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D4.1 MONITORING AND EVALUATION FRAMEWORK

Project acronym: OTTER

Project title: Outdoor Science Education for a Sustainable Future

Call: H2020-SwafS-2018-2020

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OTTER project

Funded under the EU's Horizon 2020 research and innovation programme, the **OTTER project** aims to **enhance the understanding of Education Outside the Classroom** (EOC) **methods and pedagogies** 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 analysis 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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Project Consortium

Geonardo Environmental Technologies **(GEO)**

European Science Foundation **(ESF)**

University of Groningen **(RUG)**

University of Limerick **(UL)**

Bridge Budapest **(BB)**

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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1. Executive Summary

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1.1 Objective

This deliverable aims to outline the main aspects of the evaluation and monitoring of the OTTER project. This document describes how, in what way, and when the evaluations will be conducted, identifying ways to define the indicators and target audiences for the evaluations. In presenting the framework for the evaluation and monitoring of the project, we provide details of the principles for choosing tools for data collection, the coordination and training strategies for the evaluations, and the ethical considerations that will guide all OTTER data collection and analysis.

1.2 Rationale

How evaluation will be implemented in OTTER?

The evaluation and monitoring process is built in fine dialogue with the project objectives. OTTER is structured in three primary objectives that comprise: (i) to enhance the understanding of Education Outside the Classroom methods and pedagogies, (ii) to enhance the understanding of how Education Outside the Classroom 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, and (iii) 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. In more detail, the project has five specific objectives.

Specific objectives of the OTTER project

- Strengthen Education Outside the Classroom networks within Europe, connecting experts from a wide range of regions within the continent.
- Increase the understanding of the effects of Education Outside the Classroom on EU students undergoing traditional classroom education, including their levels of sophisticated consumption and scientific citizenship.
- Enhance young people's scientific literacy concerning global environmental issues surrounding plastic waste and recycling.
- Identify characteristics of effective Education Outside the Classroom practices considering gender aspects and geographical differences.
- Measure and assess Education Outside the Classroom programmes/methodologies and enrich the inventory of tools available for future methods of accreditation beyond the end of the project.

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To this end, the project will investigate the role of Education Outside the Classroom in four pilot countries – Spain, Hungary, Ireland, and Finland. Considering OTTER's goals, the evaluation of the pilots will rely on multiple sources of evidence, covering, therefore, a mixed approach of data collection and analysis.

By adopting a mixed perspective, both quantitative and qualitative elements are combined precisely because OTTER is immersed in a complex social context with multiple characteristics that can affect the project's success. We understand that ignoring the complexity of OTTER's multiple contexts (e.g., different educational systems, different socio-cultural contexts among participating countries) could impoverish its evaluation (Frechtlin & Sharp, 1997). By critically choosing a mixed approach, however, we aim to take advantage of the strengths of each one and minimize the weaknesses of a single method, drawing on multiple sources of evidence. Thus, the data generated by the project will be analyzed based on triangulation. The intentional choice for triangulation arises from the possibility of contrasting statistical results with qualitative results to obtain complementary evidence to answer the research questions (Creswell & Plano Clark, 2006) (see *Research questions* box). Through data triangulation, we will obtain a better understanding of the project's results, given that both qualitative and quantitative methods can lead us to an adequate evaluation of this project, increasing confidence in the results (Bennedtt, 1984; Creswell & Plano Clark, 2006).

Evaluation is a process that will take place before, during, and after the OTTER activities. Based on this approach, we hope to answer five major questions that guide the project (see *Research questions* box). This research evaluation will be carried out in each partner country, and the results will be synthesised to produce a comprehensive account of the project's impact. The focus will be on students and their science learning outside the classroom and in formal education.

Research questions of the OTTER project

- How does young people's engagement in the project's activities increase their motivation for learning science?
- How does young people's engagement in the activities influence their aspirations for scientific careers?
- How does out-of-school learning help build scientific citizenship?
- How does young people's engagement in the project's activities support the development of their knowledge about clean water and sanitation, climate action, life below water, life on land, and plastic pollution?
- What are the design characteristics and dimensions (e.g., social-environment, cognitive) of effective models of partnerships between the formal and the informal sector?

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2. Introduction

2.1 About this deliverable

This is the first deliverable from OTTER's Work Package 4 (WP4). WP4 develops and implements a comprehensive monitoring and evaluation plan, gathering and analysing data from all participants in the project – students, teachers, families, public members, researchers, other stakeholders. In the Figure 1 are described the deliverables related to evaluation and monitoring and the interconnection between them.

