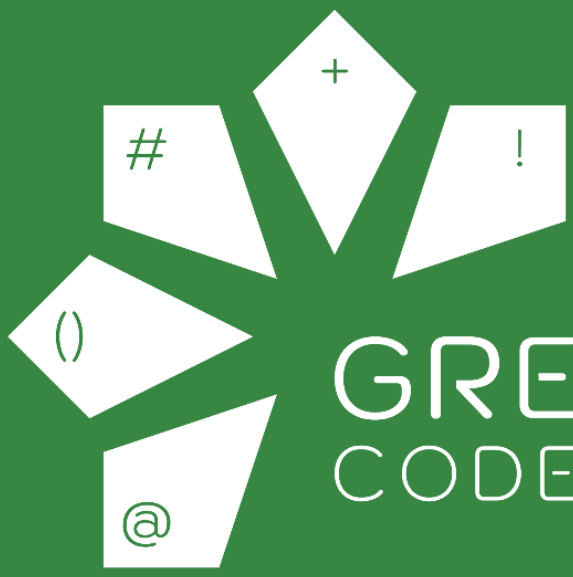

Activity Book

Educational Robotics and Environmental Education in Early Childhood Education

Funded by the European Union

Activity Book – Educational Robotics and Environmental Education in Early Childhood Education

Connected to **Higher Education Course Curriculum on Robotics Environmental Education.**

Note: Can be used separately from the Erasmus+ GREENCODE "Building an Eco-Friendly Future with Robots" *Preparing Future Educators: **Higher Education Course Curriculum** on Robotics and Environmental Education* and Erasmus+ GREENCODE "Building an Eco-Friendly Future with Robots" *Preparing Future Educators: **Digital Handbook** on Robotics and Environmental Education*, as an activity book with step-by-step instructions for teachers and printable pages for students.

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Table of contents

Introduction

Inquiry-Based Learning (IBL) is a powerful approach to education that nurtures curiosity, problem-solving, and hands-on exploration. For preschool-aged children, creating an environment that encourages questioning, discovery, and reflection is essential for building foundational learning skills. Through structured yet flexible learning experiences, children are given the opportunity to actively engage with their surroundings, develop critical thinking abilities, and gain a deeper understanding of key concepts.

The GREENCODE Activity Book is designed as a practical resource for pre-service Early Childhood Education (ECE) teachers, providing ready-made, printable activities that support the implementation of IBL, environmental education, and educational robotics in preschool settings. These materials can also serve as inspiration for in-service teachers, offering fresh ideas on how to integrate technology and sustainability into their early childhood practice.

This book explores six key topics, each focusing on a unique environmental theme while following the full IBL cycle:

1. **Planet Earth** – Everything is connected (University of Latvia): Exploring the interconnectedness of nature and fostering environmental appreciation.
2. **A city** – Encourage small steps to reduce pollution (Sveučilište u Rijeci): Raising awareness about urban pollution and promoting sustainable habits.
3. **Animals around us** – Knowing and caring for the birds in the city (Instituto Politécnico de Viseu): Observing and understanding the role of urban wildlife.
4. **Gardens** – The relationship between bees and flowers for a thriving garden (Universität Mannheim): Learning about pollination and the importance of biodiversity.
5. **My habits** – Creating eco-friendly habits (Early Years – the organisation for young children ROI): Encouraging children to adopt sustainable practices through role-play activities.
6. **Let's recycle** – Promoting recycling awareness (Mellis Eğitim Teknoloji Ticaret Limited Şirketi): Using unplugged activities and robotics to teach waste sorting.

Each topic follows a comprehensive IBL framework, which consists of multiple learning activities divided into structured sections that gradually guide children through the stages of inquiry: engaging with the topic, investigating concepts, questioning and predicting, experimenting, collecting and interpreting data, and reflecting on learning outcomes.

The GREENCODE approach values teacher autonomy, acknowledging the diverse educational systems across different partner countries. The materials have been developed with flexibility in mind, allowing

educators to adapt and modify activities based on their students' age, maturity, interests, and prior experiences. Whether working with mixed-age groups or single-age groups, teachers can customize these lessons to align with their specific learning objectives.

By incorporating a mix of plugged (robotics-based) and unplugged (technology-free) activities, the Activity Book fosters the development of computational thinking while reinforcing environmental awareness. The educational robot Reco serves as a playful guide throughout the activities, inviting children to explore topics interactively. However, educators are encouraged to adapt or replace this character according to their or the children's preferences and classroom dynamics.

The GREENCODE Activity Book is a collaborative effort, integrating ideas and feedback from teachers across multiple partner countries. The content reflects real-world classroom needs and aims to provide engaging, adaptable, and impactful learning experiences.

Disclaimer – the material contains various examples of images and activities, but the teacher can use their own images, create their own materials in line with the guidelines and specifics of Early Childhood Education in their country. When developing the materials for the Activity Book, the suggestions and teachers' ideas from the roundtable meetings across all partner countries were taken into account to ensure that the resources reflect the diverse needs and practices in each country.

Activity 1: Planet Earth

Ketlīna Tumase and Arta Rūdolfa, University of Latvia, Latvia

In this world and on planet Earth, everything is connected. One event can create a "chain reaction" and affect many other processes in nature. Before we think about what we can each do to live in a way that respects and cares for nature, we need to learn to be grateful for what nature gives us.

By introducing children to Earth's "Ecosystem cycles" and/or "Food chain", we can explain that nothing in nature is unnecessary, everything has its place and meaning. Every raindrop has a purpose and without every living being, our planet as we know it could not exist. At the end of this topic, children can conclude that every creature and object (other than man-made) in nature is necessary and that we should respect and care for everything we find in nature.

Everything is connected

Title of Activity	**Everything is connected**
Objectives	1. Identify and describe the connections between living and non-living things in nature, recognising how "Ecosystem cycles" and "Food chains" function. 2. Observe, list, and label elements in the environment and compare their roles within an ecosystem. 3. Explain the interrelationships within ecosystems by reflecting on food chains and ecosystem cycles. 4. Ask and analyse questions about the natural world to promote curiosity and awareness of the role in sustaining the environment. 5. Design and execute step-by-step algorithms for educational robots to perform tasks related to environmental concepts, enhancing computational thinking and problem-solving skills.
Materials Needed	· Simple robots (for example Bee-Bot, Photon, Code & Go Robot Mouse). · A robot mat or area on the floor that is taped out with identical rows. · Drawing instruments (pencils, crayons, gouache, watercolours, markers, etc.). · Cardboard squares, matching each robot square (where learners draw). · Various food chain resources and references (pictures, encyclopaedias, videos, etc.). · Printouts of the activity worksheets included in the lesson (see printable pages).

	· Coding cards (*optional*).
Preparation Steps	1. Plan an outdoor trip (if possible) to the nearest park or forest. 2. Provide a variety of information sources on Earth's "Ecosystem cycles" and "Food chain" – pictures, encyclopaedias, videos, etc. Review and print the provided printable pages needed for each day. 3. Become familiar with an educational robot appropriate for the preschool age – its functions, operation, and principles of work organisation. (See GREENCODE Digital Handbook, Chapter 4 – Educational Robotics and Eco-friendly Attitudes and Behaviours.) 4. Introduce the preschool educational robot to the children – its functions, operation, and the rules for working with technology.
Age Group	Children from 3 to 6 years old in mixed groups. As an IBL process, 5 to 6 years-old will more easily manage some of the steps.
Duration	Day 1 – going out into nature, observing. Day 2 – asking questions, finding and collecting information. Day 3 – visual representation of information. Day 4 – task with the educational robot. Day 5 – reflection phase: evaluation, a presentation of their work and discussion/conversation.

Recommendations for teachers

To support the idea of inquiry-based learning for preschool-aged children, it's essential to create a structured yet flexible environment where children feel encouraged to explore, ask questions, and reflect on their learning. Providing hands-on experiences, encouraging curiosity, and facilitating discussions are key. Each step in the inquiry process builds a foundation for the next by gradually increasing the complexity of the tasks and deepening the children's understanding.

Note: Teachers can create their own printable task, adapting it to their needs using one of the tools available online. For example, Maze Generator https://www.mazegenerator.net or Puzzlemaker https://puzzlemaker.discoveryeducation.com/maze.

Pre-reading for teachers

- https://climatekids.nasa.gov
- https://kids.nationalgeographic.com
- https://scied.ucar.edu/learning-zone/how-climate-works

- https://scied.ucar.edu/learning-zone/air-quality
- https://www.vedantu.com/evs/about-oxygen-cycle
- https://education.nationalgeographic.org/resource/resource-library-the-water-cycle
- https://www.bbc.co.uk/bitesize/articles/zkwgvwx#zsxrg7h

A video for teachers and/or children

- https://www.youtube.com/watch?v=cn9PhiDJp-A&ab_channel=Hopscotch (Song about global warming by Matt & Joanna Pace, in partnership with Octopus Electric Vehicles.)

