D5.3 FINAL OTTER TOOLKIT – ADAPTED FINAL VERSION

Project acronym: OTTER

Project title: Outdoor Science Education for a Sustainable Future

Call: H2020-SwafS-2018-2020

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History			
Version	Date	Reason	Revised by
01	09.02.2024	Version 1	UL, GEO
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Table of contents

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 101006482

1 OTTER project

OTTER is a H2020 funded project that aims to **enhance the understanding of Education Outside the Classroom** (EOC) **approaches** and how they can help **improve the acquisition of scientific knowledge and transferable skills in students**, **specifically in the field of environmental sustainability and the reduction of plastic waste**. It aims to increase interest in scientific topics among young people, while also contributing to the range of innovative educational projects and the increase of scientific citizenship within the EU.

OTTER aims to strengthen educational outside-the-classroom (EOC) **networks within Europe**, connecting experts from four different regions within the continent (**Finland, Hungary, Ireland and Spain**). The strengthening of these networks will be utilised to carry out a programme of EOC pilot schemes and analyse of the effect they have on the performance of participating students, including their levels of sophisticated consumption and scientific citizenship, to increase understanding of the effects of education outside the classroom on EU citizens. The pilot schemes will share a common theme revolving around issues of plastic waste and recycling in order to build upon recent momentum in tackling related global educational, social, and environmental issues and due to the close relationship between reducing plastic waste and the need for more sophisticated consumers.

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2 Project Consortium

Geonardo Environmental Technologies **(GEO)**

European Science Foundation **(ESF)**

University of Groningen **(RUG)**

University of Limerick **(UL)**

Learning Scoop - oppimisen osuuskunta **(LS)**

The Big Van Theory **(TBVT)**

Center for the Advancement of Research & Development in Educational Technology **(CARDET)**

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Executive Summary

3 Objective

The OTTER Learning Platform is a hands-on space for teachers and other practitioners to use various materials and guidelines when implementing Education Outside the Classroom activities. The OTTER Learning Platform consists of four sections, which are independent of each other but complementary to one another:

1. OTTER Lab design: e-learning module how to design and implement an OTTER Lab

2. Sustainability: comprehensive pack of information on the topic of sustainability to educators

3. EOC and sustainability: e-learning module that focuses on linking knowledge of sustainability to the aspects of Education Outside the Classroom

4. Toolkit: a practical guide for practitioners to start EOC activities with the students, and implement education outside the classroom methodology

The three first parts of the Learning Platform offer useful background information for educators interested in learning more about EOC and sustainability in education. The fourth part – the Toolkit – is more of a practical guide for educators to start applying EOC in their own work.

The Toolkit as a separate section of the Learning Platform was created to give a quick and easy-to-use guide for teachers and other educators to start using EOC in their work, without compromising the pedagogical rationale. The toolkit provides EOC practitioners with a practical guide for implementing education outside the classroom, especially in topics related to sustainable development and environmental issues. The toolkit gathers together the most useful findings of the OTTER project and presents them in an easy-to-use way.

Toolkit offers practical ideas for teachers and other educators on how to implement EOC in an easy, yet pedagogically justified, and effective way.

In the Grant Agreement, the purpose of the Task 5.3. was to *"provide a practical toolkit of best education outside of classroom practices for practitioners (teachers, educators, EOC providers etc.)"*. Furthermore, the Grant Agreement stated that *"In this task the most innovative EOC practices across Europe are gathered and described in detail".* This information was to be assembled through literature review, OTTER Hub and OTTER Labs.

The core idea in GA was that *"The toolkit provides a practical guide for education professionals to find new ideas and make their own applications of education outside classroom"*. The idea was that the Toolkit *"will be incorporated into the OTTER Learning Platform, which will be accessible by teachers and EOC practitioners to help with future EOC projects/activities"*. All this guided the work done in T5.3. and the creation of the Toolkit.

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The Toolkit can be found on the OTTER project website: https://otter-project.eu/learning-platform/toolkit

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The OTTER Toolkit

4 The process of developing the Toolkit

OTTER Toolkit was created in three different parts. This process was suggested by the task leader Learning Scoop and agreed together with all partners in the fourth progress meeting in September 2023. The idea was *to utilize all important information gathered in other tasks of the OTTER project and choose their most relevant findings for the Toolkit.*

Especially the following deliverables were utilized in this task:

- Literature review and compendium of successful practices (D2.1),
- Report on the launch of the online EOC Hub portal (D2.3),
- Guidelines to develop OTTER Outdoor Lab (D3.3),
- Report on EOC accreditation in Europe (D5.1.), and
- A protocol for quality assurance to inform the accreditation process (D5.2).

All contributors - GEO, UL, RUG, TBVT, CARDET - provided useful content for the Toolkit. Once the first version of the script for each part was drafted, it was sent for all contributors to have their comments and insights on it. After getting the feedback, Learning Scoop finalized the script for each part and sent it to Geonardo who was responsible for creating the online implementation of the Toolkit. Learning Scoop and Geonardo collaborated closely to prepare an inspiring online Toolkit for the interested educators.