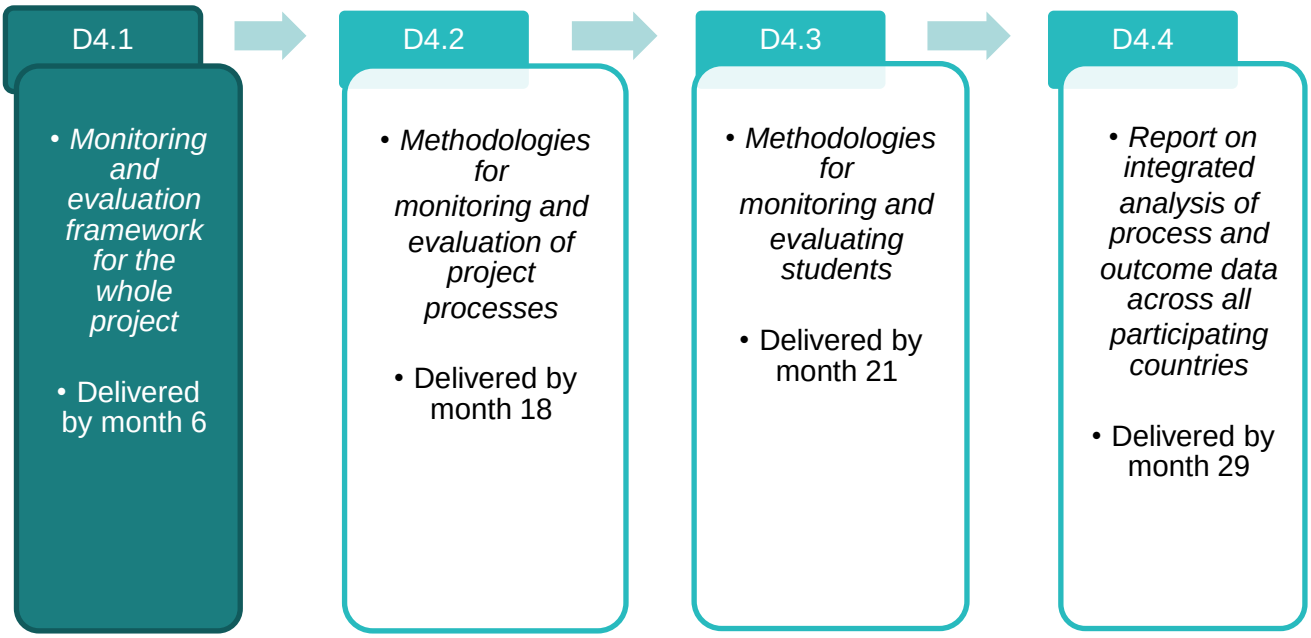

Figure 1. Deliverables of WP4 emphasising the first one described in this document.

The objective of the process assessment is to determine the design characteristics and dimensions of effective models of partnerships between the formal and informal education sectors. The outcome assessment aims to determine the effects of the Education Outside the Classroom activities on students' acquisition of scientific knowledge as well as 21st century skills and the eight key competencies for Lifelong Learning in the European Union (European Commission, 2018).

The goal of the *D4.1 Monitoring and Evaluation Framework* is to propose an overarching monitoring and evaluation structure to conduct future OTTER's activities. This deliverable presents an integrated evaluation outline based on this premise and is designed around impact categories according to the public and professional audiences. This deliverable, therefore, focuses on a broader conceptual and methodological approach for the project. Specific tools will be detailed in the deliverable *D4.2. Methodologies for monitoring and evaluation of project processes* and *D4.3 Methodologies for monitoring and evaluating students' scientific knowledge and 21st century skills.*

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2.2 Structure

This document is structured as follows:

- The *Evaluation Strategy* section briefly summarizes what we already know about Education Outside the Classroom to inform what principles we consider to OTTER's evaluation strategies. The section then presents the research approaches and methods used to answer the different research questions, detailing the OTTER impact categories and the principles for choosing and designing the quantitative and quantitative tools.

- The *Monitoring and Evaluation Framework* section is structured in nine parts that detail (i) how the OTTER project is considering implementation and (ii) the design of monitoring and evaluation; (iii) what are the OTTER quality targets; (iv) how will the coordination and training for evaluations occur; (v) the role of monitoring and evaluation checks throughout the project; (vi) the ethical principles for data collection and processing; (vii) the integration of gender strategy principles throughout the monitoring and evaluation process; (viii) the challenges previously identified, and (ix) the possibilities for analysis and the expected results of the project.

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3. Evaluation Strategy

3.1 What we already know about Education Outside the Classroom?

The reported outcomes of Education Outside the Classroom approaches have been many, including higher scientific reasoning abilities among students' interactive, cognitive, and logical thinking skills, practical mathematics, skills, and knowledge transferable to outside school (Gerber et al., 2001) improvements in self-esteem, motivation, and concentration (Knight, 2011), improvements of social skills, of physical motor skills and development of language and communication (O'Brien, 2009). These could be grouped and categorised as cognitive (knowledge and understanding), affective (attitudes and feelings), social/interpersonal (such as empathy and communication skills), and physical/behavioural (civic, moral, and ethical skills) (Brody et al., 2008). Moreover, in the last decade, it was revealed that Education Outside the Classroom has benefits for students, avoiding the nature-deficit disorder, terminology that defines the variety of behavioural and psychological troubles due to living in urban areas (Louv, 2008).

Precisely because of the vast literature on the topic, the initial work of OTTER has begun with a broad literature review, detailed in the *D2.1 Literature review and compendium of successful practices*. Overall, this in-depth review of previous empirical research on the impacts of Education Outside the Classroom, methodologies for assessing such influences, and the effects of Education Outside the Classroom on media literacy and scientific citizenship will be used to inform the next steps of OTTER. The goal is to compile and analyse the available knowledge about Education Outside the Classroom practices and their impacts on citizens, regardless of pedagogy, activity type, or approach. Thus, based on the results presented in the deliverable *D2.1*, we will bring more informed strategies for measuring project outcomes later in *D4.2 Methodologies for monitoring and evaluation of project processes*.

3.2 Concept and Methods

Considering what has been pointed out previously in the literature, a mixed methods research approach (e.g., Creswell & Plano Clark, 2006) and design-based research are critically incorporated methods in the OTTER monitoring and evaluation framework. As we have indicated, the use of both quantitative and qualitative research strategies, also known as mixed methods research, draws on the strengths of both approaches by using complementary assessment methods. Mixed methods research aims for workable, rather than perfect, solutions: it applies a pragmatist philosophy and methodological pluralism as the best way to answer important research (Johnson & Onwuegbuzie, 2004). Combining different data collection and analysis strategies is more likely to produce results

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that accurately inform us about the accomplishment of program goals (Brody et al., 1992). This approach is claimed to have results superior to monomethod (Brody et al., 1992).