IBL approach step-by-step guide

<table>
<tr><th colspan="2">Steps and actions</th><th>Teachers' role</th><th>Step-by-step guide</th></tr>
<tr><td rowspan="2">ENGAGE</td><td>OBSERVING</td><td>Directs and guides the process</td><td rowspan="2">DAY 1

Introduction of the topic

Location A: Outside. The teacher and the children go for a walk, during which they meet/re-meet the robot Reco, the story's lead character.

Location B: In the classroom. The teacher and the children sit down in the classroom for story time, during which they meet/re-meet the robot Reco, the story's lead character.

The teacher tells the children that Reco has come from the robot factory and wants to explore the planet, so he asks them different questions: Is everything connected on planet Earth? Printable page No. 1 / Printable page No. 2.

Children are then invited to look around (or at pictures) at the trees, plants, birds, insects, sky, rivers, sand and other things in the park or forest, and to share their thoughts on what they see and how they are connected.

The teacher listens carefully and follows the children's thinking. Some children may focus on Earth's "Ecosystem cycles" (like how land, air, and water are connected), while others might be more curious about smaller elements for example – the "Food chain" or how animals interact with their environment. The teacher should follow the children's interests but can help guide them by using prompting questions, such as:
Earth's "Ecosystem cycles"
· What do you think happens to the rain when it falls on the ground?
· How do the plants and flowers grow here? What do they need?</td></tr>
<tr><td>DESCRIBING</td><td>Directs and guides the process</td></tr>
</table>

<table>
<tr><td></td><td></td><td></td><td>· Earth's ecosystem cycles: What do you think they are?
"Food chain"
· How do you think the trees help the animals?
· Why do you think birds fly to different places during the year?
· What do the insects do in the park, and how do they help other living things?
· "Food chain". What do you think that is?</td></tr>
<tr><td rowspan="3">INVESTIGATE</td><td>RESEARCHING</td><td>The teacher only supports the process and the ways chosen by the children</td><td rowspan="3">DAY 2

Story Development

Story: Reco is very fond of planet Earth and would love to stay here, living in harmony and showing respect for nature around him. Following the children's interests, the teacher can choose between two different stories to explore further: one about the food chain and the other about Earth's ecosystem cycles.

a) Children are invited to listen to a story about Reco's discovery. Reco has heard about a food chain connecting all living things on Earth. Curious, he wants to understand what it means. The children are invited to help Reco learn more by exploring what a food chain is and how it links animals, plants, and people. Printable page No. 3.

b) Children are invited to listen to a story together with Reco. The story is titled "The Adventures of Little Raindrop, Gentle Breeze, and Tiny Pebble." This tale explains how the ecosystem cycles are all interconnected. It's an adventure where children can learn how elements like air, water, and land interact with each other. Printable page No. 4.

The aim of both stories is: The children are trying to understand and learn that everything in nature is connected.

Guiding Questions: Children explore these questions by considering how they can explain to Reco what a food chain or ecosystem cycle is and how it is all connected.

Children ask their questions, however the teacher can lead the way, for example by asking:
· What is the role of the food chain in nature?
· What is our role in nature?
· Can we make a path/road to demonstrate the food chain to Reco?</td></tr>
<tr><td>COMPARING</td><td>Facilitate the comparison and integration of new knowledge with prior knowledge</td></tr>
<tr><td>QUESTIONING</td><td>Encourage and support further questioning and investigation</td></tr>
</table>

<table>
<tr><td></td><td>PREDICTING</td><td>Support children in making predictions and discussing their hypotheses</td><td>· How do living beings like birds, fish, and insects need both land and water to live? Can you give Reco an example?
· How do rivers and lakes help the animals and plants that live nearby?
· What happens to a raindrop after it falls from the sky? Where does it go, and how does it help plants and animals?
· How are water, air and land connected on planet Earth?</td></tr>
<tr><td rowspan="2">CREATING</td><td>COLLECTING DATA</td><td>The teacher only supports the process and the ways chosen by the children</td><td rowspan="2">DAY 3

Activities

1. To collect data, children have the option to find answers to their questions using various sources, such as pictures, encyclopaedias, or videos provided by the teacher. Printable page No. 5 and No. 6 + suggested video.
2. To interpret the data, children work in groups to summarise the information they have learned and share it with each other, trying to answer the questions from the previous section They can represent it visually (drawing the links of the food chain or ecosystem cycles as separate pictures) with different drawing instruments (pencils, crayons, gouache, watercolours, markers, etc.) or telling their story to little robot Reco (for smaller children the teacher can offer colouring pages). Printable page No. 7.

DAY 4

3. Once the children have come up with some answers to their questions and shared with each other what they learned, each group is tasked with planning an experiment based on what they know so far. Printable page No. 8.
4. The experiment should focus on something that needs further exploration, learning, or understanding. The teacher here can support children by:
Helping the children think about what they want to explore by asking open-ended questions such as, “What would you like to learn more about?” or “How can we find out what happens when…?”
Offering suggestions based on the children’s interests while allowing them to choose their own direction.
Helping to break the experiment into simple, manageable steps. Use visuals, hand gestures, and clear instructions to help children understand what comes first, next, and last.
Providing a range of materials that are safe and suitable for the experiment.</td></tr>
<tr><td>INTERPRETING DATA</td><td>Guide the interpretation of data and facilitate discussions</td></tr>
</table>

	PLANNING EXPERIMENTS	Support children in planning and conducting experiments	Encouraging children to discuss their ideas, with the teacher supporting them by asking questions like, *"What do you think will happen if we do this?"* or *"How can we check if this is true?"* Allowing children to imitate the process but giving them the freedom to try things in their own way. After the experiment, asking children to share what they observed, using questions like, *"What did you see?"* and *"Did it happen the way you thought it would?"* Helping them connect their findings to the initial questions, reinforcing the learning process. 5. Children are invited to demonstrate what they have learned to the Reco robot by placing pictures of the food chain or ecosystem cycles on the robot mat/floor and walking through the cycle with the robot, coding it using coding cards or a device.
	EXPERIMENTING	Support and encourage experimen-tation	**Materials** · A variety of sources about the food chain or ecosystem cycles (pictures, encyclopaedias, videos, etc.). · Drawing instruments (pencils, crayons, gouache, watercolours, markers, etc.). · Cardboard squares of the same size, matching each robot square (where learners draw). · Simple robots (for example Bee-Bot). · A robot mat or robot area on the floor taped out with identical rows. · Coding cards. **Suggestions for tasks with an educational robot** 1. Children are invited to demonstrate to the Reco robot what they have learned by first placing the drawn pictures of the food chain or ecosystem cycles on the robot's mat/floor. 2. Together with the robot (in groups), plan a path so that the robot goes through the whole cycle of the food chain on any of the ecosystem cycles in the correct order. 3. Pause at each picture to allow time to say what it shows. 4. Test the robot's planned path for errors (if there are mistakes, correct them and then start again).
REFLECT	CONCLUDING	Guide and support the reflective process	**DAY 5** **Evaluation and Discussion** Assessment: Children evaluate whether their algorithms worked and discuss how well they demonstrated the food chain or ecosystem cycles

	EVALUATING	Guide and support the evaluation process	to Reco. Everyone joins together in a discussion where they answer different questions proposed by themselves or the teacher. **Possible Questions** · *What did you find most challenging in these activities?* · *What did you find most exciting?* · *What do the food chain/ ecosystem cycles teach us?* · *Is there any living being in nature that is not needed and that we could easily live without?* · *What did these activities teach us about protecting the environment?* · *How should we treat and behave towards living nature on planet Earth?* · *Why should we plant trees? What do trees give us?* · *How can we help Reco make Earth a happy place for everyone?* In the last phase, children reflect on the task with the educational robot and are encouraged to think about the future of planet Earth. They may realize that every element – air, water, land, and all living creatures – plays a vital role in maintaining the balance of nature. By understanding this, children can conclude that everything in nature is connected and needs to be cared for. They are encouraged to adopt a respectful attitude towards all living things, showing care for the environment through their actions, such as not littering, protecting trees, caring for animals (not fertilizing, not breaking trees, not squashing ants, not polluting rivers, etc.) At the end of the lessons, the children and the teacher can create a song about what they have learnt by making up the lyrics. You can use the AI tool Suno (available in several languages) to create a song – for example: Song "Tiny Planet Heroes" created in AI tool Suno.

Printable pages list

· Printable page No. 1 – Discussion
· Printable page No. 2 – Maze
· Printable page No. 3 – Storytelling – Food chain
· Printable page No. 4 – Storytelling – Ecosystem cycles
· Printable page No. 5 – Infographics
· Printable page No. 6 – Puzzle
· Printable page No. 7 – Colouring
· Printable page No. 8 – Planning an experiment

The End of 1st Activity

Activity 2: A city

Jasminka Mezak and Sanja Vranić, University of Rijeka, Croatia

Urban areas face challenges such as air, soil and water pollution. This pollution affects not only the environment, but also the quality of life for all of us. It is important to introduce children to these problems at an early age so that they understand their causes and consequences, but also to develop an awareness that they can contribute to the preservation of the environment through their daily habits and actions. Learning about pollution helps children to develop responsibility towards nature, to think creatively about possible solutions and to develop a willingness to work together to improve the environment in their city.