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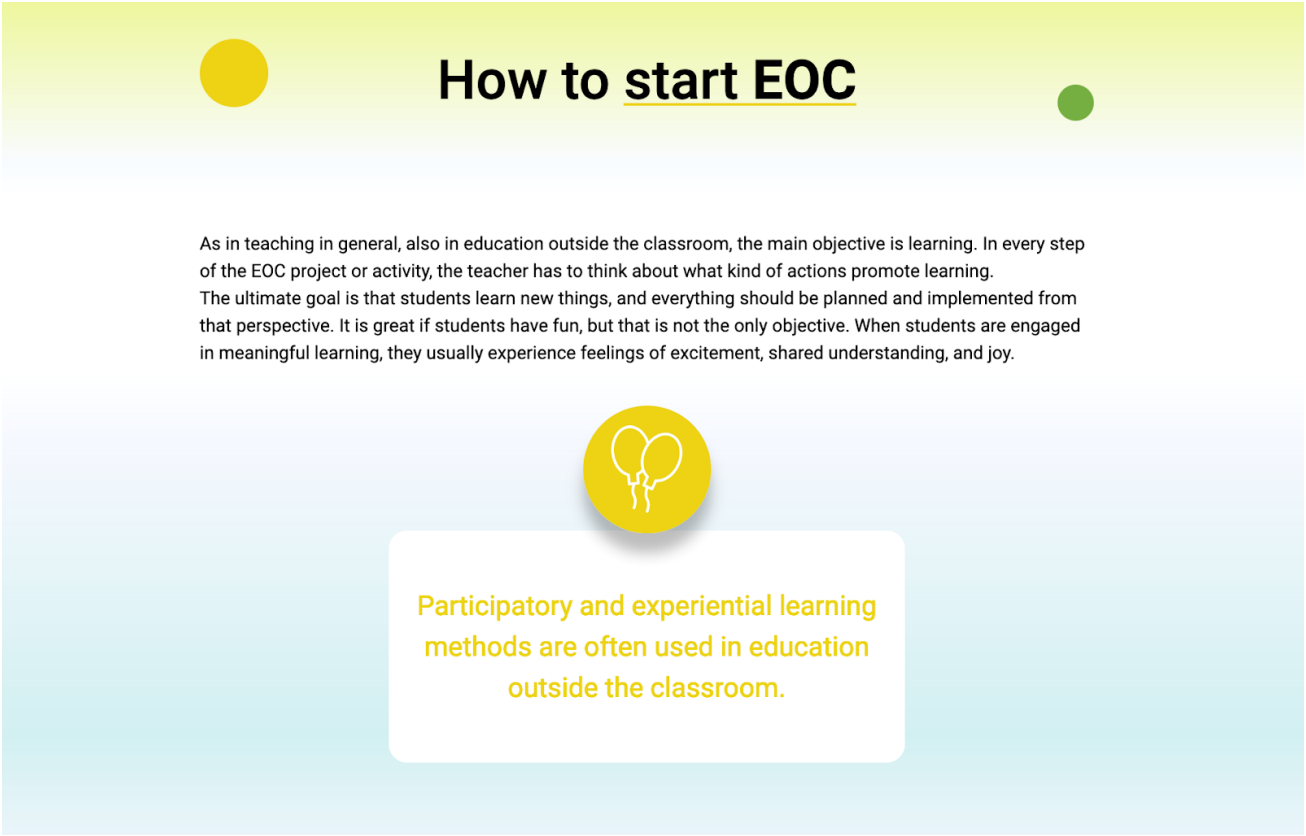
5 The contents of the Toolkit

5.1 The first part, How to start EOC

The first part, *How to start EOC* (see Annex I), includes practical instructions and tips on how to start EOC. It offers pragmatic ideas for the first steps in planning an EOC activity. It presents the core ideas of participatory and experiential learning and highlights the meaning of pre- and post-learning in EOC activities.

Moreover, to deepen the educators' view on sustainable development in education there is Sustainable development in education video covering for example latest research related to ESD, concepts, results, benefits and outcomes in using ESD, outdoor education and ESD, new insights and concrete tips, advice and resources to get started etc.

In addition, there is quality criteria for high-quality EOC learning experiences for students. Quality criteria refer to the requirements that should be met when a teacher plans and implements education outside the classroom.



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Participatory learning

Participatory learning means that students learn best when they are active agents and construct their knowledge of the subject being studied. For constructing personal knowledge, the students need to actively participate in their learning process. Ownership of learning can only be achieved if the students internalize knowledge through interaction, communication, exploration and experimentation.

Experiential learning

Experiential learning enables observations in a variety of ways: by exploring, sensing, and experiencing things personally. Collaboration is an essential part of experiential learning. Collaborative learning arises from sharing one's thoughts, experiences and observations.

First steps

If a teacher has not implemented teaching outside the classroom before, it makes sense to start with small steps. At first EOC activities may seem challenging for both a teacher and students, when they are familiar with classroom setting, and before new routines are formed.

It is advisable to plan and implement EOC activities regularly, so you will develop a routine with them.

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Pre-learning

Pre-learning is an important part of the learning process.
Pre-learning means orientating to the new topic, mapping pre-existing knowledge, setting research questions for the actual EOC activity etc. Pre-learning activates pupils' prior knowledge and helps them to make the right connections between new knowledge (acquired during EOC activity) and pre-existing notions. This way new information is easier to understand, and it becomes relevant to students. Half an hour pre-learning before 1,5 hours EOC activity is a good rule. If a topic is new to the students, more time will be needed for pre-learning.

post-learning / reflection

If pre-learning is important, so is post-learning / reflection as well. The post-learning should include deepening the learned new topics, reflecting the whole learning process, analyzing what has been learned and what we still want to learn, setting new learning goals for the future etc.

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5.2 The second part, OTTER Labs

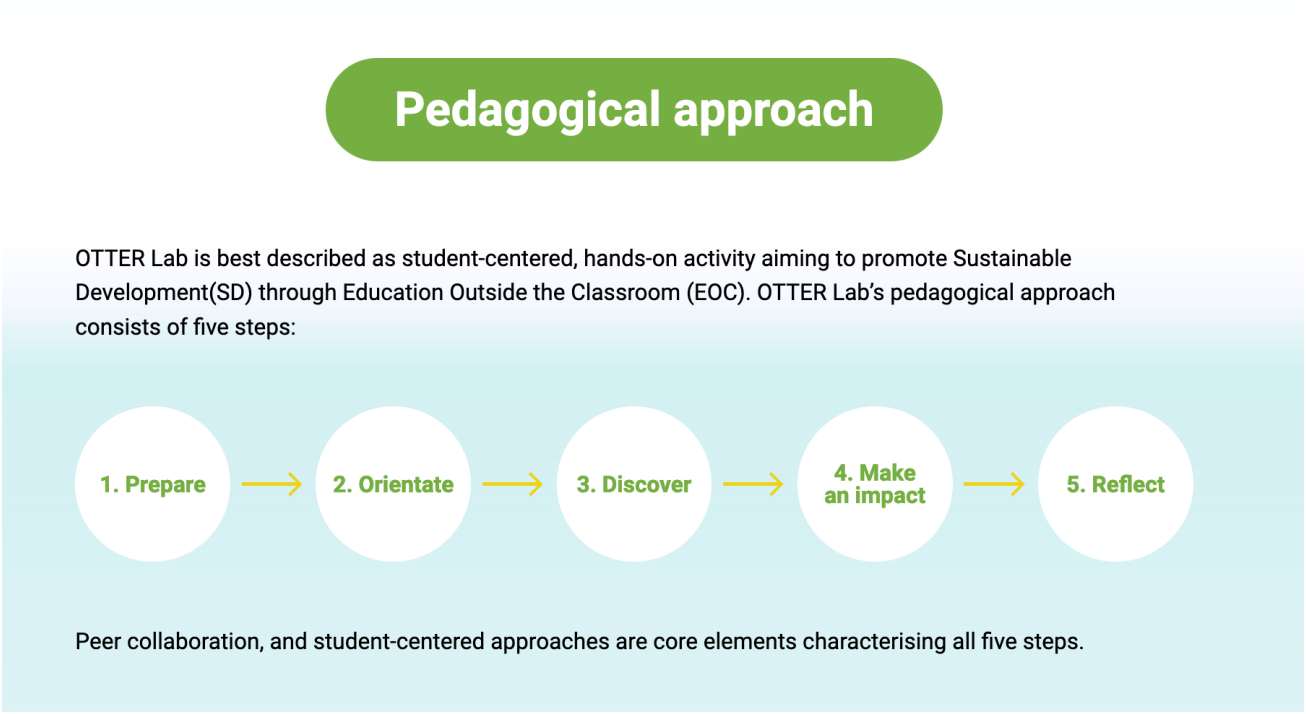
The second part *OTTER Labs* (see Annex II) contains a closer description on OTTER Labs and their implementation. The second part consists of the pedagogical approach of the OTTER Lab: what pedagogical views OTTER Lab is based on and what kind of principles it follows.