In this scenario, the research evaluation consists of different sub-research studies (Table 1), carried out in each partner country and framed within the design-based research paradigm (Brown, 1992; Collins, 1992), which is used for studying learning in the context of real-life settings (e.g., community settings) where complex interactions take place. Among the research questions for the project evaluation, we provide an initial and non-exhaustive list that is being considered for the choice of research instruments (Table 1). These questions help to understand the parallels between impact and methodology.

Table 1. Parallels between research questions, methods, and impacts.

Research question	Methods	Expected impact
What are the design characteristics and dimensions (e.g., social environment, cognitive) of effective models of partnerships between the formal and the informal sector?	Research approach: Analysis of the nature of the collaborations (e.g., nature of resources, activities, involvement) and the effectiveness of partnerships across the partner countries (both formal and informal). Data: Various findings from all work packages (e.g., reports, science events, curriculum materials, focus group).	The creation of new partnerships in local communities to foster improved science education for all citizens within various out-of-school contexts.
- How does young people's engagement in the project's activities increase their motivation for learning science? - How does young people's engagement in the activities influence their aspirations for scientific careers? - How does out-of-school learning help build scientific citizenship?	Research approach: Combination of quantitative and qualitative methods. Data: Will be collected through various instruments. - Questionnaires with a sample of the participants - Semi-structured Interviews with a selected group of participants - Ethnographic observations of participants' engagement in activities - Semi-structured Interviews with students and other participants (e.g., public, parents) - Content analysis of various outcomes (e.g., students' work)	Out-of-school science education should contribute to a more scientifically interested and literate society and young people with a better awareness of and interest in science and scientific careers.
How does young people's engagement in the project's activities support the development of their knowledge about clean water and sanitation, climate action, life below water, life on land, and plastic pollution?	Research approach: Combination of quantitative and qualitative methods. Data: Will be collected through various instruments. - International Programme for Student Assessment (PISA) of scientific literacy domain - Semi-structured Interviews with participants (students, public) alongside new tools that will be developed as part of the project - Participatory Observation and analysis of customs, cultures, etc.	Activities should provide participants with opportunities to construct scientific knowledge concerning global environmental issues

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As the OTTER project is framed in the design-based-research paradigm, data of different types will be collected: questionnaires, surveys, interviews, focus groups, ethnographic observations and video records, and written data (e.g., students' work, or from the online platform). The framework adopted by OTTER is structured in six impact categories that will be the target of the evaluations (Table 2) through the future chosen instruments.

Table 2. Impact categories target* of OTTER framework.

Impact category	Public audience	Professional audience
Awareness, knowledge and understanding (of)	STEAM concepts, processes, or careers	Informal STEAM Education/ outreach research or practice
Engagement or interest (in)	STEAM concepts, processes, or careers	Advancing informal STEAM education/outreach field
Attitude (towards)	STEAM-related topic or capabilities	Informal STEAM Education/ outreach research or practice
Behaviour (related to)	STEAM concepts, processes, or careers	Informal STEAM Education/ outreach research or practice
Skills (based on)	STEAM concepts, processes, or careers	Informal STEAM Education/ outreach research or practice
Other	Project specific	Project specific

*Based on Allen et al. (2008).

These impact categories result from a broad review done by the Division of Research on Learning in Formal and Informal Settings of the National Science Foundation in the US (Allen et al., 2008). They assure a comprehensive and multidimensional evaluation of learning outside of school and are grounded in research on informal science education.

For measuring these impact categories, we build on the synthesis of Allen et al. (2008) to pursue evidence of possible changes targeting students participating in OTTER activities. In the impact category "awareness, knowledge and understanding (of)", we will measure changes related to the exercise of awareness about sustainability subjects. In the category "engagement or interest (in)," we intend to identify changes in involvement, excitement, motivation, interest in scientific topics, and interests in STEAM areas or careers. In the impact category "attitude (towards)", we intend to

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identify changes related to empathy, compassion for the human being and environment and the role of science in society. In "behaviour (related to)", we intend to evaluate changes or exercises in behaviour related to STEAM topics that deal with sustainability and environmental issues. Finally, in the impact category "skills (based on)", we will focus on identifying skills that were improved or acquired during the project (e.g., argumentation, questioning, research mapping, scientific investigation and exploration, participatory observation and collective acting, classification), having as reference the potential of the activities executed during the OTTER Outdoor Labs.

3.2.1 Quantitative tools

Based on the research questions (Table 1) and the impact categories (Table 2), we will use the literature review (*D2.1*) to guide the selection of methodologies for OTTER (which will be developed later in the deliverables *D4.2 and D4.3*). Reviewing and selecting appropriate methodologies will allow us to create a more tailored approach and develop tools that enable a reliable and multi-faceted assessment of the impacts of Education Outside the Classroom practices.

Among the possible quantitative tools that can be used to evaluate OTTER impacts, we highlight some (Table 3). For selecting these research instruments, besides the students' age, the alignment of the tool to the project objectives and its support in the literature, we will also consider other criteria. These criteria will be deemed to be based on the literature on research instruments (e.g., Bennet, 1984; Stokking et al., 1999; Schwarz, 1999; Bryman & Bell, 2011; Azevedo & Scarpa, 2018; etc.) and concerns, for example, usability, data collection and processing time, reliability of data, and validity of the objectives to be assessed. Also, based on this literature, these tools will be adjusted to the OTTER contexts; this includes translating the tools into a language understandable by the respondents and using and adapting appropriate instruments for different age groups.

Questionnaire surveys are an established method for collecting data across a project, specifically in out-of-classroom education, as they can make participants more comfortable answering questions compared to interviews (Couper et al., 2002; De Vaus, 2013). In addition, the questionnaires adopted by OTTER will prioritize closed-ended questions since they are more inclusive for large samples, have a higher response rate (Groves et al., 2004), afford closer insight with discussions of large-scale work present in the literature, and facilitate the translation process for the different OTTER partners (both in data collection and analysis).