Encourage small steps to reduce pollution

Title of Activity	**Our Dream City**
Objectives	1. Develop an awareness of and a sense of responsibility regarding the human impact on pollution. 2. Develop an awareness of and lifelong habits to reduce air, water, and soil pollution. 3. Recognise the importance of green areas in urban environments. 4. Improve their algorithmic thinking by organizing and sequencing instructions to navigate the robot through *Our Dream City*.
Materials Needed	· Encyclopaedias, picture books, posters or video clips about pollution in urban areas. · Pictures of your city or kindergarten neighbourhood that show air, water, or soil pollution. · Drawing materials (paper squares the same size as the squares on the robot pad (mat) field, crayons and markers). · Camera or tablet for recording urban features during outdoor observations. · 3 boards or a wall surface for displaying drawings/photos. · Scissors and dice for board game. · Bee-Bot or other educational robot. · Transparent mat for robot.
Preparation Steps	· Plan a walk to the city centre and/or around the kindergarten neighbourhood. · Have some picture books or storybooks (video clips) on the topics (or create one), or use the story from Printable page No. 1.

	· Optional: provide photos of different kinds of city pollution that fit on each grid square of the Our Dream City activity. · Set up spaces for sorting drawings/photos into *"I Like It"*, *"I Don't Like It"* and *"Our Dream City"* boards. · Ensure the robot and mat/grid are ready for use. · Ensure that children are familiar with the way the selected robot will work. · Prepare board game from Printable page No. 2.
Age Group	Children from 3 to 6 years old in mixed groups. As an IBL process, 5 to 6 years-old will more easily manage some of the steps.
Duration	The estimated time is stated, but may vary depending on the children's interest: · Indoor Story and Discussion: 45 minutes. · Outdoor Observation Walk: 1.5 hours. · Follow-Up Reflection and Drawing: 45 minutes. · Sorting Drawings: 20 minutes. · Dream City Planning and Robot Activity: 1 hour. · Experiment Design and Implementation: depending on project (e.g., 1 month for tracking habits).

Recommendations for teachers

- Water pollution | Water Contamination | Video for kids
- Air Pollution | Video for Kids | Causes, Effects & Solution
- Soil Pollution || What are the causes of soil pollution || soil pollution effects
- Pollution – General Science for Kids!

IBL approach step-by-step guide

Steps and actions		Teachers' role	Step-by-step guide
ENGAGE	OBSERVING	Directs and guides the process	Indoor version: Begin by introducing the character of Reco, a friendly robot who has arrived in the city for the first time. Explain that Reco is here to learn about cities and their challenges and read the story about Reco (Printable page No. 1). After reading, engage the children in a discussion by asking open-ended questions such as: · *What did Reco notice about the city?*

	DESCRIBING	Directs and guides the process	· *What made some parts of the city dirty or less enjoyable?* · *Can you think of examples of things that make our own city dirty?* Use visual aids like photos or illustrations to help children connect the story to real-life situations. Outdoor version: A walk with the aim of getting to know your own city. Before the walk, read a story about the city and pollution in the city (Printable page No. 1). Explain the purpose of the walk: to observe their city and help Reco learn more about it. Discuss the story and encourage the children to think about their city and what they like and dislike about it. While on the walk, the teacher encourages the children to observe their surroundings and point out what they like and dislike. Depending on the resources available, the children can take photos themselves (using tablets) or the teacher can do this for them. The teacher can also write down the details of what the children point out.
INVESTIGATE	RESEARCHING	The teacher only supports the process and the ways chosen by the children	When they return to the kindergarten, the children reflect on and discuss what they have seen and highlighted. The children can draw a picture of what they like most and another of what they do not like about their city. Alternatively, if the children or the teacher have taken photos, these can be printed out and integrated into this step. The photos serve as a visual aid that allows the children to reflect on their observations and share their thoughts. For the rest of the activity, it is important that the dimensions of the drawing or photo correspond to the size of a square of the grid on which the robot moves. The children sort their drawings onto two boards: I like it (or Things We Like) 👍, I don't like it (or Things to Improve) 👎. Encourage the children to describe their drawings and/or photos and explain why they like or dislike them. Let the children take turns on the role of Reco and describe what they observe through "his" eyes. **Our Dream City – activity with robot** The children are asked the research question: *"Imagine you were building a Dream City for Reco the Robot and yourselves. What important things would you want to add from what you have seen to make it a great place to live for everyone?"* The children select up to 10 photos and/or drawings from the board "I like it" (or Things We Like) and put them on the new board "Our Dream City".
	COMPARING	Facilitate the comparison and integra-tion of new knowledge with prior knowledge	

			In the next step, children will use the drawing/photos from the board "Our Dream City" to create a city layout/map. It is assumed that the children are familiar with one of the educational robots, so they place the selected drawings under a transparent mat. The teacher introduces the children to the story and guides them: *"Now that we have designed our Dream City and chosen the things we really like, it's time for our robot friend Reco to take a walk through the city we have created! Just as we explored the city together before, Reco will now explore the drawings and photos we placed on the new 'Our Dream City' board."* The robot takes a walk, just like the children did. *"Let's see if we can guide Reco on the best route through Our Dream City!"* *"Can the robot visit all the places in one walk?"* *"How can you rearrange or remove the drawings so that the robot can visit everything?"*
	QUESTIONING	Encourage and support further questioning and investigation	*"What else is missing in your city?"* The children draw, select up to 5 more drawings and place them under the mat (e.g., parks, playgrounds, recycling bins). Discuss why these elements are important. To introduce a challenge, the teacher can choose a picture from the "I don't like it" board (or another that was prepared by the teacher before the activity) and place it in the Dream City layout to create a problem for the children to solve. It is recommended that the teacher chooses litter or another source of pollution that the children have noticed. *"Oh no! Reco has just noticed that there's a pile of trash in Our Dream City! How can we help him solve this problem?"* *"What would make Our Dream City greener or less noisy?"* Suggest that the children involve the robot in solving the problem (e.g. waste sorting and disposal in proper bins or planting trees) and complete the background of the city with the necessary elements (e.g. where is the waste disposed of?). Encourage them to draw or build the solutions (e.g., creating a small trash disposal area or adding trees to absorb noise). The children discuss the drawings they have placed on the "I don't like it" board. The teacher selects several drawings that represent a problem in the city (noise, traffic, waste, lack of green spaces, smog, plastic waste in the water, etc.).

<table>
<tr><td></td><td>PREDICTING</td><td>Support children in making predictions and discuss-ing their hypotheses</td><td>“So, there are things we don’t like in our city. How can we help to reduce the number of drawings on the “I don’t like it” board?”

The children share their thoughts about pollution issues in their city. The teacher encourages them to explore why and how soil, air and water pollution occur.

The children are asked to choose a specific topic about pollution that they would like to learn more about – perhaps something they find particularly interesting or something they know the least about.</td></tr>
<tr><td rowspan="3">CREATING</td><td>COLLECTING DATA</td><td>The teacher only supports the process and the ways chosen by the children</td><td rowspan="3">In the next step, the children are encouraged to investigate the topic they have chosen and find out how each of us can contribute to reducing pollution in the city.

The teacher provides resources such as encyclopaedias, picture books, posters or video clips on the topics of water, soil and air pollution in the city.

“Which of the following problems do we cause ourselves and is it possible for us to reduce them?”

The children choose a pollution problem that they can address and plan how they will take action to reduce it.

Based on the selected problems, the children plan activities that they can implement, for example:
· How can we reduce traffic?
· How can we reduce waste?
· How can we create more green spaces?

The teacher can support the children in planning and carrying out their experiment by guiding and facilitating the collection of information and keeping track of the frequency of activities.

For example, the teacher prepares picture-based questionnaires, which each child fills in by ticking the given categories:
· How do you travel to kindergarten (on foot, by bike/scooter, by car, by public transport)?
· Does your family separate waste (yes/no)?
· Do you care for plants (houseplants, vegetable gardens, flower gardens)?

