviour of animals. In one project, children programmed robots to mimic the pollination process,

enhancing their understanding of plant biology and the importance of bees, ants or other natural creatures and processes. By integrating robotics with nature, teachers can create a balanced learning environment that promotes **both a knowledge of technology and a passion for nature**. This approach prepares children to navigate and positively impact a world increasingly influenced by digital and ecological factors.

Integrating robotics with nature and environmental education is about using technology to enhance, not replace, our interactions with the natural world. This approach encourages children to consider the role of technology in society and the importance of its responsible use. By blending robotics with environmental education, children learn to see technology as a tool to support and amplify their understanding of nature. In addressing the ethical consequences of robotics use in environmental and educational settings, this ideology underlines that technology should enhance rather than replace our interactions with the natural world. Robotics can simulate natural processes, collect environmental data, or solve ecological problems, enriching outdoor activities and making them more engaging and educational. Children learn that while technology can offer solutions to environmental challenges, it should not be an excuse to avoid outdoor activities. Robotics should support environmental stewardship, encouraging hands-on experiences that foster a lifelong connection to and respect for nature.

By adopting this philosophy, teachers can inspire children to think critically about how technology intersects with the natural world. They can guide children to explore how robotics can positively impact environmental sustainability and encourage discussions on the ethical use of technology.

CHAPTER 1

Increasing Environmental Awareness from the Early Years

Jasminka Mezak and Lucija Jančec, University of Rijeka, Croatia

Why Environmental Education in ECE?

By fostering respect and love for the environment from an early age, we not only contribute to the preservation of our planet, but also ensure a generation of thoughtful, responsible and compassionate citizens.

Developing a bond with nature and awareness of the environment from a very early age is crucial for several reasons:

- **Foundation of lifelong habits:** Early childhood is a formative period in which habits and values are established. Teaching children to care for the environment from an early age helps them develop lasting behaviours that they are likely to maintain into adulthood
- **Empathy and responsibility:** Teaching children to respect and love the environment fosters their empathy and sense of responsibility. Children who understand the impact of their actions on the planet are more likely to make decisions that benefit the environment and society.
- **Awareness and education:** Early environmental education helps children understand the importance of natural resources and the need to protect them. This awareness can lead to more informed and conscientious decisions as they grow older.
- **Connection to nature:** Developing a relationship with nature can improve a child's physical and mental well-being. Time spent outdoors has been shown to reduce stress, improve mood and increase physical activity.

- **A sense of responsibility for the future:** Today's children are tomorrow's leaders. By fostering a love and respect for the environment, we are preparing future generations to be better stewards of our planet, able to meet environmental challenges with knowledge and compassion.
- **Community and global impact:** Children who learn to care for their immediate environment are more likely to extend that care to their communities and the world. This can lead to collective efforts to address global environmental issues such as climate change and biodiversity loss.
- **Problem-solving skills:** Engaging with environmental issues can promote critical thinking and problem-solving skills. Children learn to observe, ask questions and find solutions – valuable skills for all walks of life.
- **Connectedness:** Understanding the interrelationships between all living organisms helps children appreciate the delicate balance of ecosystems. This knowledge can inspire a sense of wonder and a desire to protect the natural world.

Explaining sustainable development to young children is an ongoing process. To help children understand this important concept, use simple language and break down the term “sustainable development” into easy-to-understand words. For example, you can say: “Taking care of nature and the environment ensures that humans, plants and animals can live happily now and, in the future”.

We can explain the concept using examples from children's everyday lives. For example, explain that we need to share and look after our resources such as water, trees and air so that they can be used by everyone, just as children need to share their toys with their friends so that everyone can play.

Visual aids are very useful for describing abstract concepts. For example, we can use pictures, videos or drawings to illustrate the difference between a healthy and a neglected environment. Games and songs that deal with sustainability can be integrated into daily activities. For example, a game where the children must pick up litter or a song about saving water can make learning fun. Storytelling can also be used. We can find stories that illustrate sustainable practices or make them up together with the children. For instance, a story about a community that plants trees, recycles and saves water can describe and show how these small activities help everyone. In addition to storytelling, a role-playing activity where the children pretend to be farmers planting trees or superheroes saving the planet by recycling can be used. Children often ask the question “Why?” To understand why sustainable development is important, we could give an answer like this: “We want to provide enough resources like clean water, fresh air and healthy food for everyone, including animals and plants – now and in the future”. By creating habits of sustainable behaviour from an early age, we are raising responsible citizens who will care for their environment. Giving praise and encouragement when they practise sustainable behaviour will motivate children to continue with this practice throughout their lives.

Encouraging Environmental Awareness

Environmental education is recognised as crucial for society. The United Nations Educational, Scientific and Cultural Organization (UNESCO, 2021), a leading authority in heritage preservation and various aspects of quality of life, has made environmental education in schools a priority. Educating young people about the environment can lead to more sustainable behaviours and practices in their daily lives and help them develop eco-friendly habits from an early age.

As illustrated in Figure 1.1, the best way to stimulate interest in caring for and protecting the environment is through nature walks and exploration. When children learn about plants, insects and animals, they can better understand their role in the ecosystem. A preschooler's desire to explore and experiment, by connecting objects in different ways and finding their own solutions to certain problems through combinations, is an almost inexhaustible source of activity. Since a preschool child primarily learns through play, it is precisely for this reason that children's play should be used to implement educational robotics. By creating mat maps for the robot depicting different living communities, children can play games by connecting animals and their habitats or to the food they eat.

Collecting and separating waste is also a habit that should be encouraged from an early age. Children can programme a robot to separate waste into categories or they can explore and discuss how robots can help protect the environment.