Potential participants to surveys and to answer questionnaires (i.e., students, teachers, parents, stakeholders) will be contacted by OTTER researchers online or in person. The survey will be conducted through a multichannel methodology and can involve different formats and ways of

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presenting project information (i.e., in written and orally). In section *Ethics and Participant Consent* we present considerations on the ethical procedures involved in data collection.

Table 3. Some of the instruments being evaluated for OTTER data collection.

Instrument name	What does it evaluate?	Reference
21st century skills scale	21st century skills (Creativity, Communication, Collaboration, Critical Thinking)	Kelley et al., 2019
ASPIRES	Aspirations in science, Interest in science outside of school, Parental support/involvement, Parental aspirations, Parental attitudes to science, Peer orientation to school and attitudes to science, Experience of school science, Self-concept in science, Images of scientists, Components related to future jobs and careers	Dewitt et al., 2013
bASES21 v2 assessment model	21st century skills (Learning and Teamwork, Citizenships and Social Responsibility, Information and Communication Technology Proficiency, Communication)	Martins-Pacheco et al., 2020
Career Interest Questionnaire	Perception of supportive environment for pursuing a career in science, Interest in pursuing educational opportunities that would lead to a career in science, and Perceived importance of a career in science	Tyler-Wood et al., 2010
CHEAKS - Children's Environmental Attitudes & Social Knowledge	Evaluates practice, verbal commitment, affect, and knowledge around topics related to animals, energy, water, pollution, and recycling	Leeming et al., 1995
CREBS - Children's Responsible Environmental Behavior Scale	Political action, Eco-management, Consumer and economic action, and Individual and Public Persuasion	Erdogan & Marcinkowski, 2011
Model of Environmental Values (2-MEV) Scale	Intent of support, Care with resources, Enjoyment of nature, Altering nature, Human dominance	Johnson & Manoli, 2011
NextGen Scientist Survey	Science capital, family habitus, science self-efficacy, and career aspirations	Jones et al., 2020
Relevance of Science Education (ROSE) Student Questionnaire	*What I want to learn about?, My future job, Me and the environmental challenges, My science classes, My opinions about science and technology, My out-of-school experiences, Myself as a scientist*	Schreiner & Sjøberg, 2004
RRI tools	Basic cognitive aspects of learning (e.g., Acquisition of knowledge), Experiential aspects of learning (e.g., Feelings and emotions; Attitudes and perceptions), Transversal competences (e.g., Learning to learn and Social and civic competences)	Heras & Ruiz-Mall, 2017
S-STEM (Student Attitudes Toward STEM)	Attitudes toward Science, Math, Engineering/ Technology, and 21st century skills	Unfried et al., 2015
TOSRA (Test of Science-Related Attitudes)	Social implications of science, Normality of scientists, Attitude of scientific inquiry, Adoption of scientific attitudes, Enjoyment of science lessons, Leisure interest in science, Career interest in science	Fraser, 1978; Navarro et al., 2016
PACesd-Q	*[For teachers]* Integrated Competence Framework for Professional Action in Education for Sustainable Development described by three defining characteristics: willingness, knowledge of pedagogical approaches, and self-efficacy.	Sass et al., 2021

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3.2.2 Qualitative tools

Under the data triangulation perspective adopted by OTTER and its potential to obtain information from multiple sources to validate results (Jensen, 2014), we will also use different qualitative methods to monitor and evaluate the project (Table 4). In section *4.2 Design*, we present considerations on how the sample will be composed.

Table 4. Overview of data collection strategies* according to the target audience.

Target	How will the data be collected?	What personal data will be collected?*
Students	- Observation during OTTER Outdoor Lab - Interviews or focus groups conducted by OTTER researchers - Analysis of school activities - Answers from questionnaires	Age, gender, name of school, and country
Teachers	- Questionnaires - Interview or focus group conducted by OTTER researchers - Texts from the project's virtual platform (OTTER EOC Hubs) - Observation of activities conducted by teachers	Age, gender, name of school, and country
Parents	- Questionnaires - Interview or focus group conducted by OTTER researchers	Name of child's school, gender, and country
Stakeholders (e.g., researchers, members of the public)	- Questionnaires - Interview or focus group conducted by OTTER researchers	Occupation, gender, and country

*See *Ethics and Participant Consent* section.

In this way, the questionnaires (see preliminary selection in Table 3) will be combined with methodologies like focus groups, ethnographic observations, and analysis of materials produced in the project context (e.g., student activities and teacher forums on the OTTER hubs). All participants will be informed about the study's objectives, the data collection and the recording procedures to decide whether or not to participate in the research (see *Ethics and Participant Consent* section). Below, we present the methodological framework that will be adopted for each of these procedures.

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Interviews and focus groups

Multiple semi-structured interviews and focus group protocols will be provided by the University of Groningen team based on specific literature (e.g., Breen, 2006; Tucker et al., 2011; Nyumba et al., 2018; Robinson, 2020) and previous research (e.g., Christidou et al., 2022). Interviews and focus groups will be conducted only by OTTER researchers who have previously received training to ensure respect and protection of the participants (see the section on *Coordination and Training*). OTTER researchers will contact potential participants. The focus group and interviews will be conducted in local languages to allow participants to fully share their experiences during OTTER activities.