Using the data collected, the teacher helps the children to analyse together the frequency of certain activities and habits and their impact on the city.</td></tr>
<tr><td>INTERPRETING DATA</td><td>Guide the interpretation of data and facilitate discussions</td></tr>
<tr><td>PLANNING EXPERIMENTS</td><td>Support children in planning and conducting experiments</td></tr>
</table>

	EXPERIMENTING	Support and encourage experimen-tation	The children can also play a board game (Printable page No. 2). To further support the experiment, the teacher can facilitate additional activities: · Recording the children's travel to and from kindergarten over a month. · Introducing waste separation in the kindergarten or finding creative ways to reuse materials. · Encouraging children to plant something outside the kindergarten (or indoors if there is no outdoor space available). · Helping the children to create a game where the robot replicates these activities in the Dream City model.
REFLECT	CONCLUDING	Guide and support the reflective process	Analyse the results and plan additional activities that can help reduce pollution · *What have we learned about pollution and how it affects our city?* · *Why is it important to reduce pollution?* · *What small changes can we make in our daily lives to reduce pollution?* · *What would Reco say about our city now?* · *What else could we do to make our city greener and cleaner?* Based on their reflections, consider additional activities to further improve the city, such as organizing a "Green Day" for families or expanding recycling efforts.
	EVALUATING	Guide and support the evaluation process	

Printable pages list

· Printable page No. 1 – Our City Story
· Printable page No. 2 – The Board Game

The End of 2nd Activity

Activity 3: Animals around us

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Cities are full of life, and birds are some of the fascinating creatures that share urban spaces with humans. From pigeons in the park to sparrows on windowsills, birds are all around us, yet we often overlook them. Exploring birds with children can help them develop curiosity, observation skills, and a deeper connection to the natural world – even in a busy urban environment.

Learning about birds encourages children to notice the small details in their surroundings, fostering an appreciation for wildlife and the role birds play in our ecosystem. It also introduces important concepts like habitats, food sources, and migration in a way that is engaging and accessible for pre-schoolers.

These activities will spark curiosity, support early science learning, and encourage outdoor exploration and technology integration in learning. By helping children recognize and appreciate city birds, we can inspire a lifelong love for nature, even in the heart of the city.

Knowing and caring for the birds in the city

Title of Activity	**Knowing and caring for the birds in the city**
Objectives	1. Identify common birds in their local environment (e.g., pigeons, sparrows, robins, crows). 2. Find similarities and differences between birds and other animals. 3. Ask and answer questions about bird behaviour and habitats. 4. Express inquiry findings through art, role play, and storytelling. 5. Gain awareness of scientific methodology: question, hypothesise, look for answers, experiment and collect data, analyse information, draw conclusions and communicate. 6. Manifest concern and respect for nature and the environment. 7. Recognise and mobilise technological resources for inquiry. 8. Use educational robotics to express knowledge and attitudes towards birds.
	· Simple robots (for example Bee-Bot, Photon, Super DOC & Go Robot Mouse). · A robot mat or area on the floor that can be expanded with more cells as needed. · Drawing instruments (pencils, crayons, gouache, watercolours, markers, etc.).

Materials Needed	· Recycled and reusable materials that allow 3D constructions (egg cartons, milk cartons, yarn, cans, card boxes, etc.) and tools for building (scissors, glue, staplers, Hot Glue Gun Kit, etc.). · Various information sources about birds (see below suggested websites, books, magazines, encyclopaedias, children's literature books, etc.). · Printouts. · Outdoor camera. · Binoculars. · Mobile phone or tablet or laptop. · Possibility of printing photos. · Video editor: Open Broadcaster Software | OBS or iMovie, or similar. · Sound recorder and editor: Audacity, or similar.
Preparation Steps	1. Observe the playground and spaces around the ECE centre/kindergarten to identify birds that are visible. 2. Provide a variety of information sources on birds from your country – websites, pictures, encyclopaedias, videos, etc. – and from the world. Identify the ones that are visible in the city you live in or close by. 3. Read through GREENCODE Digital Handbook Chapter 3 – Eco-friendly Practices in Early Childhood Education and GREENCODE Curriculum Module 3 – The Importance of Outdoor and Indoor Activities for Environmental Education in ECE. 4. If not done before, become familiar with an educational robot appropriate for the preschool age – its functions, operation, and principles of work organisation. Read GREENCODE Digital Handbook Chapter 4 – Educational Robotics and Eco-friendly Attitudes and Behaviours. 5. If not done before, introduce the educational robot to the children – its functions, operation, and rules for working with technology. This works best if done through self-oriented activities like play. 6. Become familiar with the apps for identifying birds that are suggested below.
Age Group	Children from 3 to 6 years old in mixed groups. As an IBL process, 5 to 6 years-old will more easily manage some of the steps.
Duration	Two to three weeks.

Recommendations for teachers

1. Learn which birds are likely to exist in the city where you live and their names and features:

   European Birdsong https://www.birdingplaces.eu/pt/find-a-bird?birdlist=2

   Portuguese birds https://www.avesdeportugal.info/indice-por-nomes-portugueses

2. Get acquainted with apps that support birdwatching and identification:

   2.1. Apps for identifying birds from images and/or sounds:

   Picture Bird – Bird Identifier

   https://play.google.com/store/apps/details?id=com.glority.picturebird

   Merlin Bird ID by Cornell Lab

   https://play.google.com/store/apps/details?id=com.labs.merlinbirdid.app

   2.2. App for recording sighted birds with a global online database:

   eBird by Cornell Lab https://play.google.com/store/apps/details?id=edu.cornell.birds.ebird

3. If there is no camera in the ECE centre/kindergarten, use these live cams videos for observation:

   3.1. Camera in Nest: from nesting to fledging

   https://www.youtube.com/@nestboxcam-loughborough/videos

   3.2. Several Feeder cameras

   https://www.youtube.com/@NatureTec/videos

   https://www.youtube.com/watch?v=_IAZ36j_l5U

   3.3. Several Bird Cams from Europe

   https://www.mangolinkcam.com/webcams/birds/feeders-europe.html

4. Other resources:

   4.1 Videos about birds

   https://www.youtube.com/@LesleytheBirdNerd/videos

   4.2 Bird's sound video

   https://www.youtube.com/watch?v=lNB8iwiQb9k

   4.3 Information about birdwatching

   https://en.wikipedia.org/wiki/Birdwatching

   4.4 Children's literature books about birds (in English)

   https://pocketofpreschool.com/bird-books-for-little-learners/

IBL approach step-by-step guide

Steps and actions		Teachers' role	Step-by-step guide (Robotics and Nature Combined Approach)
ENGAGE	OBSERVING	Directs and guides the process	**DAY 1** While outside (in the playground or on a nature walk), pay attention to birds and share reactions and thoughts about them out-loud.

	DESCRIBING	Directs and guides the process	Support and feedback on children's engagement with the topic. If possible, photograph birds that have been seen or at least list their features, so it is possible to search for them later on. When indoors, share the photographs that were taken or through the description find photographs of the birds on websites and print them out. Create a display on the wall or on a table about the birds we have spotted. Explore the idea *"How do we know they are birds?"* to explore children's concepts about birds and their distinct features. Based on children's ideas, explore the larger question *"What do we know about birds, and how they live?"* Begin with open-ended questions: · *What birds have you seen around here? Do we know their names?* · *What do you know about birds?* · *Why do you think birds fly?* · *Where do birds sleep?* · *Why do birds sing?* · *How do birds have babies?* · *Do all birds eat the same?* Register children's ideas and further questions. Use the Printable page No. 1 to register the questions. Communicate to families and caregivers about the IBL Birds activity so they can collaborate throughout the process.
INVESTIGATE	RESEARCHING	The teacher only supports the process and the ways chosen by the children	**DAYS 2 TO 7** Ask children how we can learn more about birds. Show pictures and videos of different birds (e.g., robins, pigeons, owls) to stimulate conversation and curiosity. Make books and encyclopaedias available. (If possible, install a feeder with a camera in the playground so that children will have data of their own about birds. If not possible, use the live webcams available online.) Children can form small groups and go through the material looking for information but also marking favourite birds, new knowledge, etc. Create moments for sharing between groups. This should be done after each period of research. Children can register their findings by drawing, audio recordings, writing (made-up or with the adult's support), photocopying pages of books, etc. There are some printables to support
	COMPARING	Facilitate the comparison and integra-tion of new knowledge with prior knowledge	

			children in registering information, but you can create your own or have children make suggestions for them (Printable page No. 1). Different children can have access to the same material on different days. It's important to communicate findings and document them together. This can be done through the wall display or on a table made available for the inquiry. The wall or table display can be organised according to the questions that are being pursued plus other categories that children suggest. Overlapping categories should be questioned by the adult so that a clear organisation of the information is shared by all. After a few periods of research and sharing, suggest that the information is analysed and a display created with the findings so that it is clear what information is now known. This can be done physically or digitally. A collective bird book can be created with details about the birds that the children know about. There is a template of a printable for the bird book (Printable page No. 2).
	QUESTIONING	Encourage and support further questioning and investigation	**DAYS 8 TO 11** After children articulate their findings, bring the discussion around to birds in cities. Some children might have touched upon birds in cages/houses during the research; if not, introduce the topic to discuss it. Question about differences between birds living in cages vs nature. Discuss how humans like birds, and why they like birds, and ask about ways to enjoy birds without taking away their freedom. If children haven't encountered it, introduce the concept of birdwatching. Using websites and books about birdwatching and bird photography, support children's questions and investigation about the topic. As children find out more about birdwatching, show them and their families the apps for identifying birds and registering bird sightings. Discuss with children if they think they can see birds in the city or in nature areas around it. Take note of these ideas and questions so they can be checked on later. Get the children, with your support, to write to their families about a plan to go birdwatching. There is a suggested invitation as a printable (Printable page No. 3). Encourage families to go out into nature to observe birds, record sounds, and take photographs. If possible, take a nature walk with the children to observe birds in their natural habitat. Have children look for birds in trees, on the ground, or