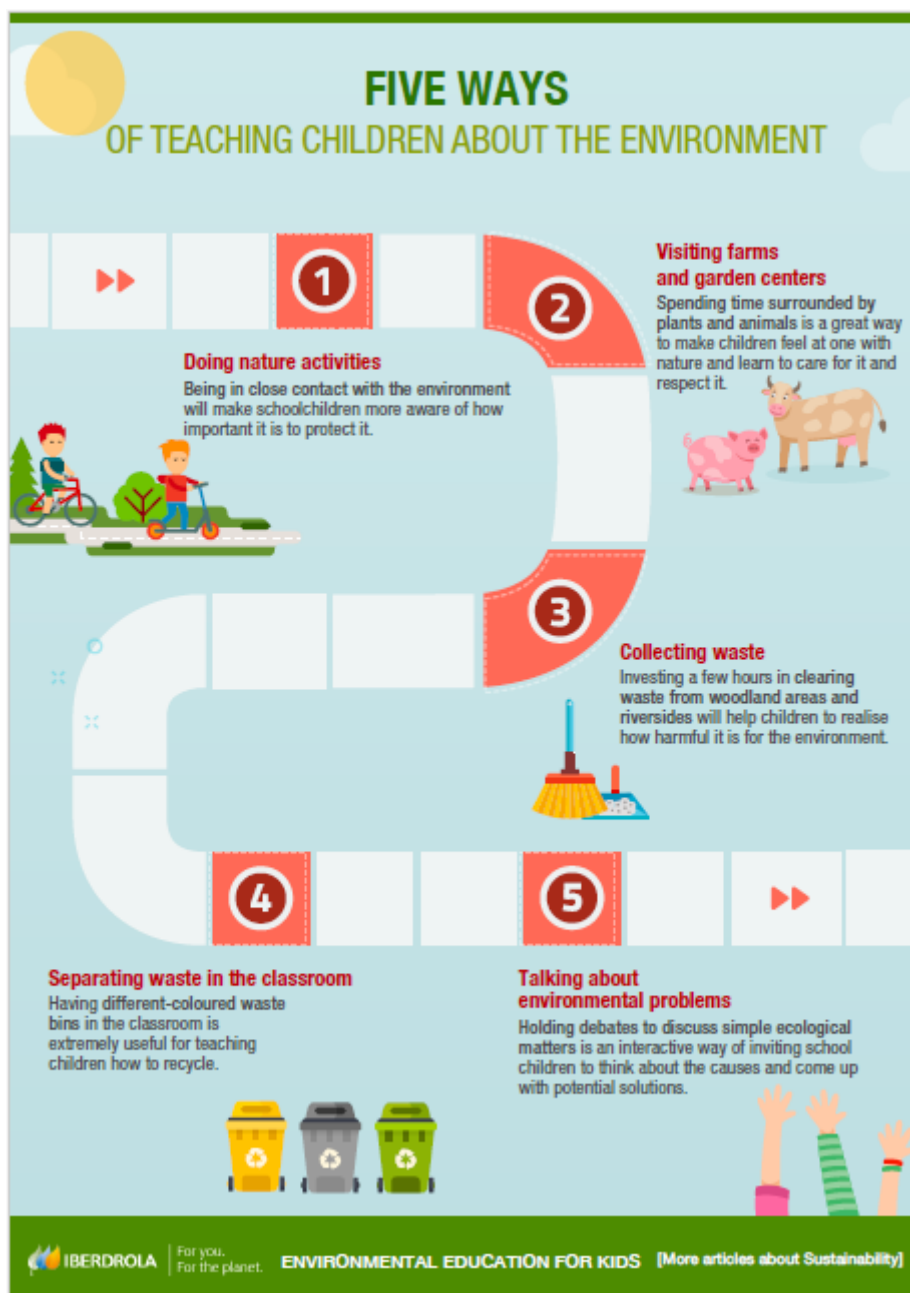
Example of Good Practice

An example of good practice in combining environmental issues and robotics was kindly provided and described by Snježana Horvat, an educator and mentor at Potok kindergarten in Rijeka, Croatia:

Interest in robotics in our group began during the carnival season, when a boy from a neighbouring group came in dressed in a robot costume. Conversations followed and soon the toy robots were brought from home. I noticed that the robots the children brought were mostly transformers from cartoons and that they gave the children a distorted picture of the use of robotics in real life. Our next step was to take part in the eTwinning project "Dear future", where we made robots out of natural and unformed materials.

Figure 1.1

Five ways of teaching children about the environment



Note. From "Benefits of environmental education in kids" by Iberdrola Group, 2024 Iberdrola, S.A.

We talked and thought a lot about what robots can do, how they work and how they move so they can help us. Here are some answers:

- "I would make a bird robot that flies and watches over everything" Jan H. (5.5 years)
- "I'd build a sea robot that cleans the sea, so my grandpa doesn't have to" Frane Ć. (5 years)
- "I would like a robot to guard the forest at my grandmother's" Lara O. (5.5 years)
- "I'd like a robot to cook and clean so my mom can play with me" Toma (4.5 years)

Our interest did not stop there, and we built a kinetic game ourselves, a robotic arm with which we could control and “catch” lighter objects (Figure 1.2).

Figure 1.2

Potok kindergarten in Rijeka, Croatia: Making a robotic arm from natural and unformed material (courtesy of Snježana Horvat, preschool teacher)



And then there was a big surprise, because we got a robot Bee-Bot, which we named Pavo (Croatian name for Willy from the cartoon “Maya the Bee”). We took Pavo to different places, mostly to different shops located in the area that the robot was supposed to use. The children learned very quickly how the robot works. It was valuable to observe how interested the children were in approaching the robot, giving it commands and observing what happened and where the robot went after they pressed the “GO” button.

Although the children’s interest in the games was very high, I thought about how to make better use of the robot, as the pad with shops did not seem to be the best solution for acquiring new knowledge. Therefore, I was guided by the children’s current interests and designed new backgrounds for the robot, which I covered with transparent foil so that it could move around.

The first background was the forest (Figure 1.3, left). As ecology, recycling and sustainable development are part of our group’s daily work, I added a few pictures of litter in the forest. My aim was for the children to learn about the animals in the forest, but also about the dangers we encounter every day, namely litter. The children determined the task of the game themselves by choosing which animal they wanted to reach, by giving it a name or by picking up litter to help the animals that live in our forests to have a better life.

In addition to the forest, I also designed a sea-themed background with marine animals from the Adriatic Sea (Figure 1.3, right). To emphasise the importance of biodiversity, I posted pictures of animals that are

protected by law in the Adriatic Sea, and at the request of the children, I also created a space-themed background.

Currently, a background on recycling is being created, which we will use to separate the waste.

Figure 1.3

"Potok" kindergarten in Rijeka, Croatia: Making different backgrounds for Bee-Bot (courtesy of Snježana Horvat, preschool teacher)



The knowledge acquired in this way encourages the children to draw conclusions by solving the problem and understanding it themselves by participating in practical activities in which the teacher takes on the role of a leader who guides the children to achieve their goals. By introducing specific situational problems, the children are motivated to learn through their own activity. This creates an environment in which the child learns to understand the problem in a practical way with the teacher's support and guidance.

Robot activities are one of the favourite activities of children, and therefore I use them not only to teach programming, but also to acquire new knowledge about the environment around us – maths, nature, the animal world, the universe. With the help of a robot as a didactic tool, children learn the basics of programming and creating algorithms, develop their logical thinking, fine motor skills, communication skills, spatial orientation, attention, memory and creativity. Working with a robot also contributes to the development of scientific literacy, the ability to solve problems independently and find multiple solutions to a given problem and develops the ability to plan and predict.

The activities were carried out individually or in groups, depending on the needs and abilities of the children. I noticed that the children cooperated very well when using the robot and helped each other. Some boys have become very adept at using the robot and programming in just a few weeks, and they use these new skills to help others.

CHAPTER 2

From Policy to Practice: Environmental Initiatives and Reflection in Early Childhood Education

Elif Anda and Caner Anda, Mellis Eğitim Teknoloji Ticaret Limited Şirketi, Turkey

Jan Delcker, University of Mannheim, Germany

Good Practices at the EU Regulatory Level

The European Commission has implemented various initiatives and policies aimed at promoting carbon footprint reduction, local and healthy food consumption, reusing, recycling, and reducing waste. Some notable examples include:

THE EUROPEAN GREEN DEAL

Launched on 11th December 2019, this comprehensive plan outlines the EU's commitment to becoming climate-neutral by 2050. It includes ambitious targets for reducing greenhouse gas emissions, increasing renewable energy usage, and improving energy efficiency across various sectors

CIRCULAR ECONOMY ACTION PLAN

The EU has adopted a Circular Economy Action Plan on 11th March 2020, which aims to promote a more sustainable approach to resource use and waste management. The plan includes measures to

encourage product reuse, recycling, and waste reduction, as well as initiatives to promote eco-design and sustainable consumption and is considered one of the main building blocks of the European Green Deal.

FARM TO FORK STRATEGY

As another part of the European Green Deal, the Farm to Fork Strategy was launched 20th May 2020, aiming to promote sustainable food systems and improve the environmental and nutritional aspects of food production and consumption. It includes targets for reducing the use of pesticides and antibiotics, increasing organic farming, and promoting sustainable food labelling.