Ethnographic observations

Protocols for ethnographic observation of activities and identifying interactions with exhibits and other activities outside the classroom will be provided by the University of Groningen teamwork. The protocols will build on multiple previous works (e.g., Allen et al., 2008; Tucker et al., 2011; Kangas et al., 2014; Marshall & Harron, 2018; Allen & Peterman, 2019; Baran et al., 2019) and will focus on identifying and better understanding participant interaction and engagement during OTTER activities. Also, some of the activities produced for the OTTER EOC Labs can be evaluated with tools standardized in the literature, such as Dimensions of Success, which evaluates STEM activities in terms of features of learning environment, activity engagement, STEM knowledge and practices, and youth development in STEM (Shah et al., 2018).

Data in written form

Written records will be generated at various stages of OTTER. For example, students participating in OTTER EOC Labs activities eventually will produce written activities (e.g., essays, texts, reports, portfolios) for school assessment purposes. We intend to select a small sample of these activities for each research group and focus on students' diversity in terms of country, age, and gender. Because these qualitative data represent a considerably smaller sample than the data obtained from the questionnaires, the written records will be considered to validate the evidence identified in the questionnaires. Also, based on the written documents, we hope to identify a group of students to be interviewed and/or to have their parents interviewed and/or participating in focus groups. According to the project's ethical procedures, all these practices will be previously informed to the schools, parents, students, and teachers (see *Ethics and Participant Consent* section).

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The project also foresees the creation of an online educational outside-the-classroom Hub (OTTER EOC Hub) that will include an online and international forum in the Moodle platform where researchers, teachers, and stakeholders can discuss their ideas, co-create innovative methodologies, and share questions and challenges, and an area of resources embedded on the website, with the resources created in the Hub. The discussions on the forum will be coordinated by the partners, who will ensure a healthy debate is maintained and encourage participants to contribute as much as possible. A sample of written records in discussion forums and activities will also be considered a form of monitoring and evaluation of the project, primarily to assess the impacts on teachers and other stakeholders who participate in the platform's activities. Like all OTTER monitoring and evaluation activities, participants in the online hubs will be informed about the research and may agree to participate in it or not (see *Ethics and Participant Consent* section).

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4. Monitoring and Evaluation Framework

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4.1 Implementation

Data informing process assessments will be gathered throughout the project, whereas outcomes assessments will be conducted in each of the four participating countries. Students in the experimental and control groups will be matched as far as possible on relevant characteristics to enable valid comparisons between scientific knowledge and skills (e.g., argumentation) and other cognitive, affective (e.g., emotional engagement) social/interpersonal (e.g., collaboration and communication skills) and physical/ behavioral skills they may have acquired.

Implementing monitoring and evaluation will focus on the different actors involved in the project. The evaluation focuses primarily on the students and their learning, but other actors will also be monitored and evaluated through different instruments and approaches (Figure 2). This process can be best understood by describing the general design of OTTER (Figure 2) and the coordination and training for the evaluations and the monitoring of data collection, as presented in the following sections.

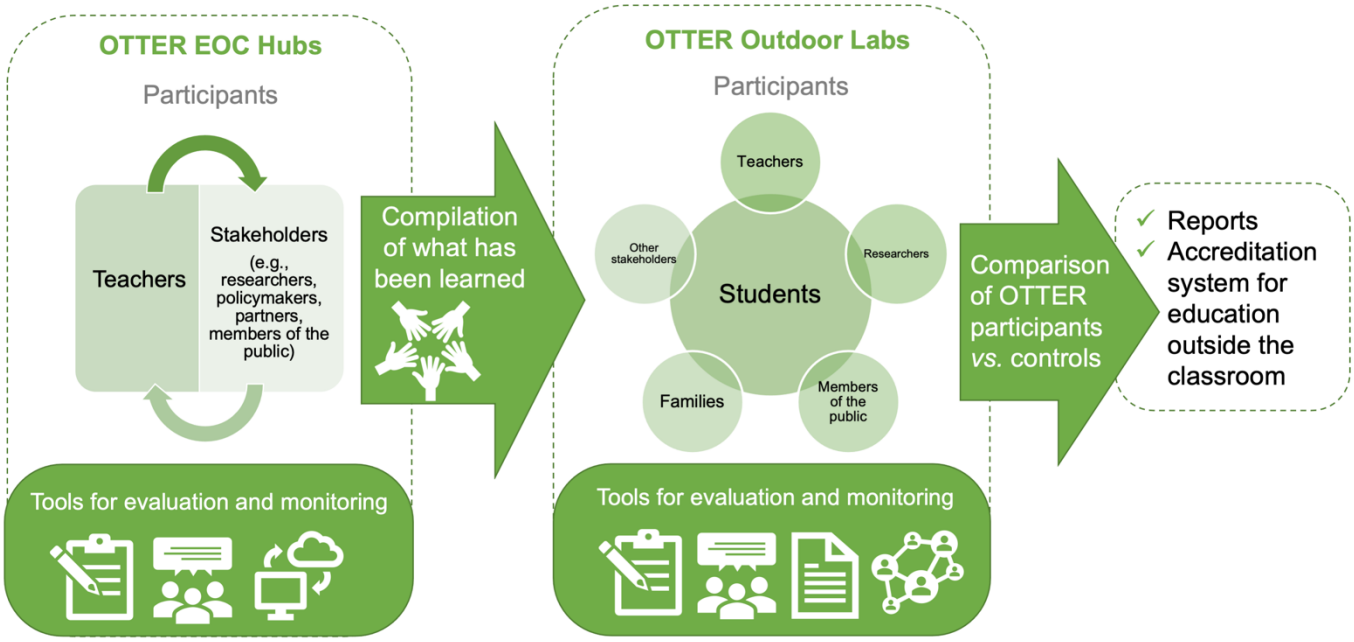

Figure 2. Overview of OTTER highlighting key data collection points for evaluation and monitoring. The tools include questionnaires, focus groups and interviews, online forum analysis, analysis of school activities, and observations

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4.2 Design

OTTER will investigate the effects of various Education Outside the Classroom activities on students (ages 6-18) by comparing performance and views of students who have been subject to additional Education Outside the Classroom activities against students who have not. Knowledge and attitude tests and questionnaires will cover both students and teachers involved to assess the impact of Education Outside the Classroom compared to traditional learning. This should provide valuable data to understand better the scale and nature of the effects of Education Outside the Classroom on classroom performance, as well as the complementarity of both formal and non-formal education, and whether it affects students' level of sophisticated consumption and scientific citizenship not seen in students subject to no additional Education Outside the Classroom practices.