	PREDICTING	Support children in making predictions and discussing their hypotheses	flying in the sky. This is a good opportunity to use the binoculars. Register the bird's sightings. Create a wall display of photos of children birdwatching and of the birds that have been sighted (Printable page No. 4). Discuss what birds they think will be sighted and the ones that won't and why. You can use the printable or create your own design to keep track of sightings (Printable page No. 5). (If it is not possible for families to go birdwatching, use the websites and the app to show children birds that are sighted near them.)
CREATING	COLLECTING DATA	The teacher only supports the process and the ways chosen by the children	**DAYS 12 TO 17** By looking at the wall display, it should be possible to see a variety of birds. Going back to the first investigation, draw out the common features of birds: feathers, beak (toothless beaked jaws), the laying of hard-shelled eggs, wings, and a strong yet lightweight skeleton (that allows some of them to fly). Highlight how some commonly associated features aren't true to all birds (penguins, ostriches, emus, and kiwis don't fly; some birds can swim). You can use the printable for organising this information (Printable page No. 6). What bird would they create? Ask children to draw their ideas. Check throughout the process that the designed characters have the features of a bird. Suggest that children think of details like habitat, sounds, nesting, diet and feeding, migration, flocking, relationship with humans, etc. (Printable page No. 7). Encourage children to share their designs (individual or pairs) and discuss them together and suggest further development of each bird. Make sure children use the inquiry findings and the sources that started the process in the investigating phase. Based on the enthusiasm and detail of the designs, suggest creating their birds in 3D using different types of materials. Provide a range of materials and support the children to create the 3D version of their bird. Groups can bring more materials from home, nature walks, etc. Natural materials can enhance the creation of nests, feeders, small puddles or bird baths, trees,
	INTERPRETING DATA	Guide the interpretation of data and facilitate discussions	

	PLANNING EXPERIMENTS	Support children in planning and conducting experiments	etc. Make a list of the variety of elements that could be made from these materials and ask for volunteers to create them. When there are enough birds and elements, collect them and ask for suggestions on how to showcase the creations to families, other children, the community, etc. If children are interested, suggest doing a video invite by placing the birds and elements on a mat (representing a park or flower bed or another natural habitat) and having the robot visit as a birdwatcher. Be sure that the mat is big enough to place all the birds on it and suggest distributing them on the margins and in the centre, leaving one corridor to circulate around. The corridors need to have the grid visible to make the programming easy. With the children, decide how to make a visit to the habitat. Have the children create routes for the robot and programme and test them. When they are happy with it, video record the "visit" with a mobile or tablet. Have the children record some narration of the visit and add sounds to it. Edit the videos as an invitation for the families/other groups to join the children in learning about these new birds.
	EXPERIMENTING	Support and encourage experimen-tation	
REFLECT	CONCLUDING	Guide and support the reflective process	Prepare the classroom (and outdoor space if possible) for the visitors. Review the displays and ask children to volunteer to show them to whoever comes to learn about the project on birds. Prepare the mat with some elements and birds and the robot to guide the visitors. Again, ask some volunteers to take over that task. The creators of each bird should also be prepared to talk about their character. The preliminary designs and documentation of the production can be made available as a display. As a group, discuss what has been learned about birds, if children enjoyed the process and what they have enjoyed the most. Ask visitors to share their own experiences with birds (Printable page No. 8). List ideas for further inquiring about birds – or about other animals that live in the city. Encourage children to keep a "Bird Journal," where they can draw pictures, write words, and record the types of birds they see.
	EVALUATING	Guide and support the evaluation process	

Printable pages list

- Printable page No. 1 – Researching about birds
- Printable page No. 2 – Bird ID
- Printable page No. 3 – Invitation to families/caregivers

- Printable page No. 4 – Birdwatcher
- Printable page No. 5 – Tally and Checklist
- Printable page No. 6 – Birds we know
- Printable page No. 7 – Design of a new bird
- Printable page No. 8 – Activities for the visitors

The End of 3rd Activity

Activity 4: Gardens

Jan Delcker, University of Mannheim, Germany

Gardens are a great place to relax and to enjoy nature. Additionally, they can provide us with healthy food. They are a habitat for lots of different plants and animals, from big trees to tiny blades of grass, from birds to ants and other small insects. The growth of plants and their ability to spread, grow and produce foods like vegetables or fruits is highly dependent on the relationship between insects and flowering plants. Bees play an important role for the process of pollination. This activity focuses on this special relationship.

The relationship between bees and flowers for a thriving garden

Title of Activity	**The relationship between bees and flowers for a thriving garden**
Objectives	1. Understand the relationship between bees and flowering plants. 2. Code robotic movements on paper and using the educational robot. 3. Adapt simple algorithms to specific tasks.
Materials Needed	· Bee-Bot. · Pencil, paper for drawing. · Camera, tablet, phone for photos. · Pictures of local plants and insects. · DIN-A2 posters with a 6x2 grid (14.5 x 14.5 cm squares). · A variety of paint colours (3-6 colours).
Preparation Steps	· Teachers research some basic knowledge about bees, especially pollination and its influence on the environment. · To ensure a safe learning environment, make sure that the field you are exploring (Step One) does not contain any harmful plants. · Familiarize yourself with local plants and insects. · Familiarize yourself with the basic functions of Bee-Bot (see GREENCODE Digital Handbook, Chapter 4 – Educational Robotics and Eco-friendly Attitudes and Behaviours).

Age Group	Children from 3 to 6 years old in mixed groups. As an IBL process, 5 to 6 years-old will more easily manage some of the steps.
Duration	Engage: 1 day. Investigate and Reflect: 2 days.

Recommendations for teachers

Make yourself familiar with the basic functions of the Bee-Bot and get a general knowledge about bees, as well as how they affect flowering plants. Use documentation techniques like videos, photos or work examples from the children for parallel documentation. The media pieces can help children to remember what they did in a previous step and it is useful to guide the conclusion and evaluation process at the end of the IBL cycle.

IBL approach step-by-step guide

Steps and actions		Teachers' role	Step-by-step guide
ENGAGE	**OBSERVING**	Directs and guides the process	Take the children to a local beekeeper, your centre/kindergarten's garden or a flower field nearby. One of the main goals of this activity is for children to have a multisensory experience of this special part of nature and exploring nature with all their senses. This goal can be achieved by activating the children's sensory organs through a number of playful exercises. Observation: Let the children observe the different plants and animals. Make them aware of the different insects and let the children describe what they see. For plants, focus on the different parts of the plants – the shape of leaves, the size of the plant or the way they grow. For insects, focus on colours, their ability to move around, size or the number of legs. Examples of basic questions and prompts: · *What colour is that bug?* · *How many legs does this insect have?* · *Look at this plant. Can you find another one that looks exactly like this?*

	DESCRIBING	Directs and guides the process	· *Which colour is that flower? Can you find one of a different colour?*
			· *Which is the biggest flower you can find? Can you show me a very small one?*
			· Let children find similar plant features:
			  · pointy leaves/round leaves,
			  · small leaves/large leaves,
			  · growing tall/growing wide,
			  · blossoms/doesn't blossom.
			· Let the children find similar insect features:
			  · long shape/round shape,
			  · many legs/fewer legs,
			  · colourful/few colours,
			  · ability to fly/doesn't fly,
			  · jumps/doesn't jump,
			  · moves fast/moves slow,
			  · small/big.
			
			You can enhance this activity by:
			a) Bringing a camera or tablet for the children to document what they found by taking photographs. Take videos of moving insects.
			b) Preparing (digital) pictures of local plants and insects. Let the children search for them. You can also provide pictures of things children will not find (e.g. a picture of a lion). See Printable page No. 5 for some examples.
			c) Bringing pencils and paper and letting the children draw their favourite plant or insect that they found.
			
			Listen: Let the children stand in a circle, close their eyes and listen to the surrounding sounds for a short amount of time. Let them describe the sounds they can hear, such as the wind, rustling of leaves, humming of bees, clitter etc.
			
			Smell: A field of flowers can be explored through the different smells of flowers and plants. You can increase the smells by rubbing different parts of plants in your hands and smelling different flowers.
			