The Toolkit introduces the Lab approach and its five steps, and what cornerstones it is based on. The Toolkit also explains what is unique about the OTTER Lab.

There are two examples of how the OTTER Lab approach has been implemented in Spain and in Finland.

In addition, in the second part of the Toolkit it is clarified what kind of learning goals OTTER Lab is designed for, and how to connect curriculum to the OTTER Lab.

Finally, in the second part it is described How to implement the OTTER Lab approach for different age groups: students from 6 to 8, students from 9 to 11, students from 12 to 15, and students from 16 to 18.



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Ways of thinking

- creativity and innovation,
- critical thinking, problem solving, decision making
- learning to learn, metacognition

Ways of working

- communication
- collaboration

Tools for working

- information literacy
- ICT literacy
- scientific literacy

Living in the world

- citizenship (local and global)
- life and career skills
- personal and social responsibility

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OTTER Lab's approach is flexible, and it can be linked to any curriculum. This requires careful analysis of the curriculum one is implementing and linking the objectives of the curriculum to the OTTER Lab's approach.

Which of the objectives in the curriculum could be achieved through OTTER Lab and EOC?

Key question is: Which of the objectives in the curriculum could be achieved through OTTER Lab and education outside the classroom? The most obvious subjects to be linked to OTTER Lab are the STEAM subjects like Biology, Chemistry, Environmental studies, Geography, Mathematics, Physics, Science, Art etc., but also History, Social studies, Mother tongue, Languages, Physical education, etc.

OTTER Lab can be used in teaching one subject. However, OTTER Lab offers an excellent structure to implement a multi-disciplinary approach and combine several different subjects. One way to approach this opportunity is to introduce the idea of OTTER Lab to colleagues within the school and see if there is interest to join forces and plan the Lab together as it can be adapted to several subjects at the same time. It can also be considered if the planned EOC project/activity could be shared, for example with all the grade 4 classes in one school. Education for sustainable development could be something that the whole school commits to! Furthermore, cooperation with external stakeholders – like local NGOs, museums and other cultural organizations, companies etc. – is easier to establish if EOC is a school effort.

How to implement the OTTER Lab approach for different age groups

Different age groups present different challenges and opportunities to implement OTTER Lab and EOC. Here you can find ideas suitable for different age groups:

- Students from **6** to **8**
- Students from **9** to **11**
- Students from **12** to **15**
- Students from **16** to **18**

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5.3 The third part, The best EOC practices

The third part *The best EOC practices* (see Annex III) consists of the best EOC practices and pedagogical models across Europe. These practices and models aim to give the practitioners (teachers, other educators, EOC providers) new ideas and help them to plan and implement their own projects and activities of education outside the classroom.

In the third section one can find practices and models from early childhood education to upper secondary education in STEAM subjects. All examples share a focus on education outside the classroom, and sustainability on topics connected to the sustainable development goals. A user can filter the practices by *age group* or *subject*.

Age groups:

- under 6 years olds
- 6-8 years olds
- 9-11 years olds
- 12-15 years olds
- 16-18 years olds

Subjects:

- Biology
- Chemistry
- Earth sciences
- Ecology
- Environmental science
- Environmental studies
- Ethics
- Geography
- Geology
- History
- IT
- Language arts
- Mathematics
- Mother tongue
- Physical education
- Physics
- Renewable energy
- Science
- STEAM
- STEM
- Visual arts

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The purpose was to include to the best EOC practices database as many different good practices and models as possible for learners of different ages and for different subjects. By maximizing this diversity of EOC practices, the aim was to serve as many teachers as possible.

The best practices were chosen by utilizing all the work done during the two years of OTTER project. All the contributors – CARDET, GEO, RUG, TBVT, UL, LS – utilized their previous work in the OTTER project when possible. The selection criteria for the EOC practices were discussed during the fourth progress meeting in September 2023. The partners decided to emphasize the student-centered approach, modern pedagogy, focus on sustainability, and proven positive results. It was not possible to choose all-inclusive selection criteria because the best practices varied so much, for example according to the students' age and the subject area, but all partners agreed what type of practices would be searched and included.

Each contributor (CARDET, GEO, RUG, TBVT, UL) provided at least 5 EOC practices or pedagogical models utilizing the previous work done in the OTTER project when possible. The EOC practices were collected using a Google Form.

LS's task was to ensure that the database is as versatile as possible. LS searched for good practices that complemented the whole. LS got to know e.g. the EOC practices introduced in the sister projects from the OSTogether network:

- SALL (Schools as Living Labs, ID: 871794),
- PULCHRA (Science in the City: Building Participatory Urban Learning Community Hubs through Research and Activation, ID: 824466),
- SEAS (Science education for action and engagement towards sustainability, ID: 824522),
- OSHUB (Empowering Citizens through STEAM Education with Open Schooling, ID: 824581),
- Marine Mammals (Using marine mammals for making science education and science careers attractive for young people, ID: 710708)

LS went through the activities that have been implemented in the sister projects, and chose those that are suitable as part of best practices in the OTTER Toolkit.

The OTTER Lab pilots implemented in the OTTER project in Finland, Hungary, Ireland and Spain are also included in the database of the best practices. There are a total of 50 best practices in the database.