The Outdoor Lab will be developed for implementation in four participating countries (Finland, Hungary, Ireland and Spain) (Figure 3) and four age groups (lower and upper primary school; lower and upper secondary school). Each country will work with two age groups, one at the primary school level and the other at the secondary school level, to account for any differences in curriculum content and structure and the organisation of schools at these two levels.

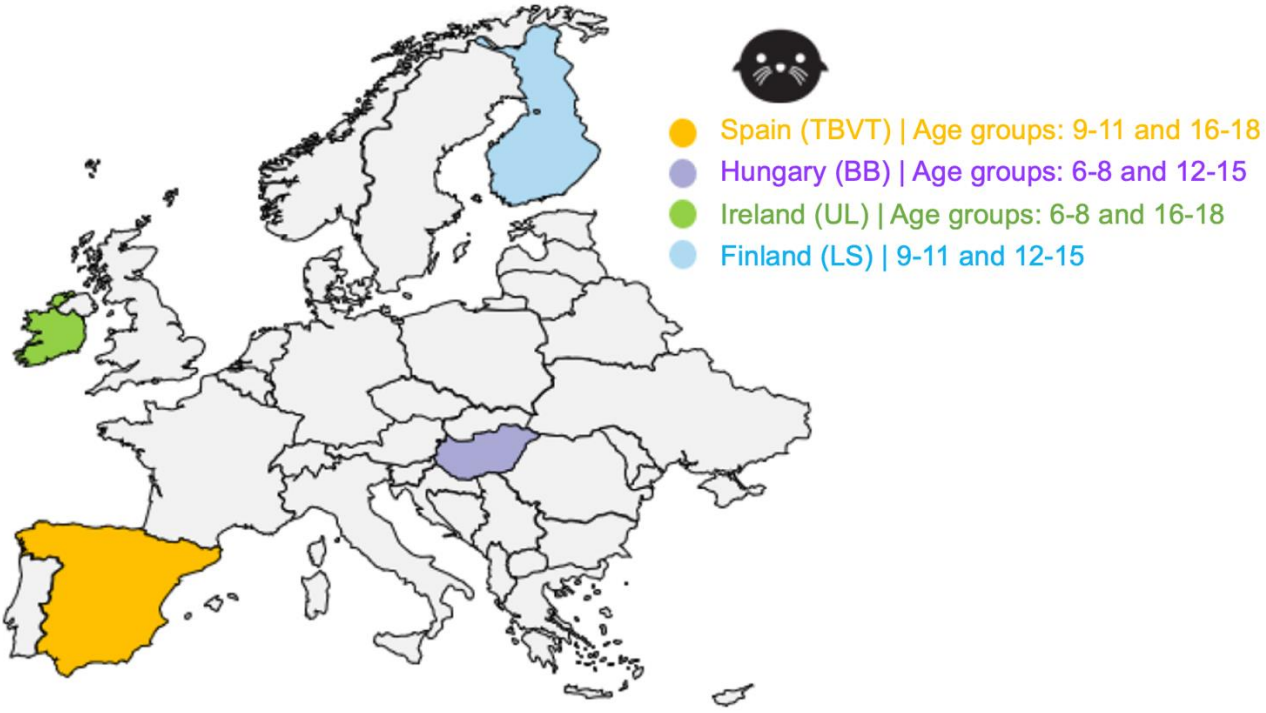

Figure 3. Countries participating in OTTER Other Labs, indicating the consortium partners and the age groups that will be followed in the partner schools

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The aim is to directly address country-specific challenges to implementation at both educational levels while highlighting the affordances and constraints within different countries and different education systems. Therefore, we seek to investigate both similarities and differences between the various country contexts and identify distinctive circumstances that might hinder or favour the Outdoor Lab concept. The approach we have outlined will provide an authentic evaluation of the Outdoor Lab in diverse contexts, thus giving other countries insights into how the OTTER programme can be implemented or adapted to their circumstances.

To kick off the development of the Labs, the pilot leaders and leaders of WP4 and *WP5 Scattering knowledge and opportunities* will meet to evaluate what was learned from the background research and Education Outside the Classroom Hub and how best to apply it to develop effective Education Outside the Classroom activities and methodologies, with content relevant for each country and each age group. As a result, at least four methodologies will be defined to account for the four different age groups between 6 and 18 years old. As well as combining their collective experience and intuition, this will promote team synergy and co-participation and encourage future frictionless communication between the partners.

After the core activities have been implemented and carried out, the WP4 will evaluate the success of the OTTER Outdoor Labs, compile the lessons learned and develop a transferability plan for other countries to carry out similar programmes based on our recommendations. To assess the acquired scientific knowledge and development of related skills, the framework that we present in this deliverable, developed by the University of Groningen team, will be implemented to evaluate science learning in a diverse set of settings outside of the classroom. This explanatory mixed-methods longitudinal research design will be implemented throughout the project with a convenient sample (over 10,000 across Europe for the quantitative data, over 800 for the qualitative data) of the participants of the project (students, families, large public, researchers, stakeholders) to offer an evidence-based research evaluation of the implementation of the various activities related to monitoring and evaluation. As we mentioned, the tools include questionnaires, focus groups and interviews, online forum analysis, analysis of school activities, and observations.