INDEPENDENT ENVIRONMENTAL INITIATIVES

Apart from the vigorous implementation of the European Green Deal, the EU has also adopted particular measures and provided fiscal resources for the purpose of dealing with the specific environmental problems.

SINGLE-USE PLASTICS DIRECTIVE

The EU adopted legislation on 1st July 2019 to reduce the consumption of single-use plastics, which are a major contributor to marine pollution and environmental degradation. The directive discourages certain single-use plastic products and encourages the use of alternative materials and reusable alternatives.

LIFE PROGRAMME

Since its launch in 1992, the European Commission's LIFE Programme has provided funding for projects that promote environmental sustainability and climate action. Many projects funded under the LIFE Programme focus on initiatives related to carbon footprint reduction, waste management, and sustainable agriculture.

Good Practices at the National Level

LATVIA

Latvia's Strategy for Achieving Climate Neutrality by 2050 is a comprehensive national plan focusing on practical implementations to make agriculture, forestry, and fisheries more sustainable, emphasising a balanced approach to land use while promoting productivity and CO₂ removal. (FAO Report, 2024) The common and country-specific practices in Latvia is shown in Table 2.1.

Table 2.1
Good practices in Latvia

Category	Practice
Common Practices	Organic farming methods
	Crop Rotation
	Environmentally friendly fertilisers and pesticides
	Separate collection of recyclables
	Composting programs
	Reforestation
	Initiatives to reduce food waste
	Investing in renewable energy sources (e.g., wind, solar, biomass)
Specific Practices	Responsible logging practices
	Protection of old-growth forests
	Supporting local farmers and producers by promoting locally grown and sourced food products
	Balanced land use approach in agriculture, forestry, and fisheries for productivity and CO2 removal

For more information check the homepage of the [Food and Agriculture Organization of the European Nation](#).

ITALY

Italy has developed a comprehensive national framework “National Plan for Adaptation to Climate Change (PNACC)” aimed at reducing the risks associated with climate change and improving natural, socio-economic adaptation (FAO Report, 2024). The common and country-specific practices in Italy is shown in Table 2.2.

Table 2.2
Good practices in Italy

Category	Practice
Common Practices	Investing in research programmes to increase understanding of climate change impacts and risks
	Initiatives for water management to enhance freshwater and aquatic ecosystems

	Promoting sustainable agriculture
	Combating desertification and implementing forestry conservation measures
	Sustainable practices in tourism and energy sectors
	Improving soil quality, reducing erosion, and adopting new technologies in agriculture
	Enhancing animal health
	Conserving genetic resources
Specific Practices	National observatory to monitor and assess climate change impacts, and facilitate data collection and analysis
	Regulating fisheries, aquaculture, and managing marine areas and coastal zones
	Preserving traditional farming techniques

For more information check the homepage of the [Food and Agriculture Organization of the European Nation](#).

CROATIA

According to a report by the European Environment Agency, Croatia is among the three countries with the highest cumulative GDP loss due to extreme weather and climate events. Croatia recognizes the urgency of combating climate change and innovative solutions for sustainable development and has taken proactive measures to promote climate change adaptation. In response, the government developed its first climate change adaptation strategy in 2019 in line with the European Green Deal (Government of the Republic of Croatia, 2019). The common and country-specific practices in Croatia are shown in Table 2.3.

Table 2.3
Good practices in Croatia

Category	Practice
Common Practices	Sustainable tourism strategies prioritising the protection of the natural environment
	Forming a working group on sustainable development goals and developing an environmental action plan
	Developing a comprehensive waste management system
Specific Practices	Regulating the maritime sector to ensure high environmental and maritime safety standards due to the expansion of maritime tourism

	Switching to alternative fuels for transport links to Croatian islands to reduce maritime traffic emissions
	Launching a project to develop a National Climate Adaptation Strategy in May 2016

For more information check the homepage of the [European Environment Agency](#).

TURKEY

Turkey's 10th Development Plan (2014-2018) points out the global importance of the concept of "green growth" and introduces the concept in areas such as energy, industry, agriculture, transport, construction, services and urbanisation within the scope of climate change policies (Öztürk, 2022). According to the Plan, combating climate change and adaptation will be carried out in line with "common but differentiated responsibilities" and "relevant capabilities", considering national conditions. Furthermore, Türkiye adopts pollution prevention efforts, conservation and sustainable use of natural resources and protection of biodiversity as priorities (EEA Report, 2024). The common and country-specific practices in Turkey is shown in Table 2.4.

Table 2.4
Good practices in Turkey

Category	Practice
Common Practices	Preserving genetic resources and biodiversity
	Sustainable and climate-adapted agricultural production methods and technologies
	Ensuring sustainable water management balancing conservation and resource development
	Energy efficiency in transport, buildings, and industries
	Raising awareness among consumers and producers on sustainable consumption and production
	Ensuring GHG emission control through new technologies
Specific Practices	Encouraging "zero waste" at the industrial scale
	Promoting bioplastics and eco-labelling
	Preventing and reducing marine litter

For more information check the homepage of the [European Environment Agency](#).

IRELAND

Ireland prioritises the health of its oceans and recognizes that climate change severely harms the most vulnerable populations by threatening their well-being and capacity to adapt (Doyle, 2017). Ireland understands the critical role its marine environment plays in social, economic, and environmental well-being (Doyle, 2017) besides other critical environmental challenges. The National Development Plan 2018-2027 provides for EUR 116 billion in capital investment over 10 years (EEA, 2018). 18% of this is solely allocated to SDG-related projects, including those on renewable energy and energy security (Government of Ireland, 2018). The common and country-specific practices in Ireland are shown in Table 2.5.

Table 2.5
Good practices in Ireland

Category	Practice
Common Practices	Raising renewable energy (RE) shares regularly (e.g., 40% of electricity from RE in 2020)
	Reducing carbon emissions regularly
	Reusing nearly 100% of wastewater in agriculture and other areas
	Applying individual wastewater treatment systems (e.g., domestic treatment plants, septic tanks) for urban wastewater
Specific Practices	Establishing a national SDG Stakeholder Forum that includes environmental issues
	Creating a national web-based system for the dissemination of information on the SDGs
	Maintaining distance from the target for biological treatment of urban wastewater with nitrogen and/or phosphorus removal

For more information check the homepage of the [European Environment Agency](#).

PORTUGAL

The Ministry of Environment and Climate Action defined its action strategy based on three key pillars: promoting the circularity of the economy, valuing nature in land; and being on track to carbon neutrality (EEA, 2024). The next step for the government includes the consolidation of this work, improving the robustness of the existing indicators, developing calculation methods for the missing indicators, and the possibility of introducing qualitative indicators (Republic of Portugal, 2017). The common and country-specific practices in Portugal is shown in Table 2.6.

Table 2.6
Good practices in Portugal

Category	Practice
Common Practices	Over 50% of electricity production from renewable energies, including solar and wind power
	Well-developed public transportation system as an eco-friendly alternative to private car ownership
	Investing in sustainable transportation initiatives, such as electric buses and cycling infrastructure
	Reducing carbon emissions regularly
	Encouraging local markets and small shops
	Embracing reusable shopping bags as a crucial element of sustainable living
Specific Practices	Establishing a national SDG Stakeholder Forum that includes environmental issues

For more information check the homepage of the [European Environment Agency](#) and [Portugal Residency Advisors](#).