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The best EOC practices

The EOC examples described here represent the best EOC practices and pedagogical models across Europe. These practices and models aim to give the practitioners (teachers, other educators, EOC providers) new ideas and help them to plan and implement their own projects and activities of education outside the classroom.

Here you can find practices and models from early childhood education to upper secondary education in STEAM subjects. All examples share a focus on education outside the classroom, and sustainability on topics connected to the sustainable development goals.

Filters

Age

Search

Subject

Search

Math city map

Mathematics

Earthkeepers program

Environmental Science

Learning through Immersion in Content-Rich Settings

Biology, Environmental Science

Playground physics

Physics

Forest Schools

Visual arts

OTTER Lab: Water in my life

Science, Visual arts, STEM

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Marine mammals for science education

STEM

Sustainability and future cities

Science, STEAM

Game-based approach for Marine Citizen Science

Biology

ECOCIDADANIA Environmental Education Program

Biology

Exploring nature through arts

Visual arts

Field trips in protected and conservation areas

Environmental studies

Education for Environmental Citizenship (EEC) Learning Intervention

Biology

"Greenize" Your School and Create a School Garden in an Urban Environment

Biology, Environmental studies, Mathematics, Physics

Exploring ecosystem services and nature-based solutions to urban problems

Biology, Earth sciences , Ecology

NBS and Hardy Plants for a Sustainable City

Biology

Learning to reforest

Biology, Ecology, Geography, Geology

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Annex I

6 Toolkit, part 1 How to start EOC

6.1 Key principles of EOC

As in teaching in general, also in education outside the classroom, the main objective is *learning*. In every step of the EOC project or activity, the teacher has to think about what kind of actions promote learning. The ultimate goal is that students learn new things, and everything should be planned and implemented from that perspective. It is great if students have fun, but that is not the only objective. When students are engaged in meaningful learning, they usually experience feelings of excitement, shared understanding, and joy.

Participatory and experiential learning methods are often used in education outside the classroom. *Participatory learning* means that students learn best when they are active agents and construct their knowledge of the subject being studied. For constructing personal knowledge, the students need to actively participate in their learning process. Ownership of learning can only be achieved if the students internalize knowledge through interaction, communication, exploration and experimentation.

Experiential learning enables observations in a variety of ways: by exploring, sensing, and experiencing things personally. Collaboration is an essential part of experiential learning. Collaborative learning arises from sharing one's thoughts, experiences and observations.

Nowadays many children and young people are aware of and concerned about environmental issues, e.g. climate change and global warming, plastic pollution, and loss of biodiversity, and they want to participate in offering solutions to environmental problems. It is important that their voices are heard, and they are encouraged to act responsibly for the environment! By encouraging children at an early age, we have a chance at raising active citizens who want to participate in, value and support sustainable lifestyles in adulthood.

6.2 First steps

If a teacher has not implemented teaching outside the classroom before, it makes sense to start with small steps. At first EOC activities may seem challenging for both a teacher and students, when they are familiar with classroom setting, and before new routines are formed. It is advisable to plan and implement EOC activities regularly, so you will develop a routine with them.

When thinking about an EOC site initially, it would be good to consider a place nearby a school that is easily and safely accessible. For many, this can be the school yard or nearby park or other green area.

One of the pre-arrangements is to check if EOC activities can be done in collaboration with one's colleagues. This usually increases the quality of the activity, helps in planning, implementation and reflection. In addition, collaboration allows teachers to learn from one another.

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It should also be considered if the developed EOC project or activity could be shared with all the classes in the same grade in one school. Education for sustainable development should be something that the whole school commits to!

Students can be engaged in developing and planning the EOC activity in many ways. For example, the students can be involved in choosing a suitable topic for EOC activity. Pupils can also give suggestions on the methods / activities implemented during the EOC project. If the teacher already has the objectives and contents chosen, the students can suggest suitable locations etc.

Pre-learning is an important part of the learning process. Pre-learning means orientating to the new topic, mapping pre-existing knowledge, setting research questions for the actual EOC activity etc. Pre-learning activates pupils' prior knowledge and helps them to make the right connections between new knowledge (acquired during EOC activity) and pre-existing notions. This way new information is easier to understand, and it becomes relevant to students. Half an hour pre-learning before 1,5 hours EOC activity is a good rule. If a topic is new to the students, more time will be needed for pre-learning.

If pre-learning is important, so is post-learning / reflection as well. The post-learning should include deepening the learned new topics, reflecting the whole learning process, analyzing what has been learned and what we still want to learn, setting new learning goals for the future etc.

Post-learning / reflection is thinking about and analyzing one's own learning. Reflective learners process their learning, relate it to what they already know, adapt it for their own purposes, and translate thoughts into action. Reflection develops creativity, ability to think critically about information and ideas, and metacognitive skills (ability to think about one's own thinking). Furthermore, reflecting one's own learning enhances deep learning. Through reflection new knowledge is adhered to one's own knowledge structure and is more easily remembered afterwards.

6.3 Sustainable development in education video

Education for Sustainable Development (ESD) empowers learners of all ages with the knowledge, skills, values and attitudes to address the global challenges we are facing, including climate change, environmental degradation, loss of biodiversity, poverty and inequality.

How to transform education through Education for Sustainable Development (ESD)? With this video you will learn:

- Finland as an example using ESD in curriculum
- Latest research related to ESD and concepts
- The main top 3-5 transitions happening in education at the moment
- The challenges, problems, concerns and needs schools face in relation to these transitions/trends and how to overcome these challenges
- Results, benefits, outcomes in using ESD
- Outdoor education and ESD
- Learn about existing solutions in the field of ESD you can start using immediately
- New insights and concrete tips, advise and resources to get started

In this video Dr. Marianne Juntunen, awarded as the most innovative science teacher in Finland, together with her colleagues Karla Soto and Marjo Vesterinen open up the challenges as well as the numerous opportunities related to ESD.

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6.4 Quality criteria

Quality criteria refer to the requirements that should be met when a teacher plans and implements education outside the classroom. Students get meaningful learning experiences when the quality criteria are fulfilled in education outside the classroom process.