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4.3 Clarifying the targets

OTTER's evaluation will be carried out in each partner country (Finland, Hungary, Ireland and Spain), and the results will be synthesised to produce a comprehensive account of the project's impact. The main focus will be on students and their science learning outside the classroom and in formal education.

By the nature of the project, monitoring and evaluations will be conducted at strategic points. For students, teachers, and parents, we will apply questionnaires before and after the OTTER Outdoor Labs activities, with control groups of participants who did not participate in the activities. In addition, during the OTTER Outdoor Labs activities, we will use qualitative tools (see *Evaluation Strategy* section) to evaluate several of the project's indicators and targets, as indicated in the following box:

OTTER qualitative targets

- Awareness of how science and STEAM works
- Awareness on scientific/STEAM careers
- Knowledge and conceptual understanding of plastic use/pollution, clean water and sanitation, climate action, life underwater, and life on land
- Interest in science, STEAM, and scientific careers
- Positive attitudes towards science, STEAM, and science/STEAM careers
- Positive attitudes towards environmental issues, reduced plastic use, and sustainability
- Behaviour changes in relation to consumer behaviour, civic behaviour, and promoting sustainable development in their own communities
- Development of 21st century skills in the light of Lifelong Learning approach

4.4 Coordination and Training

Previous work has indicated that a primary concern in assessment development and implementation lies in the way assessments are conducted. They often disrupt the flow of Education Outside the Classroom activities and have a pattern of interaction typical in traditional teaching, referring to assessments with grades or judgments of student proficiency (Bevan et al., 2010). Aware

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of these needs, OTTER intends to incorporate meetings for training the partners who will contribute to the data collection. With this strategy, we seek to collect data in a less intrusive and disruptive way to the teaching processes, hoping to contribute to more robust and meaningful data collection.

This level of concern will be addressed with consortium members in training sessions. During the OTTER, WP4 will conduct remote sessions with consortium members to address the overall purpose of the evaluation and the particularities of the methods (e.g., questionnaires, focus groups) for each evaluated target audience (e.g., students, teachers). The training sessions coordinated by the University of Groningen team will cover the specific needs of each of the evaluated groups, discuss ways to obtain diverse samples for each audience, and how to recruit participants. Complementarily, the University of Groningen team will develop detailed guides for consortium members, with instructions and a step-by-step structure to optimize data collections and do so in an ethical, responsible, and transparent way (see *Ethics and Participant Consent* section).

Throughout the development phases of OTTER, several actions for consortium member involvement will be incorporated. Among them, we highlight the effort to involve the different working groups, especially to consult them on demographic and inter-cultural issues that may impact the data collection. The collaborative work between the consortium partners will undoubtedly be crucial for obtaining information to help implement the data collection.

4.5 Monitoring and Evaluation checks

To ensure the effective implementation of the monitoring and evaluation framework, the University of Groningen team will provide continuous support for data collection throughout the project. We understand that the close relationship between the consortium members and the evaluation team/WP4 will be crucial for the project's success. Based on the principles presented in this document, the evaluation and monitoring team will constantly contact the pilots' teams to answer questions and make methodological adjustments based on local contexts when necessary. Regular meetings will be held to answer questions, assist in implementing the evaluation, and optimize data collection. In addition, the evaluation and monitoring team will send out frequent reminders and instructions (see the previous section) regarding the data that needs to be collected and stored.

4.6 Ethics and Participant Consent

Approval to research in the OTTER context was obtained by applying to the Research Ethics Committee (CETO) of the Faculty of Arts, University of Groningen (Proposal #85494053), liberated on 20 January 2022. The CETO has established that the research protocol follows internationally recognised standards to protect the research participants.

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The consent and assent forms were previously submitted to the CETO to be used for data collection. All activities of this project were considered low risk for the researchers and participants. The main risk previously identified was possible inconvenience related to the time needed to participate in the research. Accordingly, the participants will be informed, and we will follow the principles established in *D7.1. H Requirement n°1* and *D7.2. POPD Requirement No.4*, related, respectively, to criteria that will be used to identify/recruit research participants and anonymisation and pseudonymisation techniques.

From these documents, we highlight that all instruments and consent and assent terms will be translated into a language understandable to the target audience. This means that the information will be presented according to the participants' local idiom (Spanish, Hungarian, English and Finnish), but mainly that the terms will include the necessary adjustments in language to be understood by the target audience (e.g., students of all age groups, teachers, parents). In addition, these terms contain clear information about the research objectives, how the data will be collected and how they will be processed. Finally, all participants will also be explicitly informed (in writing and orally, where necessary) that they have the right to withdraw at any time from participating in the research.

Personal and sensitive data will be managed according to the *D1.4. Data Management Plan* and comply with the Ethics Appraisal Procedure required by the Horizon 2020 research program, funded by the European Commission. Accordingly, OTTER follows the Regulation (EU) 2016/679, the EU new General Data Protection Regulation (‘GDPR’).

4.7 Gender Strategy and Evaluation

In line with the Horizon 2020 Guidance on Gender Equality and SDG 5, OTTER will contribute to promoting gender equality as a cross-cutting issue throughout the project by implementing actions aimed at ensuring gender balance in all project activities as well as researching relationships between students’ gender and learning outcomes in terms of scientific knowledge and 21st century skills. A range of geographical locations will be accounted for in order to improve the quality, variety and validity of research, so it is applicable across all regions of the EU, and this is also essential in order to contribute to SDG 4 (ensure inclusive and equitable quality education and promote lifelong learning opportunities for all), which is one of the pillars of this project.