GERMANY

Germany's CO₂ emissions fell to 673 million tonnes last year, the lowest level since the 1950s. Emissions fell 46% below 1990 levels, surpassing the German government's 2023 climate target of 722 million tonnes of CO₂ emissions. Following an 11% decline in energy-intensive production, industrial emissions also fell by 12% year-on-year to 144 million tonnes. These results show how much effort is made for environmental protection in Germany (EEA Report, 2024). The common and country-specific practices in Germany is shown in Table 2.7.

Table 2.7
Good practices in Germany

Category	Practice
Common Practices	Launched campaigns to raise public awareness about environmental protection
	Established committees and councils to promote collaboration between government, stakeholders, and academia on sustainability issues and environmental protection.
Specific Practices	Launched a plan of action for marine conservation and sustainable fisheries with funding (€180 million +)

	Established a federal research and development program (MAREN) focused on sustainable fisheries
	Promoted renewable energy use through the Renewable Energy Sources Act, incentivizing electricity generation from wind, solar, and other renewable sources
	Collaboration with Länder (German federal states) as they have legislative and administrative powers in vital environmental areas

For more information check the homepage of the [European Environment Agency](#) and this [article by Reuters](#).

Good Practices at an Individual Level

The following good practices can be **adopted by adults and families, but also presented to children** in narrations, stories and/or games when designing learning processes in preschool learning environments.

TRANSPORTATION

- Walk, bike, or use public transportation whenever possible.
- If you must drive, choose a fuel-efficient car, carpool, or consider electric vehicles.
- Maintain your car properly to improve fuel efficiency.
- Combine errands into one trip to reduce the number of car journeys.
- Consider using aeroplanes strategically – choose direct flights and avoid unnecessary layovers.

ENERGY CONSUMPTION

- Switch to energy-efficient appliances and light bulbs.
- Unplug electronics when not in use.
- Wash clothes in cold water and air-dry them whenever possible.
- Shorten shower times and turn off faucets while brushing your teeth.
- Utilise natural light during the day and adjust your thermostat settings.
- Consider alternative energy sources like solar panels if feasible.

LOCAL AND HEALTHY FOOD CONSUMPTION

- Buy local and seasonal productions to support local farmers and reduce transportation emissions.
- Plan your meals to avoid impulse purchases and food waste.

- Reduce meat consumption since it has a significant carbon footprint and opt for plant-based meals more often.
- Grow your own food to provide fresh ingredients and reduce reliance on grocery stores.
- Compost food scraps to reduce waste going to landfills and create nutrient-rich compost for your garden.
- Read food labels to choose minimally processed foods with simple ingredients. (Symbols on the labels can be focused on for ECE).
- Reduce food waste by storing food properly, buying only what you need, and utilising leftovers creatively.

REUSING AND RECYCLING

- Invest in reusable alternatives such as using reusable water bottles, shopping bags, coffee mugs, and food containers instead of disposables.
- Buy products with minimal packaging and use your own bag when shopping.
- Donate or sell unwanted items.
- Repair broken items instead of replacing them.
- Learn about your local recycling program and separate your waste accordingly.
- Collect rainwater or water plants with used water (when appropriate).

REDUCING CONSUMPTION

- Evaluate if you truly need something before purchasing it.
- Consider borrowing tools or equipment instead of buying them for infrequent use.
- Invest in high-quality items that will last for years.
- Plan your shopping trips and stick to your list.
- Look for used clothes, furniture, or books at thrift stores or online marketplaces.
- Choose companies committed to reducing waste and using recycled materials.

CHAPTER 3

Eco-friendly Practices in Early Childhood Education

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Introduction

This chapter explores a range of eco-friendly practices commonly implemented in preschools and early childhood education (ECE) centres worldwide. It serves as an inspiration for everyday sustainable activities and routines that can be incorporated into early childhood education settings. Environmental education in early childhood is crucial for fostering a sense of environmental stewardship and understanding of ecological principles.

Our approach is connected to the **UN's Sustainable Development Goals** (SDGs). According to the UN's website: "The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. At its heart are the 17 Sustainable Development Goals (SDGs), which are an urgent call for action by all countries – developed and developing – in a global partnership. They recognize that ending poverty and other deprivations must go hand-in-hand with strategies that improve health and education, reduce inequality, and spur economic growth – all while tackling climate change and working to preserve our oceans and forests" <https://sdgs.un.org/goals>.

Many of the goals support aspects of early years practice and pedagogy, such as SDG12 about responsible consumption and production and SDG13 about climate action to name but two. If you are interested in knowing more, try this good introduction quiz to the 17 SDGs for children and adults: <https://www.bookwidgets.com/play/QKUJZZ>.

Another important axis of this chapter is a **whole centre approach** that connects children's learning and activities with the organisational level. A whole centre approach to sustainability generally includes three

areas of action: environmental management ("greening") of the school, establishment of ongoing partnerships with the wider local community, and incorporation of sustainability in the curriculum (Gericke, 2022). These actions overlap and are articulated because children's learning and the curriculum are central to early childhood education.

Finally, the chapter borrows from the eco-schools programme framework (for information in English: <https://www.eco-schools.org.uk/ten-topics/>) with the idea of breaking down large, global issues like climate change into more **manageable and directed themes** that allow centres, teachers, and young children to consider environmental changes that they can make within their schools and everyday lives. This allows for different solutions to be valued.

The chapter first presents the dimensions of environmental education in ECE. Then it considers those at different levels to highlight themes and actions that can be taken with children, families, and the wider community.

Dimensions of Environmental Education in ECE

Research, practice, and curricular frameworks reveal that different dimensions of environmental education are relevant to children's learning. This chapter presents some of the important concepts, attitudes, and skills connected to environmental education in ECE, and some suggestions for activities.

COGNITIVE AND BEHAVIOURAL DIMENSION – KNOWLEDGE AND SKILLS

Knowledge and understanding: basic ecological concepts, such as the water cycle, energy sources, plant growth, and the role of animals, fungi and bacteria in ecosystems. This also includes understanding the human impact on the environment and how it can be alleviated.

Problem solving and critical thinking: encouraging young children to ask questions and think about how their actions affect the environment and look for solutions to problems. Simple activities like walking in nature or thinking about what happens to robots and other electronics that no longer work foster this skill. Trying to understand and change a habitat degradation (like a garden or a park) or tackle waste reduction in the classroom are also good examples.

Habits and practices: environmentally friendly habits, such as recycling, conserving water, and reducing waste. Simple, age-appropriate actions can make these practices second nature.

Responsibility: encouraging children to take responsibility for their environment. This can be done through classroom tasks such as watering plants or cleaning up outdoor play areas.

Curiosity and sensory engagement: direct experiences with nature through outdoor play, field trips, and interactive activities like planting seeds or building bird feeders. Using all the senses to explore and understand the environment, such as touching different textures, listening to sounds of nature, or smelling flowers and leaves.

AFFECTIVE AND ETHICAL DIMENSION – CONNECTION WITH NATURE

Emotional connection: a sense of wonder and appreciation for nature. Activities such as nature walks, gardening, and observing wildlife can help children form emotional bonds with the natural world.

Empathy: care for living organisms, whether plants, animals, fungi, or fellow humans, promotes empathy and a deeper connection to environmental stewardship.

Values: concepts of fairness and respect for all living organisms. Discussions about why it's important to protect the environment and how everyone can contribute and reinforce ethical thinking.

Stewardship: a sense of responsibility and caretaking for the Earth, encouraging the idea that taking care of the planet is a shared responsibility.