Following indicators are essential when aiming for quality EOC learning experiences for students:

EOC activities

- support the idea that the core of the whole process is learning

- focus on authentic real-world and contextual phenomena, creating deeper connections with the issues of today's world (e.g. sustainability)

- utilize versatile learning environments

- emphasize collaboration and communication

- include meaningful pre and post learning opportunities

Learning objectives

- are derived from the national curriculum

- promote the development of 21st century skills

- include aspects of knowledge, skills, attitudes, values and ethics

Practitioners

- adopt/adapt aspects of participatory and experiential learning to learning experiences

- are aware of surrounding prospective EOC locations and stakeholders locally

- have a facilitating role, supporting students' learning

- use multidisciplinary and interdisciplinary approach where several teachers and different subjects are involved if possible

- understand the importance of adequately addressing health and safety procedures

Students

- are involved in all phases of the EOC process, and own their work and learning

- can influence the content, activities, and learning environment (student-centered approach)

Assessment

- is versatile: student-student, student-teacher, teacher-student, teacher-teacher

- is aligned with the objectives and embedded within the EOC process

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Annex II

7 Toolkit, part 2 OTTER Lab as an approach for education outside the classroom

OTTER Lab is best described as a student-centered, hands-on activity aiming to promote Sustainable Development (SD) through Education Outside the Classroom (EOC). OTTER Lab's pedagogical approach consists of five steps: 1. Prepare 2. Orientate 3. Discover 4. Make an impact 5. Reflect. Peer collaboration, and student-centered approaches are core elements characterising all five steps.

7.1 Pedagogical approach of the OTTER Lab

Modern educational research has revealed many factors that promote learning: learner's own activity, motivation, participation, collaborative learning (learning with and from each other), reflection, connections to prior knowledge, physical activity, and using versatile teaching and learning methods. This contemporary learning theory is called the socio-constructivist approach. (Lonka 2018, 28–48.) OTTER Lab's approach is based on the socio-constructivist view on learning.

The socio-constructivist view of learning rests on the following principles:

- Learning is perceived as an active, not passive, process through which knowledge is constructed by the learner
- Knowledge is mutually built and constructed in the social contexts of learning
- Prior knowledge, understanding and experiences are relevant to learning new things.
- The teacher's role is to support and nurture the learning process: teachers are facilitators who enable students' development and learning. (Lonka 2018, 28.)

7.2 The OTTER Lab approach

7.2.1 The OTTER Lab approach

OTTER Lab offers teachers a flexible approach with pedagogical underpinnings to build a well-thought educational EOC activity to suit different classes and curricula.

The OTTER Lab

- is tied to the socio-constructivist view of learning and based on current research on learning.
- is an easy approach to start with if you have no or little experience of EOC. Furthermore, it offers a structure for those teachers who already have experience in EOC and want to develop their EOC practices further.

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- does not include ready-made contents and methods on how to implement it. It is the teacher who decides the contents and methods within the OTTER Lab approach.
- is easily connected to real-world issues of sustainability and can be harnessed to create deeper connections with the issues of today's world - in any subject.
- is adaptable to different countries and curricula.
- encourages teacher collaboration in planning and implementing the EOC practices.
- offers the capacity to involve the students in designing OTTER Lab activities.

It is noted in several scientific studies that in order to gain a deep learning experience, EOC must involve meaningful **pre and post learning**. Pre-learning and post-learning are important parts of the OTTER Lab process as well. Pre-learning means orientation to the topic, mapping students' pre-existing knowledge, and setting research questions for the EOC activity (Orientate step of the approach). Post-learning includes deepening the learned new topics, reflecting the whole learning process, analyzing what has been learned, and setting new learning goals for the future (Make an impact and Reflect steps of the approach).

In the OTTER Lab process, it would be useful to create a path during which 1) the student is involved in **self-assessment** and reflects on what they have learned (for example using learning diary or other writing assignments), and 2) the students evaluate their work in groups and as a group, and give each other constructive **peer feedback** on joint work and achievements. Receiving encouraging feedback promotes the holistic development of the students. In addition, self-assessment and peer assessment skills are an important part of 21st century skills. By using these assessment methods during the OTTER Lab, individuals' metacognitive and reflective skills, and their working skills are developed.

One of the novelties of OTTER Lab is the **youth initiative**, which aims to develop students' active participation and citizenship skills. The youth initiative is a student-led activity that enables students to participate, makes them active agents of their own learning and actions, and gives them the opportunity to influence their own environment and current environmental issues.

The youth initiative is a student-led activity that enables students to participate and gives them the opportunity to influence their own environment.

The youth initiative helps the students to incorporate the curricular objectives and use the competencies they have gained to solve an environmental or sustainability challenge. They will understand the reasons why the EOC activity has been carried out and realize that skills and information learned during the EOC activity are useful to face environmental problems. While students are carrying out the youth initiative, they train and practice skills and competencies to become active agents of change and to act as ambassadors that raise awareness among the people around them.

This "action" piece of the OTTER Lab seems to be the most impactful and novel part of the approach. What is observed and learned through EOC is put into further practice and knowledge generation through an action (no matter how small).

You will find several examples of OTTER Labs in the Best EOC practices section.

7.2.2 Learning objectives

Learning objectives direct the whole learning process: they tell what students should be able to do or know after the course. Learning objectives help teachers select and organize lesson or course content and activities and choose the assessment methods. In addition, learning objectives guide students through the course, and help them assess their learning process.

What do I want the students to understand and master when they complete this project?

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When setting the learning objectives, the teacher needs to ask themselves: “What do I want the students to understand and master when they complete this project / course?” The teacher should consider a range of learning objectives to ensure the holistic development of students.

OTTER Lab was designed to aim for several, broad learning goals:

1. To support the acquiring of scientific knowledge in the fields of environmental sustainability and global environmental challenges (linked to United Nations’ Sustainable Development Goals, SDGs).
2. To facilitate the development of students’ 21st-century skills.
3. To promote an inclusive attitude, embracing diversity and participation of all students.

These broad goals can work as a basis for designing OTTER Lab. More specific learning objectives derived from the national curriculum can be linked to them.

The first objective is linked to both SDGs, as well as subject specific objectives defined in different national / local curricula. The teacher can use, for example, the SDG’s below as basis for designing OTTER Lab and link relevant subject specific objectives to them. UNESCO’s publication *Education for Sustainable Development Goals* has been used as the source of the learning objectives (https://unesdoc.unesco.org/ark:/48223/pf0000247444).

Clean Water and Sanitation:

Ensure availability and sustainable management of water and sanitation for all
Learning objectives for Clean Water and Sanitation, e.g.:
- Understand water as a fundamental condition of life itself, the importance of water quality and quantity, and the causes, effects and consequences of water pollution and water scarcity.
- Understand the global unequal distribution of access to safe drinking water and sanitation facilities.
- Communicate about water pollution, water access and water saving measures and to create visibility about success stories.
- Learn about water usage in a student's own country, and compare the facts to another country.
- Feel responsible for their own water use, and reduce their individual water footprint and to save water practicing their daily habits.