			Feel: Children will touch the grass and the plants in the field while they are exploring it. You can enhance this experience by actively asking them about the temperature of different places (a sandy patch will have a different temperature than a place under a tree) and the texture of different plants. Some are harder and stiffer or covered in thorns, while others are softer, covered with fine hair or have a very smooth surface.

			Show the children the Bee-Bot (pre-programmed with some basic moves) and let them describe the characteristics of bees and the robot. They can use their senses again to get a feeling for the robot. Its surface is smooth and cold, the movements are stiff, it makes a distinctive sound when moving. If it is not moving on a smooth surface (bring the Bee-Bot map).
INVESTIGATE	RESEARCHING	The teacher only supports the process and the ways chosen by the children	Let the children taste some honey and explain that it is made by bees (don't explain how it is done). Introduce the children to the beekeeper and what his job is. Let the children watch the beekeeper go through the steps of making honey. Naturally, the children will ask questions at different parts of the process if they do not understand something. If the children are too shy, you can use some prepared questions to encourage children in their research. The beekeeper should be asked those questions, not the children. In this way, you will act as a positive researcher role model: · *How often can we harvest honey?* · *How many bees does it take for a glass of honey?* · *Which flowers are most important for honey?* · *Do the bees need to go to the doctor if they are sick?* · *How do the bees know where to go?* · *How do bees tell other bees where to go?* The last 2 questions are very important to transition to the next activity. As bees use two different dances (Waggle Dance, Round Dance) to communicate, a connection to the Bee-Bot and its movement can be drawn. Let the children compare the movements of bees in the fields with the bees' intention to produce food for their offspring. They are targeting flowering plants, fly back to the hive and produce food from pollen. Let the children paint coloured flowers on the prepared map (Printable page No. 6), comparable to what they saw in the field. Alternatively, you can use Printable page No. 4 for a pre-coloured map. The task is to create an environment where a Bee would find a lot of flowers for pollen to produce food.
	COMPARING	Facilitate the comparison and integration of new knowledge with prior knowledge	
	QUESTIONING	Encourage and support further questioning and investigation	Encourage the children to ask questions about the specific production steps and how they move from plant to plant (Is it random? Do they target specific colours/plants?). Show the children a video of the Wiggle Dance and the Round Dance (e.g. here or here). The dances are known by

	PREDICTING	Support children in making predictions and discussing their hypotheses	each bee. Just as a bee, the Bee-Bot is able to move around and has a set of known movements (the programming of the bot). Give the children a coding scheme (Printable page No. 1) to programme the Bee-Bots. Let them predict which coloured field the robot will end on (use the coloured map, Printable page No. 4). Encourage them to change the programme to see how the movement changes.
CREATING	COLLECTING DATA	The teacher only supports the process and the ways chosen by the children	Watch the videos of the moving insects that you took on the field trip. The children already collected their data in nature. They can do the same with the Bee-Bot now: Let the Bee-Bot move over the field (you can programme them first and then let the children change the code). Let the children collect data about the way the code and the programming guides the robot. You can challenge them by making a video where the Bee-Bot: a) Moves over all fields. b) Go around in a circle. c) Moves over all fields and goes back to the start. d) Moves over all fields and goes back to the start the same way it came. e) Place a specific flower on the map, find the shortest way to the flower and go back to the hive (start). Help the children interpret the connection between code and movement. Discuss if there might be errors in the code and what changes could be made. Let the children experiment with changes in the code and observe the influence these changes have on the movement of the robot. The children should always draw the code first (Printable page No. 2) by drawing each step as a simple arrow (↑, ↓, ←, →). You can also use the printable arrows (Printable page No. 3) for a visual representation of the code. Creating a visual representation of the code is an important part of working with the Bee-Bots, as the robots themselves do not present the programmed code visually. There are multiple ways to support children's interpretation of the code, which should be adapted to their prior knowledge and skills: Easy: The children programme the code into the Bee-Bot and let it run. Afterwards they compare whether the robot achieved the goal or not. If there is a mistake, the children draw a new code and let it run again.
	INTERPRETING DATA	Guide the interpretation of data and facilitate discussions	
	PLANNING EXPERIMENTS	Support children in planning and conducting experiments	

	EXPERIMENTING	Support and encourage experimen-tation	Medium: The children programme the code into the Bee-Bot and let it run. If there is a mistake in the planned path, the children instantly pause the robot and try to find the place in the code where the error occurs. Hard: The children discuss their codes in pairs, deciding whether a code (or both or none) will let the Bee-Bot land on the right field. After the discussion, the code is tested. If there is an error, the children work together to find the error in the code and run the code again. These described steps can be adapted, and a mixture of the steps can be applied, depending on the skills and competences of the children.
REFLECT	CONCLUDING	Guide and support the reflective process	Support the children in concluding the similarities and differences between robots and real bees. Take the children through the different activities and reflect on what they learnt during the work with the bees and the Bee-Bot. You should focus on some important aspects to underline the role of bees in nature: · The children have seen that bees fly from flower to flower, collecting nectar to make honey and spreading pollen, which helps plants grow fruits, vegetables, and seeds. · Because of their behaviour, we see beautiful fields of flowers (you can use the pictures/videos/drawings from the previous steps). · Bees work together, just as the children did when finding plants and insects on the field or programming the Bee-Bots. What else would the children like to know? Which steps of the process were unclear and need revision? What part did the children like best?
	EVALUATING	Guide and support the evaluation process	

Printable pages list

- Printable page No. 1 – Coding Scheme
- Printable page No. 2 – Coding Scheme Layout
- Printable page No. 3 – Printable Arrows for the Coding Scheme
- Printable page No. 4 – Simple Bee-Bot Map (A2 format)
- Printable page No. 5 – Example Pictures for local Flora & Fauna
- Printable page No. 6 – Table

The End of 4th Activity

Activity 5: My habits

Mary O'Reilly and Noletta Smyth, Early Years – the organisation for young children ROI, Ireland

Composting is nature's way of recycling! Think of compost as an upmarket rubbish pile that must be sorted in a particular order and occasionally the ingredients must be stirred up. Once children have a good understanding of what can and cannot go into the compost bin and get the balance right then they will be able to produce rich compost that can help grow plants in the spring and enrich the soil around us. Not only that but it will provide a great habitat for some minibeasts like insects and worms. This is a very productive habit to instil in children from a very young age.

Creating eco-friendly habits

Title of Activity	**Creating eco-friendly habits: role-play activities**
Objectives	1. Develop lifelong habits to protect the earth. 2. Understand the basic concept of recycling food waste and composting. 3. Be able to explain the composting process and the role of robots in recycling. 4. Develop an awareness of the importance of recycling food waste and how technology can assist this process.
Materials Needed	· Short video on recycling food waste Make the Most of Compost! · Stories and books on food waste and composting. · Compost Stew Story Book – An A to Z Recipe for the Earth by Mary McKenna. · Poster on composting – example. · Green Materials – various food scraps (fruit peels, apple cores, vegetable scraps). · Brown materials – leaves, cardboard, twigs, straw. · Composting materials (soil, worms, compost containers). · Drawing materials (paper, crayons, markers). · Magnifying glasses. · Programmable robot. · Local community garden centres and vegetable gardens to visit.
Preparation Steps	· Read up on composting for children. · Have a supply of reference and story books available on the subject. · Keep the activities hands-on and interactive to maintain engagement.

	· Plan visits to garden centres and community food gardens. · Use age-appropriate language and visuals. · Encourage questions and curiosity throughout the process. · Ensure the robot activities are simple and safe for young children to handle.
Age Group	Children from 3 to 6 years old in mixed groups. As an IBL process, 5 to 6 years-old will more easily manage some of the steps.
Duration	Each section of IBL approach is planned over 1 week with the ECE day. This will be a continuous activity throughout the ECE year.

Recommendations for teachers

Reference and Story Books on food waste and composting for children.

Pre-reading for teachers

- https://learn.eartheasy.com/guides/composting/#howtocompost
- https://www.kidsdogardening.com/how-to-start-composting-with-children
- https://www.natgeokids.com/uk/parents/how-to-compost-with-kids

What to put in your compost bin

Grass clippings, cardboard (shredded), leaves, vegetable peelings from the kitchen, apple cores, coffee grounds, wood shavings/sawdust, standard printer paper.

What NOT to put in your compost bin

Any meat products, dairy products, animal waste, plants that have a disease, weeds that have produced seeds, charcoal or coal ash from a fire indoors.

Getting the balance right – Green and Brown waste

The two main ingredients that go into a compost bin are defined as brown and green waste. When adding waste to your compost bin, you need to get the balance right, otherwise the mixture won't be the right consistency to create that magic. Ideally, you will be looking to add 25 to 50% green material, with the remainder being brown material. Anything over 50% green can turn your compost rather sludgy and not so nice to use.