SOCIAL DIMENSION – CIVIC ENGAGEMENT

Community and cooperation: collaborative projects that enhance environmental awareness, such as group gardening projects or community clean-up events. These activities teach children the importance of working together for a common goal. Engagement with the community is also an important aspect.

Cultural awareness: understanding how different cultures interact with and value the environment. Stories, songs, and traditions from various cultures can highlight diverse environmental perspectives and practices.

Environmental Education in ECE: Levels, Themes and Actions

Some examples of activities and actions have been mentioned in chapter 2. We have placed them in a matrix (Table 3.1) to make them more visible. We have also added some more suggestions that show

how at different levels, actions and themes can be incorporated into practices. Use the matrix to have a better understanding of your own actions in terms of level and focus.

Table 3.1

Environmental Education in ECE: levels, dimensions and actions

Level	Knowledge and Skills	Connection to Nature	Civic Engagement
Organisational	Make sure the team is knowledgeable about eco themes Have plants and animals as part of the centre responsibilities Guarantee responsible energy consumption in the centre (light and water consumption, for example)	Use outdoor and natural spaces for meetings and events Grow your own food in the centre's vegetable garden Collect rainwater or water plants with used water	Involve the team in the eco review Engage parents and the community with eco themes and initiatives Promote eco-friendly transport (bikes, carpooling, etc) for staff, children and parents/carers
Classroom	Choose natural materials and recycled resources Seek out children's literature that engages with eco-friendly or nature themes Play-based learning	Design a creative workshop Use the outdoor and natural spaces for several activities, as well as reading books. Play-based learning	Engage with families and/or stakeholders that can provide recycled materials Play-based learning
Community	Learn about your local recycling programme and separate your waste accordingly	Involve families and caregivers in exploring natural spaces and resources in your centre and the community	Choose companies committed to reducing waste and using recycled materials

ENVIRONMENTALLY COMMITTED TEAM

In the early childhood sector, teamwork is the key. Promoting a sustainable environment works better when everyone in the team is committed to sustainability. In this sense, Hadland (2020) makes some suggestions:

- Organise events for the staff: to promote a vision towards being a more sustainable institution, have someone important explain the benefits of a sustainable institution and show examples of other institutions that already embrace this vision. In these events, the staff can also play eco-games (e.g. eco-quiz games) and participate in discussion circles about the theme.
- Recruitment: In the interview process incorporate a few sustainability-related questions and establish environmental awareness as a criterion for recruitment.

- Organise staff surveys that could include questions on sustainability and will indicate where the team stands and make improvements over time more visible.
- Discuss the eco-schools' themes and find ways together of contributing to them. Have the staff do the review as an exercise before implementing it with the community.
- Use the outdoor spaces and natural spaces in the community for work meetings and events so that the team is comfortable and used to being in those spaces.

RESOURCES

Sustainability education provides children with opportunities to engage in critical thinking and problem-solving activities. By exploring these real-world issues, such as waste management, climate change, and resource conservation, we give opportunities to the children to come up with new ideas and solutions to solve these problems within their environments at home and in the early years setting.

The messages of sustainability are reinforced through the resources you choose for your outside area – think about these carefully. Try to support locally sourced materials, buy products made from recycled materials, and ensure that any big items are durable and of high quality and can be repaired.

Let us consider SDG 12 – Responsible Consumption and Production and specifically Indicator 12.5.1 – By 2030, substantially reduce waste generation through prevention, reduction, recycling, and reuse.

MATERIALS FOR PLAY

You could develop an outdoor **creative workshop** that can be equipped with recycled materials. Many networks support reusing materials – find one in your local area or start one up yourself! Using recycled materials sends out a strong message so let everyone know that this is part of your sustainability policy. Also look at how you can set up a recycling depot within your preschool for clothes, cans, paper, cleaned household materials etc.

REMIDA www.remida.org is the creative recycling centre in Reggio Emilia in Italy and was established in 1996 as a cultural project for sustainability, creativity, and research into discarded materials. Remida opposes the one-use and throwaway culture and instead suggests creative reuse as a way of valuing materials and inviting in multiple interpretations and potentials.

The materials come from over 200 local companies/industries that are interested in being involved. Materials can vary from remnants of materials – cloth, fabric, wool, cardboard, packaging, plastic, metal, foils, lids, tops, foam, tubes, spools, trays, beads, tools, etc-, to unsold items and seconds. All of this contributes to a reduction in landfill and waste.

Every Infant Toddler and Preschool centre in Reggio has a Remida space filled with open-ended materials for creative exploration which is changed constantly with the addition of “new” materials to provoke more ideas for project design. Professional development workshops and courses for teachers, students, artists, parents, and the general public are offered on how to be inspired by and “listen” to these materials. There are now 8 Remida centres in Italy and 6 others throughout the world.

Inspired by this innovative project there are two centres in the island of Ireland.

ReCreate Ireland www.ReCreate.ie is a membership organisation in Ireland whose mission is to divert end-of-line materials from landfill by collecting and redistributing discarded goods as low-cost supplies for art, education and social services from the Creative Resource centre, The educational mission is to increase creativity and lateral thinking, while at the same time raising awareness among children, young people and the general public regarding the green benefits of reusing materials.

The **Play Resource Centre in Northern Ireland** www.playresource.org has over 30 years of experience in recycling waste materials from factories, shops, offices, and warehouses across the region through their unique Scrapstore. They are committed to raising environmental awareness by promoting the re-use of non-toxic waste materials in creative activities and educational projects and belong to a network of Scrapstores within the UK.

All these organisations offer creative ideas and inspirations, endless supplies of resources, information, training, and networking opportunities for a small annual membership fee.

INVOLVING FAMILIES AND CAREGIVERS

Parents, families, and caregivers can be powerful allies and help the ECE centres in adopting eco-friendly practices, and for that, some strategies can be employed (Hadland, 2020; Spiteri, 2020):

- When parents go to the centre, it is an opportunity to speak about why environmental caretaking is important for their children, and during this time the teachers can point out the composter, the children’s garden, the plants inside, etc. Hadland (2020), explains that showing off to parents the bamboo toothbrushes that they use at her nursery in England, inspired some parents and children to ask to buy one for home as well.
- Give parents surveys with questions on whether the school being eco-friendly was important to them. It is possible to include some open questions and get interesting information. For example, with this information the teachers might find one parent loves gardening and might be happy to come in sometimes to show children how to plant some vegetables or plants; another might make handmade soap and might be happy to do a demonstration for children or to provide some.

- Encourage children to share good practices with their parents. Send home posters about sustainability that children have drawn to continue the message there. Children are at the forefront; they are the ones who can tell parents to stop using plastic bags and suggest options, to encourage them to use cloth nappies, and to stop buying balloons. Spiteri (2020), in her observations in some centres in Malta, confirmed that most parents were influenced by their children's appeals to engage in pro-environmental actions.
- Have an attractive and motivating noticeboard in the centre, and/or posters around clarifying what their children are doing about sustainability. Share this information also on social media (Facebook, Instagram, LinkedIn, etc.). Share some beautiful photos/pictures of their children with plants, or in the sand, or share interesting stories about turtles and whales or other wild animals, or even about insects.
- Engage parents in activities and events. For example, invite parents to join the staff members and their children on a beach cleaning activity; ask them to bring to the centre boxes, tubes, and cartons to recycle within craft activities; organise with family's playdates, toy swaps, or toys construction through recyclable materials workshops.