Sustainable Cities and Communities:

Make cities and human settlements inclusive, safe, resilient and sustainable
Learning objectives for Sustainable Cities and Communities, e.g.:
- Understand basic physical, social and psychological human needs and be able to identify how these needs are currently addressed in their own settlements.
- Learn to evaluate and compare the sustainability of their and other settlements’ systems in meeting their needs particularly in the areas of food, energy, transport, water, safety, waste treatment, inclusion and accessibility, education, integration of green spaces and disaster risk reduction.
- Learn the basic principles of sustainable planning and building and identify opportunities for making their own area more sustainable and inclusive.
- Learn to contextualize their needs within the needs of the greater surrounding ecosystems, both locally and globally, for more sustainable human settlements.
- Feel responsible for the environmental and social impacts of their own individual lifestyle.
- Be able to speak against/for and to organize their voice against/for decisions made for their community.
- Be able to co-create an inclusive, safe, resilient and sustainable community.
- Be able to promote low carbon approaches at the local level.

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Responsible Consumption and Production:

Ensure sustainable consumption and production patterns

Learning objectives for Responsible Consumption and Production, e.g.:

- Understand how individual lifestyle choices influence social, economic and environmental development.
- Understand roles, rights and duties of different actors in production and consumption (media and advertising, enterprises, municipalities, legislation, consumers, etc.).
- Learn about strategies and practices of sustainable production and consumption.
- Envision sustainable lifestyles.
- Plan, implement and evaluate consumption-related activities using existing sustainability criteria.
- Communicate the need for sustainable practices in production and consumption.

Climate Action:

Take urgent action to combat climate change and its impacts

Learning objectives for Climate Action, e.g.:

- Understand the current climate change, and the greenhouse effect as a natural phenomenon caused by an insulating layer of greenhouse gases.
- Learn which human activities – on a global, national, local and individual level – contribute most to climate change.
- Understand the main ecological, social, cultural and economic consequences of climate change locally, nationally and globally, and how these can themselves become catalysing, reinforcing factors for climate change.
- Learn about prevention, mitigation and adaptation strategies at different levels (global to individual) and for different contexts.
- Be able to explain ecosystem dynamics and the environmental, social, economic and ethical impact of climate change.
- Be able to encourage others to protect the climate.
- Be able to understand their personal impact on the world's climate, from a local to a global perspective.
- Understand that the protection of the global climate is an essential task for everyone and that we need to completely re-evaluate our worldview and everyday behaviours in light of this.
- Be able to anticipate, estimate and assess the impact of personal, local and national decisions or activities on other people and world regions.

Life Below Water:

Conserve and sustainably use the oceans, seas and marine resources for sustainable development

Learning objectives for Life Below Water, e.g.:

- Understand basic marine ecology, ecosystems, predator-prey relationships, etc.
- Understand the connection of many people to the sea and the life it holds, including the sea's role as a provider of food, jobs and exciting opportunities.
- Understand the basic premise of climate change and the role of the oceans in moderating our climate.
- Understand threats to ocean systems such as pollution and recognize and can explain the relative fragility of many ocean ecosystems.
- Learn about opportunities for the sustainable use of living marine resources.
- Be able to show people the impact humanity is having on the oceans (biomass loss, acidification, pollution, etc.) and the value of clean, healthy oceans.
- Be able to research their country's dependence on the sea.

Life on Land:

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Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
Learning objectives for Life on Land, e.g.:
- Understand basic ecology with reference to local and global ecosystems, identifying local species and understanding the measure of biodiversity.
- Understand the manifold threats posed to biodiversity, including habitat loss, deforestation, fragmentation, overexploitation and invasive species, and can relate these threats to their local biodiversity.
- Be able to classify the ecosystem services of the local ecosystems including supporting, provisioning, regulating and cultural services and ecosystems services for disaster risk reduction.
- Understand the slow regeneration of soil and the multiple threats that are destroying and removing it much faster than it can replenish itself, such as poor farming or forestry practice.
- Be able to argue against destructive environmental practices that cause biodiversity loss.
- Be able to connect with their local natural areas and feel empathy with non-human life on Earth.
- Be able to question the dualism of human/nature and realizes that we are a part of nature and not apart from nature.
- Be able to create a vision of a life in harmony with nature.

The second objective is linked to 21st century skills which have been identified as vital in 21st century society and the world. In the OTTER Lab special attention was given on these 21st century skills:

1. Ways of thinking
   - creativity and innovation,
   - critical thinking, problem solving, decision making
   - learning to learn, metacognition

2. Ways of working
   - communication
   - collaboration

3. Tools for working
   - information literacy
   - ICT literacy
   - scientific literacy

4. Living in the world
   - citizenship (local and global)
   - life and career skills
   - personal and social responsibility

Suggested resource to assist in generation of learning objectives related to 21st century skills: https://unesdoc.unesco.org/ark:/48223/pf0000242996

The third objective is linked to promoting inclusion and diversity and providing equal opportunities for all. OTTER Lab identified three key areas necessary in the development of EOC experiences:
- Interacting considerately: non-discriminatory and respectful
- Creating awareness: diverse genders, ethnicity, nationality and socio-economic background
- Acting with respect: showing interest in and respect for others.

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7.2.3 How to connect curriculum to the OTTER Lab

Education outside the classroom has to be aligned with the objectives set in the curriculum. This applies to OTTER Lab as well.

OTTER Lab's approach is flexible, and it can be linked to any curriculum. This requires careful analysis of the curriculum one is implementing and linking the objectives of the curriculum to the OTTER Lab's approach.

Which of the objectives in the curriculum could be achieved through OTTER Lab and EOC?

Key question is: *Which of the objectives in the curriculum could be achieved through OTTER Lab and education outside the classroom?* The most obvious subjects to be linked to OTTER Lab are the STEAM subjects like Biology, Chemistry, Environmental studies, Geography, Mathematics, Physics, Science, Art etc., but also History, Social studies, Mother tongue, Languages, Physical education, etc.