By ensuring representation of students from different geographical corners of Europe and of different genders, analysis will be carried out to identify any gender/location specific trends in relation to the OTTER’s specific objectives and help to improve understanding of how differences in performances between genders might vary geographically and whether Education Outside the Classroom activities are more effective for a particular gender and/or geographical location. Bearing

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in mind that gender performance differences are dependent on the region, OTTER will strive to present precise research results for each of the countries and the effects Education Outside the Classroom will have had.

Monitoring and evaluation actions are gender sensitive, especially when conducting analyses of the knowledge and skills acquired. Building on *D1.3 Gender Strategy*, we outline some of the principles, practices and evidence that will be adopted by WP4 throughout the OTTER monitoring and evaluation (Table 5).

Table 5. Principles in line with the *Gender Strategy* adopted for evaluation and monitoring.

Principle	Practice	Evidence
[Principle 1] Gender is a cross-cutting theme across all dimensions of the project	- All work-packages consider the impact and place of gender, gender equality and differences across genders within the related deliverables - A balance of girls and boys is supported in the evaluation panels	The framework presented in this deliverable
[Principle 2] All research conducted throughout the project is gender-sensitive (paying attention to the participation of a range of genders, providing equal opportunities for all, and integrating gender into the research content all the way from the initial research idea to the dissemination of results	- The relevance of gender to the research topic is considered - Research questions/ hypothesis are gender-sensitive - The research methodology ensures that (possible) gender differences are investigated - The research methodology ensures that sex and gender differentiated data is collected and analysed throughout the research cycle - All research instruments are designed to explore potentially relevant sex and/or gender differences in the data collection - Gender neutral language is used in the design of all research instruments - A balance of girls and boys is supported in the selection of participants in the research - Data is analysed according to the sex/gender variables	Gender issues are covered in the research proposal and the theoretical and methodological framework of the project. In addition, the research instruments being considered for data collection support suitable analysis of gender differences throughout data of interest for the project.

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4.8 Challenges

Considering the effects of the COVID-19 pandemic and the massive increase in online activities that can overwhelm individuals, we intend to optimize data collection. Therefore, wherever possible, data collection instruments will be shortened and presented in a pleasing and/or interactive way according to the target audience. Among some of these efforts, we highlight, for example, the possibility of conducting more focus groups rather than interviews and having more condensed questionnaires.

Grounded in previous experiences, we have also identified that another challenge lies in engaging students' families in educational research. Aware of this challenge, we intend to incorporate learnings from other experiences portrayed in the literature (e.g., Doolan et al., 2010) to recruit parents, seeking to have a diverse sample. Also, one of the main difficulties related to the actions described in this deliverable concerns recruiting partners for the project in the context of the COVID-19 pandemic. To overcome this challenge, dissemination activities in the online context (see *D6.1 Dissemination plan and visual identity*) will be fundamental to reduce the possible impacts on the targeted number of students that will compose the study data.

4.9 Analysis and Expected results

Data analysis will cover integrating quantitative and qualitative findings across participating countries. Analysis of similarities and differences will highlight areas where Education Outside the Classroom might have complemented classroom activity or led to learning that did not happen in the classroom. The quantitative data analysis will also investigate relationships between gender and geographical location in terms of students' learning outcomes.

Qualitative data will be analysed according to the literature, using different techniques (e.g., content analysis, thematic analysis). Concerning the quantitative data – which will represent the most significant part of the data –, initially, the results will be organised in terms of descriptive statistics (frequencies, averages, medians, standard deviations, etc.) and/or the creation of indexes (according to the questionnaires format decided a priori). Further, according to the nature of the distribution of the available data (e.g., normal or not), the data may be analysed preferably by inferential statistics.

Among the possible approaches for evaluating the impact of the activities, we consider performing, t-tests, ANOVAs, ANCOVAs, and correlation analyses (Ary et al., 2018). Assessment of students' scientific knowledge and acquired skills will permit comparisons between those who participated in the OTTER Outdoor Labs and those who did not, in order to gauge the relative effects of the EOC experience, compared with formal education, on students' scientific literacy.

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Complementarily, to review social indicators (e.g., gender and country), multiple correspondence analysis may also be used (Akturk et al., 2007).

Out-of-school education has been shown to impact positively students' cognitive, affective, social/interpersonal and physical/ behavioral skills (Brody et al., 2008). We expect that our innovative OTTER Outdoor Lab programme will help develop various outcomes including, but not limited to, independence, confidence, self-esteem, interpersonal and social skills, concentration, empathy and compassion for the other, awareness, analytical and critical thinking, motivation and physical skills. Several of these outcomes have already been proven by our partners *Learning Scoop* and *The Big Van Theory*'s activities. They have reported that experiencing something — as opposed to hearing it described or reading about it — can help improve young people's recall and reflective skills, that opportunities for interaction with people in the local community helps to develop independence and social skills and that Education Outside the Classroom activities make young people more engaged in both social and learning contexts. Compiling research and projects in the topic, engaging practitioners and researchers in discussions around Education Outside the Classroom practices, selecting best practices and developing together the programme will allow OTTER to find the best methods to achieve a high acquisition of transferable skills along the OTTER Outdoor Labs.

4.10 Final Considerations

In this document, we present the guiding principles for the evaluation and monitoring of the activities as part of the project OTTER. Based on this framework, the subsequent actions of WP4 will guide the development of the following deliverables (D) and involve:

- Defining the research instruments also guided by *D2.1 Literature review and compendium of successful practices* (to be detailed in *D4.2* and *D4.3*)
- Creating protocols and conducting training with the OTTER team for data collection (to be detailed in *D4.2* and *D4.3*)
- Coordinate data collection (to be detailed in *D4.2*, *D4.3* and *D4.4*)
- Analyse the data and synthesize the results (to be presented in *D4.4*)

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