IBL approach step-by-step guide

<table>
<tr><th colspan="2">Steps and actions</th><th>Teachers' role</th><th>Step-by-step guide</th></tr>
<tr><td rowspan="2">ENGAGE</td><td>OBSERVING</td><td>Directs and guides the process</td><td rowspan="2">Week 1

Start by reading the story 'Compost Stew' and/or show the short, engaging video to spark curiosity and interest in food recycling and composting with the children.

Through the ensuing conversation, teachers can assess children's interest and knowledge of food waste and what happens to it. The children can get involved by sharing their own experiences from home or from the ECE centre about what happens to food waste.

Plan a visit to a garden centre or community food garden to see how compost is made and used for growing food and plants.

Invite gardeners or some of your parents in to talk to the children about looking after plants and growing vegetables.

Pose a research question based on children's interests – e.g.
· How can we make compost stew?
· What do we need?
· Where will we get our ingredients?

Use the poster for reference Printable page No. 1.</td></tr>
<tr><td>DESCRIBING</td><td>Directs and guides the process</td></tr>
<tr><td rowspan="2">INVESTIGATE</td><td>RESEARCHING</td><td>The teacher only supports the process and the ways chosen by the children</td><td rowspan="2">Week 2

Allow children to investigate and gather information about food waste and composting. Children can research using books and stories provided and asking questions about food and vegetable scraps, coffee grounds, teabags, eggshells, grass clippings, feathers.

Children sort out the food waste into the different stations (e.g., fruit peels, vegetable scraps) and composting materials (e.g., soil, compost bin). Using Printable page No. 3, children can colour in the cards for this activity.

Bring the children outside for a nature scavenger hunt to gather a range of brown items- (leaves, woodchips, flowers, etc.) and have children search for them outdoors. Printable page No. 1.

Where will we find the other BROWN ingredients? (Shredded paper, newspaper, straw, cardboard etc.)</td></tr>
<tr><td>COMPARING</td><td>Facilitate the comparison and integra-tion of new knowledge with prior knowledge</td></tr>
</table>

	QUESTIONING	Encourage and support further questioning and investigation	Then discuss the type of food waste – GREEN items that goes into a compost bin. **Plugged Activity** Use the robot Reco as a "helper" in the board game that will go and help the children retrieve materials, again in the form of cards, scattered around the field which will then have to be taken to the right section (green or brown). On the board, children can consolidate their knowledge and skills in recognising and separating waste into the correct category. Printable page No. 2 and Printable page No. 3. Demonstrate: Show children how composting works. Experiment using 2 types of containers to see what happens. Use a sealed container: Have children pack green materials tightly into a sealed container. Use a container with air holes: Have children put green materials plus brown materials in a container with air holes. Compare decomposition: Watch which container decomposes first. What goes in and what does not go into the compost bin and why. Encourage children by asking questions like: · *What happens to food scraps when we compost them?* · *Why do we need holes in the compost bin?* · *What do you think would happen if …?* · *What else can we try?* · *How can the robot Reco help us sort the food scraps?* **Unplugged Activity** 1. Children make cards with the various steps for getting good compost drawn on them or, 2. Think about the sequences of actions that will need to be performed. Printable page No. 4 Have children predict what will happen to the food scraps over time in the compost bin. What could speed up this process? Introduce the idea of adding worms and insects. Consider what we can use the compost for in our garden. Collect information on the types and amounts of food scraps collected – compostable and non-compostable. Have children record their observations and data. Help them to identify patterns or trends. The children can analyse the collected data, plan further research or experiments and interpret the results.
	PREDICTING	Support children in making predictions and discussing their hypotheses	

			Use the magnifying glasses to observe the insects in the compost bin. The teacher guides their analysis by asking: · *How do you want to do it?* · *Is there anything else you could use or not use?* · *Why did you decide to try it?* · *Why do you think it will work?* · *Where can you get more information?* · *How do you know…?* Set up a composting experiment. Remember what can and cannot be composted, and how composting turns food waste into nutrient-rich soil. Have children add layers of soil, newspaper, kitchen scraps, dead leaves, and grass clippings to jars. Add rainwater, cap the jars, and poke holes in the lids for oxygen. Place the jars in a sunny windowsill and mark the top of the ingredients. Every two weeks, mark the new top and label it with the date.
CREATING	COLLECTING DATA	The teacher only supports the process and the ways chosen by the children	**Week 3** Collect information on the types and amounts of food scraps collected – compostable and non-compostable. Have children record their observations and data. Help them to identify patterns or trends. The children can analyse the collected data, plan further research or experiments and interpret the results. Use the magnifying glasses to observe the insects in the compost bin. The Bee-Bot Reco can go and study the insects inside the compost. Children could also decorate the Bee-Bot to become one of the insects they found in the compost. The teacher guides their analysis by asking: · *How do you want to do it?* · *Is there anything else you could use or not use?* · *Why did you decide to try it?* · *Why do you think it will work?* · *Where can you get more information?* · *How do you know…?* Set up the composting experiment. Remember what can and cannot be composted, and how composting turns food waste into nutrient-rich soil.
	INTERPRETING DATA	Guide the interpretation of data and facilitate discussions	
	PLANNING EXPERIMENTS	Support children in planning and conducting experiments	

	EXPERIMENTING	Support and encourage experimen-tation	Have children add layers of soil, newspaper, kitchen scraps, dead leaves, and grass clippings to jars. Add rainwater, cap the jars, and poke holes in the lids for oxygen. Place the jars in a sunny windowsill and mark the top of the ingredients. Every two weeks, mark the new top and label it with the date.
REFLECT	CONCLUDING	Guide and support the reflective process	**Week 4** Assess their understanding and reflect on their learning. Have children draw pictures showing the composting process and how the robot Reco helped. Ask children through open ended questioning to explain what they learned about recycling food waste and composting, and why it's important. Children could use Reco to make up their own story about composting. For reflection and discussion ask questions such as: · *What did you notice about…?* · *What do you conclude from this?* · *If you had to do it again, what would you change?* · *What would happen then?* Discuss how using robots made the process easier or more fun. Encourage children to think about other ways robots could help us create other eco-friendly habits. Think about saving energy – switching off lights and electronic devices when not in use. Not wasting water by leaving it running while washing face or teeth. Collecting rainwater to water plants or clean pathways. Reusable towels and kitchenware.
	EVALUATING	Guide and support the evaluation process	

Printable pages list

- Printable page No. 1 – Compost Poster/Flyer
- Printable page No. 2 – Board for Compost Game
- Printable page No. 3 – Compost Cards for Board Game
- Printable page No. 4 – Composting Steps/sequence

The End of 5th Activity

Activity 6: Let’s recycle

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Recycling is a process of producing new products from old and used materials. This process helps reduce the energy used to make new materials and the waste of potentially useful materials. Recycling is a part of the waste management hierarchy: Reduce, Reuse and Recycle, which nowadays has been redefined into 7 phases: Rethink, Refuse, Reduce, Reuse, Repair, Re-gift, and Recycle, allowing for a much more nuanced and thoughtful approach to waste management.

Wrong recycling habits can affect the environment and recycling system negatively. Especially, throwing non-recyclable items into recycling bins and contaminating recyclable materials with food waste can cause significant harm. Encouraging children to adopt proper recycling habits from the early years is of vital importance for our future.

Recycling adventure

Title of Activity	**Recycling adventure**
Objectives	1. Understand the meaning of the term ‘recycling’, identify recyclable materials, and explain reasons for waste segregation. 2. Sort recyclable and non-recyclable items, perform sorting tasks, and investigate recyclable materials in the environment. 3. Program a robot to sort materials and apply problem-solving strategies to create sorting algorithms. 4. Collect and analyse data on recyclable materials and categorise them accordingly. 5. Analyse sensory data to determine the material composition of collected samples. 6. Collaborate with peers while completing recycling-related games and tasks, improving teamwork and strategy development. 7. Develop new ideas for improving future recycling practices. 8. Reflect on recycling issues, waste management practices, and making responsible environmental decisions.
Materials Needed	· A programmable educational robot suited for ECE. · Coloured recycling bins.

	· Recyclable and non-recyclable items: a) Recyclable materials: Aluminium cans, plastic bottles, glass jars, steel cans, paper, cardboard, batteries. b) Non-recyclable materials: Plastic bags, coffee cups, bubble wrap, straws, foam packaging, and certain food waste. · Picture books or visual charts with recycling symbols and images of recyclable items. · Coding Map. (The length of each square edge should be equal to one movement of the Reco, the robot.) · Tape. · Sheets for children to record data. · Safety gloves.
Preparation Steps	· Read some information on recycling and learning activities about recycling in ECE · Provide videos, story and picture books on recycling. · Allow children to engage with the subject and inquire about recycling by encouraging them to ask questions. · Plan visits to landfills and other environments. (Ensure safety conditions are met.) · Use age-appropriate language and visuals. · Start from simple tasks towards more difficult ones while interacting with the educational robots.
Age Group	Children from 3 to 6 years old in mixed groups. As an IBL process, 5 to 6 years-old will more easily manage some of the steps.
Duration	6 days. Day 1 – Starting in the classroom, going out into landfills, observing. Day 2 – Researching, robotic coding activities. Day 3 – Questioning, predicting. Day 4 – Data collection and interpretation. Day 5 – Experimenting, robotic coding activities. Day 6 – Reflecting.