OTTER Lab can be used in teaching one subject. However, OTTER Lab offers an excellent structure to implement a multi-disciplinary approach and combine several different subjects. One way to approach this opportunity is to introduce the idea of OTTER Lab to colleagues within the school and see if there is interest to join forces and plan the Lab together as it can be adapted to several subjects at the same time. It can also be considered if the planned EOC project/activity could be shared, for example with all the grade 4 classes in one school. Education for sustainable development could be something that the whole school commits to! Furthermore, cooperation with external stakeholders – like local NGOs, museums and other cultural organizations, companies etc. – is easier to establish if EOC is a school effort.

Looking closer to the objectives of the potential subjects one can find several themes suitable for OTTER Lab and EOC. Here are some examples from Online magazine for environmental education:

Chemistry
In chemistry, students get to study many kinds of natural phenomena and topics related to nature. In addition, topics of sustainable lifestyle are part of everyday chemistry: What substances do the products I use every day, such as food, cosmetics and detergents, contain? What kind of sustainable practices can I adopt? How do I handle dangerous substances? Sustainable use of natural resources, life cycle thinking and understanding ecosystem are also essential contents in chemistry teaching.

Physics
Energy is one of the central topics in physics instruction. Physics deals with energy as a phenomenon, its preservation and change, and energy production. Energy consumption can be observed in the student's own everyday life, such as in the school building or at home. On the other hand, getting to know the methods of energy production is an important theme. In teaching physics, students can learn about technological solutions that effectively save natural resources or otherwise promote a sustainable lifestyle.

Mathematics
From the point of view of environmental issues, mathematical understanding is essential. Examples can be found from the easiest math basics to the most difficult and complex problems. In primary school level, pedagogically guided games and activities are one important way of working in mathematics. For example, in nature it is easy to concretize the decimal system, symmetry and measurement and to make statistics based on observations.
Also in lower secondary level, the goal is to find examples from students' own life. For example, direct and inverse proportionality is clearly visible in natural phenomena, and it is easy to start building

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equations, building statistics or handling trigonometric functions with the help of experiential nature tasks.
Dealing with mathematical problems in a natural environment also motivates children and young people, and helps them find meanings alongside abstract numbers. Environmental problems are often described with diagrams, statistics and figures. Climate change, over-consumption of the earth's natural resources and population growth are illustrated through mathematics.

Mother tongue
One aim of the mother tongue is to practice thinking skills and especially critical thinking. Instead of learning individual facts, it is more important to learn creative thinking and constructive communication. Sustainable solutions are only created through interaction and co-operation. The reflection and expression of one's own opinions are basic skills that are necessary when building a sustainable future together with others. In terms of environmental issues, it is also essential to understand the different goals and purposes of the texts. It is important to take various environmental topics as a theme for writings and to organize discussions and debates about these issues in mother tongue lessons.
The task of a mother tongue teacher is not to be a scientist or science teacher, but their task is to create learning experiences in which the reflection and thinking related to these issues can be developed.

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7.2.4 How to implement the OTTER Lab approach for different age groups

Different age groups present different challenges and opportunities to implement OTTER Lab and EOC. Here you can find ideas suitable for different age groups:

	Students from 6 to 8
Step 1 Prepare	Students from 6 to 8 like discovering, solving riddles and finding new things. When setting the learning objectives, consider how you can nurture students' natural curiosity and playful minds. It is important to have a multi-disciplinary approach, combining environmental science or STEAM subjects and other relevant subjects. For this age group learning by playing and learning by real phenomena by observing are inherent ways to learn. For students of this age, a learning environment near the school works well. What could be learned in the close surroundings of the school?

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Step 2 Orientate	When orienting students, you can use stories to get them interested. With stories you can feed their imagination and help them get emotionally involved. In addition, students' own experiences are a good way to orientate to the upcoming topic. Orientation should help students to empathize with how environmental issues affect human beings, animals and nature. When preparing students for the EOC activity it is important to make clear how they should behave during the activity and what kind of safety issues need to be considered. It is important to find out what kind of thoughts and questions students have about this topic. This can be done through play, discussion, drawing etc. When setting learning tasks for the EOC activity, make sure that everyone knows what they are supposed to do during the activity.
Step 3 Discover	When deciding the EOC activity, hands-on activities are recommended. For this age group it is essential to make the EOC activity very tangible and concrete. Let students do, engage, touch and feel things themselves. Encourage students to work together because this type of activity naturally allows them to develop their collaboration skills. Collection of data can mean, e.g. collecting real items, taking photographs or taking notes of their observations.
Step 4 Make an impact	It is important to discuss together all the findings and new information that students learned during the EOC activity. When designing the youth initiative, it is important to ask, what can we do and what do we want to change. The initiative should be something concrete and easy to understand. For this age group the youth initiative can be related, for example, to their own class or home and daily practices. The most important thing is to raise the idea that everybody can do something and make a difference.
Step 5 Reflect	As a post-learning activity, it is important to reflect on what we learned, how we learned and what we want to do next. For reflection you can use playful activities, discussion, drawing and visual work etc.

	Students from 9 to 11

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Step 1 Prepare	This age group's relationship with the surrounding world is very active: they want to explore, understand and take over new things. When setting the learning objectives, it is important to take into account what the students of this age are naturally interested in. Bear in mind the multidisciplinary approach to help students to understand real-life phenomena. Moreover, this is a great age to introduce some core concepts of STEAM subjects. Students of this age are eager to explore the world outside school and they are old enough to go further than the younger ones. An EOC activity that would allow them to experience something new and a location where they have not been before would be ideal. This age group loves to be physically active, so choosing an activity and location to suit that works well.
Step 2 Orientate	When orienting the students, it is a good idea to use examples they can relate to. Videos are a great way to both inform students about the topic and also help them to empathize with it. When mapping their prior knowledge about the topic, different co-operational methods work well. When gathering relevant background information about the topic, students can, for example, interview experts that are easy to reach (parents, grandparents, neighbors, other teachers at school etc. When setting learning tasks, make sure that each group and each student is aware of what is expected from them. If your students are not very familiar with working outside the school area, make sure they know what kind of behavior is expected and what are the safety regulations.
Step 3 Discover	Students of this age like to be involved and engage themselves in the activities! Make sure that they can actively participate in the activity outside the classroom. This is also the age when it is a good time to practice making observations and note taking. It is important that students have both chances to experience things themselves as well as collect relevant data for further analysis.
Step 4 Make an impact	It is important to discuss, analyze and share the collected data properly together after the EOC activity. Groups can present their key findings to the others. While discussing the observations, ask students what really touched or surprised them and what they would like to change. Based on these discussions, help students to identify what could be their youth initiative. The youth initiative of this age group can be, e.g. something related to their own class or the whole school. Encourage them to see what they can do themselves and how they can change things.
Step 5 Reflect	This age group is usually eager to discuss. Utilize it when reflecting on what has been learned. Different co-operational as well as creative methods, like drama or visual methods, work well for reflection.