Esterhulzen et al. (2023) confirmed that education for sustainable development is possible when parents and practitioners collaborate. The authors emphasise the importance of parent-practitioner collaboration to support education for sustainable development in the early years and highly recommend this collaboration. Grandparents are also a great resource for eco-friendly practices, particularly if they have expert, first-hand knowledge of the natural elements of the community.

CHILDREN'S LITERATURE

There are numerous captivating storybooks and fact books to share with children to educate them about sustainability (Hadland, 2020).

One kindergarten teacher in Australia used a book called "The Tomorrow Book", by Jackie French, to work sustainability into her early childhood centre. This book resulted in a project that led children to build their own "Tomorrow Town". During the project, children engaged in reflective discussions that prompted them to express their emotional responses evoked by the book's content and propose actions to help. For example, the need to reuse water, the need for trees and renewable energy, to pick up the rubbish and recycle or reuse it, to grow their own fruit and vegetables, to turn off the lights when they are not needed, to avoid having long showers or leaving taps running, to walk or ride a bicycle instead of driving, etc. (Boyd, 2023).

There are numerous captivating storybooks, picture books, and fact books that encourage discussions, enhance comprehension, develop and clarify environmental concepts, show how different cultures interact with and value the environment, and inspire actions to care for the environment (Hadland, 2020; Hsiao & Shih, 2016). Children learn important ideas through stories, making them an excellent tool for conveying memorable messages.

Hadland (2020) offers a list of suggestions with books that can be used for this purpose:

- “Duff’s Lucky Escape”.
- “Not for Me, Please: I Choose to Act Green”.
- “Lola’s Beach Clean-Up”.
- “What a Waste”.
- “The Adventures of a Plastic Bottle”.

PLAY-BASED LEARNING

Incorporating sustainability ideas into play-based learning helps children understand how their actions, as well as those of others, affect the world.

Sustainable play can take various forms, such as opting for wooden toys, open-ended toys (loose parts) (e.g. wood, metal, wool, glass, cotton, stone, shells, sand, water, natural materials), toys made with recyclable material over plastic ones, or repurposing old technology for craft projects (Hadland, 2020). For example, when playing with containers and water, children learn about the value of water, preserving it, and actively advocating for communities that may not have easy access to water (Beloglovsky & Daly, 2018).

One sustainability idea that can be incorporated into play-based learning is recycling. After introducing children to recycling, teachers can provide recycle bins in some play areas in the classroom, just for children to play. For example, teachers can provide recycle bins and recyclable items, such as cardboard, paper, and plastic in the block construction area, or in the dramatic play area, and during playtime, in these play areas, they can encourage children to sort the items into the designated bins, or simply observe if they play with it freely, and if they sort the recyclable items correctly. This idea can contribute to children’s understanding of how recycling contributes to a healthier environment.

Nature play also contributes to sustainability issues (Ernst et al., 2021). Outside environments involving the exploration of nature, the use of natural loose parts, and risky play typically offer a wider range of possible affordances. Playing in nature enables children to fully appreciate and understand its elements. For example, interacting with trees teaches children their value through direct experience. They discover that trees provide shade, making outdoor play more comfortable. Climbing trees and jumping from

heights offers fun and physical challenges. Additionally, children learn that trees are home to many animals, often their favourite creatures. Through these living experiences, they develop a sense of respect and care for the trees and the natural world in general.

USING THE MATRIX

Many teachers and centres are already doing environmentally friendly practices in their daily work. By using the matrix to organise those initiatives, it is possible to find if diversity is needed in terms of efforts.

For example, many centres sort waste, collect used batteries and reuse materials both in activities with children and in creating decorations. These actions are wonderful but all stand at the same level and contribute to the same focus. Introducing natural materials, using outdoor spaces, and involving families would also be important to make sure the actions and themes are more diverse.

Other examples would be recycling, planting, growing, composting, planting pollinator gardens, and growing organic foods, and life cycles, with children. It could be complemented with eco-friendly cleaning products, paperless communication, using local produce, using non-disposable resources, and not using single-use items, so that the organisational level is included. Other themes, more challenging for Early Childhood Education like biodiversity, oceans and other main ecosystems, solar energy and other renewable energy, environmental quality, or pollution can be tackled with a sound base: a good team, eco-aware and confident; strong ties to the community and its resources; and engaged, playful children.

Further Resources and Information

Boyd, D., King, J., Mann, S., Neame, J., Scollan, A., & McLeod, N. (2021). *An Early Childhood Education for Sustainability Resource that Embeds the Sustainable Development Goals and STEM into Pedagogical Practice*. Liverpool John Moore's University <https://www.ncfe.org.uk/media/xbcbjrfj/early-years-sustainability-resource.pdf>. This resource is full of fun ideas, activities and experiences that promote the creativity and curiosity of young children linked to the 17 Sustainable Development Goals.

Parenta (2024). *Sustainable Practices for Early Years Educators*. Parenta <https://www.cumbria.gov.uk/elibrary/Content/Internet/537/1459/7037/38508/38675/454011694.pdf>. Gives ideas and guidance on how to create an audit of where you are with regards to sustainability, recycling and work out your carbon footprint, develop SMART targets to create an achievable action plan.

Boyd, D., King, J., Mann, S., & Neame, J. (2022). *Sustainability Matters in Early Childhood*. NCFE <https://www.ncfe.org.uk/media/p1socs4v/sustainability-matters-in-early-childhood-resource.pdf>. Rich with teaching prompts, case studies, and activities that can be carried out in the classroom and beyond.

CHAPTER 4

Educational Robotics and Eco-friendly Attitudes and Behaviours

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Introduction

In Early Childhood Education, the integration of technology is emerging as an essential tool for the development of key competences in children. In particular, educational robotics is proving extremely effective in promoting skills such as problem-solving, creativity and critical thinking. In addition to these skills, educational robotics offers an innovative approach to teaching environmental responsibility and sustainability. This chapter will explore how robotics can be used to develop eco-friendly behaviour in children aged 3 to 7, and so prepare a more aware and responsible future generation.

Technology in Early Childhood Education

Integrating technology into ECE is crucial to prepare children for the demands of the 21st century. Technology, and in particular educational robotics, not only makes learning more engaging, but also helps children develop a deeper understanding of the world around them. Using programmable robots, children can learn complex concepts in a fun and interactive way, facilitating the development of essential skills for their future.

Technology provides a stimulating environment that fosters the development of fundamental skills such as problem-solving, critical thinking and creativity. Using programmable robots, children are encouraged to explore, experiment and discover innovative solutions to problems. This type of hands-on learning is particularly effective in early childhood, when children are naturally curious and eager to learn.

ACCESSIBILITY AND INCLUSIVENESS

One of the most significant aspects of the use of technology in education is its ability to make learning accessible and inclusive. Educational robots can be used by children with different abilities and learning styles, providing opportunities for everyone to succeed. For example, children with physical difficulties can interact with robots through voice commands or adaptive devices, while those with learning disabilities can benefit from visual and interactive activities that make concepts more understandable.

PERSONALISED LEARNING

Technology also allows learning to be customised to the individual needs of each child. Using educational robots, teachers can monitor students' progress and adapt activities to better meet their needs. This customised approach helps to keep children's motivation high and ensures that each child can progress at their own pace.