Pre-reading for teachers

- https://www.twinkl.ie/blog/how-to-explain-recycling-to-preschoolers
- https://happytotshelf.com/recycling-activity-for-preschoolers
- Storybooks.
- Ada's Violin: The Story of the Recycled Orchestra of Paraguay by Susan Hood.

· Flipflopi: How a Boat Made from Flip-Flops Is Helping to Save the Ocean by Dipesh Pabari & Linda Ravin Lodding.

IBL approach step-by-step guide

<table>
<tr><th colspan="2">Steps and actions</th><th>Teachers' role</th><th>Step-by-step guide</th></tr>
<tr><td rowspan="2">ENGAGE</td><td>OBSERVING</td><td>Directs and guides the process</td><td rowspan="2">Day 1

Introduction to the problem

Location: Start in the classroom and continue with a visit to a landfill. Then, begin the activity in the classroom.

Problem definition: Invite children to explore "solid waste" as an everyday problem by posing some questions to introduce them to recycling that ensures we significantly preserve our energy and natural resources. Have you ever wondered where the garbage we throw away ends up? What happens to it all? Have you ever seen landfills where the garbage is dumped?

Encourage children to share their ideas and thoughts and ask and answer each other's questions during this conversation. As a follow-up, allow them to observe solid waste by watching a video or visiting a landfill.

Include the Reco robot in the conversation. Reco's question can spark curiosity in children "What if some waste materials do not have to go into bins and landfills but instead, can be recycled for other purposes?"

"Reco is visiting us this week with big questions: What can we recycle to help us to protect our environment, and how do we do it? Reco needs your help to find the answers".</td></tr>
<tr><td>DESCRIBING</td><td>Directs and guides the process</td></tr>
<tr><td>INVESTIGATE</td><td>RESEARCHING</td><td>The teacher only supports the process and the ways chosen by the children</td><td>Day 2

Story Development

Reco, the robot, needs help to explore recyclable materials. Children can research recyclable materials at school, at their homes and in the school garden or surrounding areas. (Take safety precautions for children.) Encourage children to ask family members, and use picture books or visual aids to spot the recyclable materials. Invite them to pay attention to the recycling symbols (Printable page No. 1) and where they are on packages. Children can research those recycling symbols on various packaged products.</td></tr>
</table>

	COMPARING	Facilitate the comparison and integration of new knowledge with prior knowledge	Comparison: The children who see recycling as a new concept can compare their previous knowledge of "all solid waste goes into the trash bin" with the new concept of "recycling". To reinforce this: 1. Use Printable page No. 2 and invite children to dump their trash in the landfill. 2. Children will program Reco, the robot, to sort recyclable and non-recyclable items. To do this, children will tape a box onto Reco the robot. In this box they will put a non-recyclable item such as a plastic bag, a coffee cup, some bubble wrap, straws, a crisp package, a plastic toy, or a piece of a foam carton. Then they will decide which square on the coding map the trash bin should be located. They will decide on a starting point and programme the robot to take the garbage to the trash bin. Children will follow a similar process for recyclable materials such as aluminium cans, steel cans, plastic bottles, glass jars, paper, or batteries. To make it more challenging and fun, children can use more than one robot and programme them trying not to run into each other and work together to bring all the materials to the right bins. **Day 3** Guide children to explore further questions similar to the ones below and listen and document their answers. · *Should all recyclable items go into the same bin?* · *What happens if non-recyclable items are mixed with recyclable ones?* · *Why is it important to sort materials separately?* · *How can recyclables be processed into something new?* · *What can we do to be more helpful to the environment?* Support children in making predictions and discussing possible answers.
	QUESTIONING	Encourage and support further questioning and investigation	
	PREDICTING	Support children in making predictions and discussing their hypotheses	
CREATING	COLLECTING DATA	The teacher only supports the process and the ways chosen by the children	**Day 4** Children will collect recyclable materials from home, school, garden, or surrounding streets. (Pay attention to taking the necessary precautions, be careful that collected materials do not have sharp edges or points and ensure children wear plastic gloves for safety and hygiene.) If some children have difficulty separating the recyclable materials from non-recyclable materials, allow them to touch the materials to see whether they feel hard or soft. Encourage them to slightly tap the materials and listen to the different sounds they make. They can hold the

	INTERPRETING DATA	Guide the interpretation of data and facilitate discussions	materials in different hands and recognise that glass feels heavier than metal tins or plastic bottles. Children can analyse their collected data in more detail. For example, they can count how many recyclable items belong to each material category and identify which material is most common. Children can sort materials into categories such as paper, plastic, metal, glass, and batteries. Use visual charts separated into 4 or 5 sections. Children can draw the different materials made from metal, glass, paper, batteries, and plastic. Then they can sort those items into the correct section on the chart or use different coloured boxes representing recycling bins and ask children to put the recyclable items into the correct bins. Note that the colour codes for recycling bins can vary based on local regulations. So, better to decide on a colour code for your classroom recycling bins that is the same as your local regulations. Invite children to play the Recycling Bin Race. Start with two bins "Blue for paper and cardboard" and "Yellow for plastic". Two children will run towards the correct recycling bins depending on the item you show each time. This game will enable children to get used to the if/then algorithm, by deciding which bin they will run towards depending on which item they see. If they see a plastic bottle they will run towards the yellow bin. If they see paper or cardboard, they will run towards the blue bin. **Day 5** Increase the number of bins to three when children are used to two bins and so on. You can challenge them by showing a non-recyclable item from time to time, adding another if/then algorithm to the game by encouraging children not to run towards any bins. Using the coloured bins, children can programme Reco, the robot, to sort mixed materials into the correct bins. To make it more challenging and fun, place some non-recyclable items on the squares along the robot's path and encourage children to find different paths to the recyclable items (by avoiding those non-recyclable materials in their way) and then carry recyclable materials to the correct bins.
	PLANNING EXPERIMENTS	Support children in planning and conducting experiments	
	EXPERIMENTING	Support and encourage experimen-tation	
REFLECT	CONCLUDING	Guide and support the reflective process	Children will test the codes they created for Reco, the robot, to see if the materials are sorted correctly. If they identify some errors in the sorted

	EVALUATING	Guide and support the evaluation process	materials, they can revise the code (debugging) and ensure that each item goes into the correct bin. **Day 6** Invite children to brainstorm ways to improve recycling efforts in their school or at home. They can discuss how Reco, the robot, can further contribute to recycling and propose new ideas for zero-waste initiatives. A final suggestion would be to create a Recycling Room in the school which would be a good solution for collecting recyclable items and additionally, these items and other items could be gathered for reusing and transforming into teaching materials.

Printable pages list

- Printable page No. 1 – Recycling symbols
- Printable page No. 2 – Non-recyclable materials

The End of 6th Activity

Conclusion

The GREENCODE Activity Book is more than just a collection of lesson plans – it is a comprehensive toolkit designed to empower educators in fostering environmental awareness, scientific curiosity, and technological literacy among young children. By integrating Inquiry-Based Learning, sustainability, and educational robotics, these activities bridge the gap between play and structured learning, making complex topics accessible and engaging for pre-schoolers.

Through this resource, teachers are encouraged to take an active, flexible role in shaping their students' learning experiences. The activities are designed to be adaptable, allowing educators to modify and extend them based on their unique classroom needs. By embracing an interactive, hands-on approach, children not only gain knowledge about the world around them but also develop the skills necessary to become active participants in environmental conservation.

As young learners ask questions, experiment, and discover, they are building the foundation for a lifelong appreciation of sustainability. By guiding them through structured inquiry cycles, activities described in this book support the development of essential skills such as critical thinking, collaboration, and problem-solving – skills that will serve them well in the future.

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Brennan, K., & Resnick, M. (2012, April). New frameworks for studying and assessing the development of computational thinking. In *Proceedings of the 2012 annual meeting of the American educational research association, Vancouver, Canada* (Vol. 1, p. 25).

Futschek, G. (2006, November). Algorithmic thinking: the key for understanding computer science. In *International conference on informatics in secondary schools-evolution and perspectives* (pp. 159-168). Springer, Berlin, Heidelberg.

The United Nations Convention on the Rights of the Child (UNCRC, 1989) https://www.unicef.org.uk

The information used in this Activity Book is also based on references and sources cited in other project materials, Erasmus+ GREENCODE "Building an Eco-Friendly Future with Robots" *Preparing Future Educators: Higher Education Course Curriculum on Robotics and Environmental Education* and Erasmus+ GREENCODE "Building an Eco-Friendly Future with Robots" *Preparing Future Educators: Digital Handbook on Robotics and Environmental Education*.

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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