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	Students from 12 to 15
Step 1 Prepare	Students of this age notice things around them that they don't necessarily agree with, they have ideas how to change them, and create something new. These teenage years are not always the easiest from the schoolwork's point of view, so therefore it is important to give students possibilities to experience something new, learn in different ways and give them the experience that they can make a difference. It is also important to note that in this age group developmental differences can be very big, and the development of boys and girls can differ significantly. At this age students usually study different subjects separately so creating a multi-disciplinary learning process demands an extra effort from the teachers. Collaboration with your colleagues is essential to find a project that naturally combines the perspectives and contents of different school subjects and for example merge science and artistic disciplines. It would be ideal if students could be involved in choosing the EOC activity and a suitable location for it. It is vital to take students' interests into account (even though finding consensus among students is not always easy).
Step 2 Orientate	The teenage students often feel strongly about different matters and if you can utilize that emotional engagement, it would be a great start for the process. This age group is very familiar with visual material like videos and documentaries so using them in orientation works well. These students have already studied and learned a lot so it is essential to base the acquiring of new information on what they already know about this matter. Mapping pre-existing knowledge can be done collaboratively. Students can acquire necessary background information regarding the intended EOC activity and location before they go there. Students of this age are usually very familiar with technology so they can use that when searching for information. However, they often need guidance on how to make sure that the source of information is reliable. Teenage students very often enjoy external visitors so inviting an expert to be interviewed for background information in the classroom can be a good idea. Students can be divided into small groups for the EOC activity and different learning tasks can be assigned for each group.
Step 3 Discover	Students of this age can travel a bit further for the EOC activity if the resources allow it. Offering them an opportunity that they have never experienced before would be interesting and motivating. While students of this age group can just visit and observe, many of them enjoy engaging themselves in hands-on activities as well. Remind your students that they need to collect relevant data for further analysis and provide them with suitable tools for it. If there is an app that they can use for this, it would certainly raise their interest.

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Step 4 Make an impact	Ask groups to present their key findings to the others. Examine together the differences, similarities and possible gaps and contradictions in the information gathered by the students. Ask students to make summaries and conclusions based on the information everyone has shared. To design the youth initiative, you can use different co-operative and ideating methods like brainstorming. It is important that everyone has a say when deciding what kind of youth initiative to implement. The initiative could be targeted on a local level: in their own school or community. It is also possible to vote (an important citizenship skill) and choose a couple of different initiatives to work with. It is important that youth initiative is also carried out and, if possible, its impacts are evaluated. At this age it is vital to understand how a democratic society works and how people can affect different matters.
Step 5 Reflect	Reflection should cover the whole learning process as well as how the youth initiative was carried out, what kind of impact it had, and what we learned about it. For reflection you can use a variety of methods, including creative and co-operative methods.

	Students from 16 to 18
Step 1 Prepare	The older students practice making an impact in their environment and larger community as well as entering adulthood and active citizenship. Students of this age are usually aware of many societal and environmental problems. It is wise to engage them in setting the learning objectives and choosing the EOC activity and locations. The teacher is still responsible for linking learning outcomes with curricular objectives and contents. Students can together ideate what environmental issue they want to learn more about, what kind of activity they could be involved in and what are the possible locations for that activity. If there are enough resources and curriculum allows it, students of this age can also travel further and stay in the decided location longer.

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Step 2 Orientate	Students of this age already have a lot of knowledge and opinions of different topics. However, it is important to get all students involved in this topic. Pay attention to how students could *feel* the importance of the topic and *empathize* with it. Linking environmental issues to students' own lives and interests is one way to do that. It is important to utilize students' prior knowledge in orientation. Mapping previous knowledge about the topic can be done first individually and then in small groups to strengthen peer-collaboration and distributed expertise. You can use different methods to map this prior knowledge. For raising interest and intrinsic motivation you can introduce different kinds of background information about the topic: articles, documentaries, videos etc. Students also enjoy discussing with different experts and stakeholders, so inviting them to your class could be a good idea. Often students like to prepare their questions to the experts in advance. You can set learning tasks together with the students. Agree with them what the task of each small group is.
Step 3 Discover	The EOC activities can have various forms: it can be participating in volunteering in environmental projects, visiting places relevant to understand the topic, interviewing different experts etc. Students are encouraged to collaborate with all kinds of pertinent stakeholders to get a comprehensive insight about the topic. Special attention needs to be paid to collecting data. Provide students with appropriate tools and guidelines on what kind of information and how it should be collected.
Step 4 Make an impact	Reserve time for analyzing the collected data properly. Guide students to concentrate especially on analyzing the data: what are the main points we found out, are there contradictions we should look into more closely, is there something missing that we should still find out etc. Students can prepare small presentations to share their observations and findings with the others. After careful analysis it is important to draw conclusions and think how students could act based on this new knowledge. Students can brainstorm possible solutions to the environmental issues identified. After coming up with their most creative and feasible solution, students propose a set of activities and design the youth initiative. Youth initiative on this level can be implemented on the local/community or even societal level. When designing the youth initiative students can reach out to the local authorities or relevant stakeholders. Implementing the youth initiative is an essential part of the learning process. Whether it is sharing information, raising awareness or making an actual initiative to better things, it is important to evaluate the impact afterwards. The idea is to learn and practice active citizenship skills and promote volunteer attitude in young people. To share their work students can prepare an exhibition, write an article, make a play or a video etc.

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Step 5 Reflect	Reflection means not only recognizing what has been learned and how they learned it but how this experience has affected students' understanding about environmental issues and making an impact. The reflection can include both writing one's own thoughts and insights about the matter and discussing and sharing with others. The reflection can also include peer-assessment: assessing one's own small group and how it worked.

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Annex III

8 Toolkit, part 3 The best EOC practices

The EOC examples described here represent the best EOC practices and pedagogical models across Europe. These practices and models aim to give the practitioners (teachers, other educators, EOC providers) new ideas and help them to plan and implement their own projects and activities of education outside the classroom.

Here you can find practices and models from early childhood education to upper secondary education in STEAM subjects. All examples share a focus on education outside the classroom, and sustainability on topics connected to the sustainable development goals.

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