VIRTUAL ROBOTS AND SIMULATION SOFTWARE

Educational robotics activities do not necessarily require the use of a physical robot. They can also be carried out with virtual robots or simulative software, which offer numerous advantages. For example, virtual robots can be programmed on tablets or computers, allowing children to learn basic programming concepts without the need for expensive hardware. In addition, simulative software offers safe and controlled learning environments where children can experiment without the risk of damaging real equipment.

COLLABORATION AND SOCIALISATION

The use of educational robotics also promotes collaboration and socialisation among children. Many robotics activities require teamwork, where children must work together to program a robot or solve a problem together. This type of interaction helps develop important social skills such as communication, cooperation and negotiation.

PREPARING FOR THE FUTURE

Finally, the integration of technology in ECE prepares children for an increasingly technological future. Skills learned through educational robotics, such as computational thinking and programming, are essential in the modern world. By learning these skills from an early age, children are better prepared for the challenges and opportunities they will encounter in the future.

Key Concepts of Computational Thinking

Computational thinking is a set of skills that enables children to tackle complex problems by breaking them down into more manageable and solvable parts. The main concepts of computational thinking include:

- **Decomposition:** Breaking down complex problems into smaller, more manageable parts. For example, to tackle the problem of pollution, children can start by dividing waste into categories such as plastic, paper, glass and metal. This division makes it easier to understand and solve the overall problem.
- **Recognition of patterns:** Identify similarities within problems to make predictions and find effective solutions. For example, children can recognise that certain types of waste can be recycled in a similar way, which helps them predict how to deal with other similar waste.
- **Abstraction:** Focus only on important information while ignoring irrelevant details. For example, focus on collecting the most environmentally damaging waste rather than each individual piece of rubbish.
- **Designing algorithms:** Create a step-by-step solution to a problem. An example would be to create a programme for a robot that collects waste in a specific sequence, thereby optimising the cleaning process.

These concepts not only promote positive technological development, but also improve communication, collaboration, creativity and problem-solving skills in children.

Integration of Robotics with Environmental Education

Integrating robotics with EE emphasises the use of technology to enhance and not replace our interactions with the natural world. This approach helps children understand the ethical implications of using technology and promotes its responsible use. For example, through hands-on activities with robots, children can learn how technology can be used to monitor the environment, reduce waste and conserve natural resources.

Educational robotics offers a unique opportunity to teach children the value of sustainability through hands-on experiences. Children can programme robots to perform tasks that simulate environmental management activities, such as recycling and energy conservation. These activities not only teach

sustainability concepts, but also encourage children to think critically and develop innovative solutions to environmental problems.

EXAMPLES OF ROBOTICS IN EE

Educational robotics can be used in various ways to promote environmental sustainability. Some examples include:

- **Sustainable garden design:** Using robots to design and maintain a garden teaches children the sequence of directional commands and environmental management. For example, children can program a robot to plant seeds in a vegetable garden, learning the importance of urban agriculture and biodiversity.
- **Waste sorting:** Programming robots to sort objects into categories such as paper, plastic and metal. This activity teaches children about recycling and waste management, while promoting computational thinking and problem solving.
- **Environmental monitoring:** Use sensors and robots to monitor environmental conditions, such as air and water quality. Children can collect data and analyse it to better understand the impact of pollution on the environment and develop strategies to mitigate it.
- **Civic and environmental education:** Using robots and coding software to tell sustainability-related stories through storytelling to raise awareness and bring people closer to better every day environmental practices.

ACTIVITIES WITH EDUCATIONAL ROBOTICS

Activities with educational robotics can be divided into two main categories: unplugged and plugged activities.

Unplugged Activities: These activities do not require the use of real robots, but still help children understand the basic concepts of computational thinking. For example, activities such as sequencing daily routines or organising objects by colour and size can help children develop problem-solving skills without the use of technology.

- **Algorithmic thinking:** Activities such as sequencing daily routines or organising objects by colour and size help children understand the basic concepts of computational thinking without using real robots.
- **Environmentally friendly games:** Games that incorporate storytelling and physical movement to simulate environmental processes or conservation efforts.

Plugged Activities: These activities involve the use of educational robots and sensors to enhance environmental learning. For example, children can use sensors to monitor environmental conditions or automate simple tasks such as waste sorting. They can also programme robots to perform sustainability-related tasks such as planting seeds or sorting recyclable waste.

- **Sensor-based learning:** Introduce children to the sensors (e.g., touch, light, temperature) used in educational robots. Activities may include the use of sensors to monitor environmental conditions or automate simple tasks.
- **Coding for environmental interaction:** Teach children to write simple programmes that control real or virtual robots to perform tasks such as planting seeds or sorting recyclable waste.

EDUCATIONAL KITS AND SOFTWARE TO TEACH ROBOTICS AND SUSTAINABILITY

There are several educational kits and software that can be used to teach children aged 3 to 7 about robotics and sustainability. Some of the most popular include:

- **ScratchJr:** An educational software designed for children aged 5-7 that introduces basic programming concepts through a simple and visual interface. Children can create interactive stories, games and animations by combining coloured blocks of code, thus developing problem-solving skills, logic and creativity in a playful and intuitive environment.
- **Blue-Bot:** A programmable educational robot designed for preschool and primary school children that teaches basic programming and robotics concepts through an intuitive interface. Children can program Blue-Bot's movements using buttons on its back or through a software application on tablets and computers, which allows them to create sequences of commands and paths. Blue-Bot encourages learning through play, improving problem solving, logic and teamwork skills.
- **Makey Makey:** An educational electronic board that turns everyday objects into interactive touchpads, teaching children circuit and programming concepts. By connecting the board to a computer and using conductive objects such as fruit or tin foil, children can create keyboards, controllers and other interactive devices. Makey Makey's software allows them to program and customise these interactions, stimulating creativity and hands-on learning in a playful, engaging and experiential way.

ETHICAL CONSIDERATIONS

When integrating robotics into early childhood education, it is essential to consider the ethical implications. Some of the main considerations include:

- **Safety:** Ensure that educational robotics are designed for young children by prioritising safety. This includes using non-toxic materials and ensuring that robots do not have small parts that could be ingested.
- **Human interaction:** Emphasise the collaborative role of robots not as substitutes for human interaction. Robots should be seen as tools that enhance learning and not as substitutes for teachers or classmates.
- **Responsible use of technology:** Promote the use of technology for social and environmental good. Children should be encouraged to use technology in ways that benefit the community and the planet, rather than for purely recreational or consumerist purposes.

PRACTICAL ACTIVITIES FOR ROBOTICS IN EDUCATION

Hands-on activities with robotics can help children better understand the concepts of environmental sustainability. Some examples of activities include:

- **Sorting recyclable waste:** Use unplugged or digital programming with or without the aid of physical robots to sort objects into categories such as paper, plastic and metal. This activity teaches children about recycling and waste management.
- **Sustainable habits:** Programming animations that represent environmentally friendly daily habits, such as the fair and moderate use of environmental resources.
- **Bees and pollination:** Use physical or virtual robots such as Blue-Bot to explain the importance of bees for the environment and make children understand the various stages of pollination. These activities not only teach children about the importance of bees for the ecosystem, but also how technologies can be used to support and protect these important insects.

FAMILY AND COMMUNITY INVOLVEMENT

Family and community involvement is crucial to the success of education for sustainability and the use of educational robotics. Collaborating with parents and community members can reinforce concepts learned at school and promote a coherent and sustainable learning environment.

- **Community projects:** Organising activities such as cleaning parks, planting trees and creating community gardens can engage children and their families in practical sustainability activities.
- **School events:** Organising sustainability fairs, recycling days and robotics workshops to raise community awareness of the importance of sustainability and educational robotics.

- **Regular communication:** Maintain regular communication with families through newsletters, meetings and online platforms to share information on sustainability projects and provide tips on how to promote eco-friendly behaviour at home.

TAKEAWAYS

Promoting eco-friendly attitudes and behaviour through educational robotics in early childhood is an ambitious but achievable goal. By integrating technology with environmental education, we can prepare children to become responsible citizens and innovators of the future. With the support of educators, families and the community, we can create a learning environment that inspires children to care for our planet and contribute to a sustainable future.

Education for environmental sustainability and protection of the natural world in early childhood not only prepares children for future challenges, but also helps them develop a sense of responsibility and environmental awareness. Using educational robots, children can see in a concrete way how their actions can have a positive impact on the environment, while learning valuable skills for their personal and academic development.

USING EDUCATIONAL ROBOTICS FOR ENVIRONMENTAL SUSTAINABILITY

Educational robotics is a powerful tool to introduce children to sustainability concepts in an interactive and engaging way. Through unplugged and digital coding, children can develop computational thinking skills and learn to solve complex problems. This is how robotics can be integrated into sustainability education:

- **Unplugged coding:** without the use of advanced technologies, unplugged coding allows children to understand basic programming concepts through games and manual activities. For example, they can simulate the movements of a robot in a recycling route, thus learning the importance of recycling.
- **Digital coding:** using tools such as programmable robots and coding applications, children can create programmes that perform sustainability-related tasks. For example, they could program a robot to plant seeds in a vegetable garden, understanding the importance of urban agriculture and biodiversity.
- **Development of computational thinking:** educational robotics helps develop computational thinking, a set of skills that includes problem-solving, planning and logical analysis. These skills are essential for tackling environmental challenges such as natural resource management and waste reduction.

THE IMPORTANCE OF THE ANIMAL WORLD AND BEES FOR THE ENVIRONMENT: AN EXAMPLE

Animals play a crucial role in ecosystems and environmental sustainability. Among them, bees are particularly important. Bees are crucial for the pollination of many plants, including many foods that we consume daily. Without bees, many crops could not reproduce effectively, leading to a drastic decrease in biodiversity and a food crisis.

Importance of bees:

- **Pollination:** bees pollinate about 70% of global food crops. Without them, the production of fruit, vegetables and nuts would be severely compromised.
- **Biodiversity:** bees contribute to the reproduction of wild plants, supporting biodiversity and healthy ecosystems.
- **Food chain:** many animals depend on plants pollinated by bees for food. A decline in bees would have a knock-on effect on the entire food chain.

INTRODUCTION TO THE BLUE-BOT EDUCATIONAL SOFTWARE

Blue-Bot is an educational robot designed to teach children the basic principles of programming and robotics. It is particularly suitable for young children due to its simple and intuitive interface. Blue-Bot can be programmed to move in different directions using on-board directional buttons or a mobile device, helping children develop skills in computational thinking, problem solving and logic.

RECOMMENDED ACTIVITY: “THE JOURNEY OF THE BEES”

Activity description:

The activity “The Journey of the Bees” uses Blue-Bot to teach children about the importance of bees and their role in pollination. Children will programme Blue-Bot to follow a path simulating a bee’s journey from flower to flower, collecting pollen and pollinating plants.

Objectives:

- Understand the role of bees in the ecosystem and pollination.
- To develop basic programming skills.
- Promote critical thinking and problem-solving.
- Promote environmental awareness and protection of pollinating insects.
- Developing computational thinking through Blue-Bot programming.

Activity phases:

- **Introduction to bees and pollination:** Start with a brief discussion on the importance of bees and their role in pollination. Show pictures and videos of bees at work to help children visualise the process.
- **Exploration of Blue-Bot:** Introduce Blue-Bot, explaining how it works and how it can be programmed to move in different directions. Show how to use the programming interface to set motion commands.
- **Path creation:** Draw a large flower on a poster board and place small flowers along a path on the floor. The children will programme Blue-Bot to start from the large flower, collect “pollen” (simulated by small yellow objects) and take it to the small flowers along the path.
- **Programming the route:** The children work in small groups to plan Blue-Bot’s route. They plan the movements necessary for Blue-Bot to follow the correct path, collecting and depositing the “pollen” in the flowers.
- **Execution and discussion:** Each group executes the programme and watches Blue-Bot follow the path. They discuss the difficulties encountered and the solutions found to solve them. Reflection on the importance of bees and how we can help them survive.
- **Final reflection:** Conclude the activity with a reflection on what they have learnt. Encourage the children to think of ways to protect bees and other pollinators in their everyday environment, such as planting flowers that attract bees or avoiding the use of pesticides.

Conclusion

Promoting respect for the environment from an early age is very important. It builds lifelong habits, fosters empathy and responsibility, and raises awareness of the importance of natural resources. Children who are connected to nature develop a sense of responsibility for the future. Teaching sustainability to young children can be made accessible through simple language, everyday examples, visual aids, games, songs, storytelling and role-play.

This material provides examples of good practice and the contribution that can be made by educational robotics activities that integrate the topic of environmental issues. But no matter how many different methods we use, it is a well-known saying that *we should not only educate our children, but also educate ourselves, because our children will be observing us and following our example anyway*, so it could be said that the beginning of education starts with each one of us. It follows from this in Chapter 2 where it is made clear how much each of us can change if we take small steps in our daily lives towards a bigger goal. For example, reducing the amount of meat in our daily diets, taking public transport, walking or cycling, etc. instead of driving our own cars. There are many different practical actions that we can take in our own lives and share with our learners.

Chapter 3 explores a range of eco-friendly practices commonly implemented in preschools and early childhood education (ECE) centres worldwide. It serves as an inspiration for everyday sustainable activities and routines that can be incorporated into early childhood education settings. Environmental education in early childhood is crucial for fostering a sense of environmental stewardship and understanding of ecological principles. The approach is connected to the **UN's Sustainable Development Goals**.

Chapter 4 explores the innovative role of robotics in cultivating eco-friendly attitudes and behaviours among preschool children. By integrating technology with environmental education, the chapter illustrates how programmable robots can enhance children's understanding of sustainability while developing essential skills such as problem-solving and computational thinking. Practical activities, such as robotic pollinators and recycling simulations, are highlighted as effective methods for engaging young learners in environmental stewardship. Ultimately, this approach not only prepares children for future technological challenges but also fosters a lifelong commitment to caring for the planet.

In this handbook, higher education staff, preschool teachers or other interested parties can find relevant theoretical information on how environmental protection and the vision of sustainable development are being implemented in the partner countries, as well as examples of strategies to ensure a learning process in which children learn how to practise caring for the environment, ultimately becoming a responsible and compassionate generation of people committed to preserving our planet.

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GREENCODE Kit

The Erasmus+ GREENCODE “Building an Eco-Friendly Future with Robots” project developed a set of complementary resources:

- [Preparing Future Educators: Higher Education Course **Curriculum** on Robotics and Environmental Education.](#)
- [Preparing Future Educators: **Lesson Plans** – Supporting the Higher Education Course Curriculum on Robotics and Environmental Education.](#)
- [Preparing Future Educators: Digital **Handbook** on Robotics and Environmental Education.](#)
- [**Activity Book** – Educational Robotics and Environmental Education in Early Childhood Education.](#)
- [**Video tutorials**.](#)
- [Dream City: **Set of Cards** for Storytelling with Educational Robotics.](#)



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