EDUCATIONAL FRAMEWORK

Deliverable IO-1

‘CLIMATERACY’

“Developing Competencies of Teachers to integrate Climate Literacy Education in European Schools”

2020-1-EE01-KA201-077890

This project has been funded by the Erasmus+ Programme of the European Union. This publication reflects the views only of the author and neither the European Commission nor the Estonian National Agency can be held responsible for any use which may be made of the information contained therein.

Co-funded by the Erasmus+ Programme of the European Union

https://climateracy.eu/

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1. The Climateracy Project

1.1 Consortium

The Climateracy project is funded by the Erasmus+ Programme of the European Union and is managed by a consortium of partners composed by:

	Tallinn University http://www.tlu.ee/	**Estonia**
	Vzw UC Limburg http://www.ucll.be/	**Belgium**
	ANS Education and Consultancy http://www.ansdanismanlik.com/	**Turkey**
	Goeteborgs Universitet http://www.gu.se/	**Sweden**
	Paydaş Eğitim Kültür ve Sanat Derneği http://www.paydas.org.tr/	**Turkey**
	Wila Wissenschaftsladen Bonn http://www.wilabonn.de/	**Germany**

1.2 Aim and Objectives

The Climateracy project AIMS to enhance secondary school teachers' knowledge and competences to support their students to become climate-literate people by developing an educational framework (EF), an open online course (OOC) and online teacher community (OTC) with six partners from Estonia, Belgium, Germany, Sweden and Turkey (2). This AIM will be gained by achieving the following OBJECTIVES:

- develop an educational framework after identifying the needs of teachers and students required for the teacher training course;
- design and test open online course for teachers;
- increase synergies, communication, and collaboration among teachers by letting them meet up in an online teacher community;
- promote Climateracy open online course and online teacher community to be added to the ongoing curriculum of secondary schools through dissemination events;
- enhance knowledge and competences of teachers in secondary schools who commonly teach 13–19-year-old students usually from 7th or 8th grade upwards which will facilitate them in the long run to raise the level of climate literacy of students;
- improve the supply of high-quality learning opportunities in the field of climate literacy tailored to the needs of both teachers with no prior relevant knowledge in the field, as well as of average-level skilled teachers with climate issues background;
- encourage students and teachers to engage in energy saving practices and raise awareness on different pathways to become climate-literate persons.

1.3 Target Group

- The primary target group will be lower and upper secondary school teachers, who are eager to get training to strengthen their knowledge and competences to be able to support their students to become climate-literate;
- The secondary target group will be lower and upper secondary school students, who will be the direct beneficiaries of the Climateracy Project's teaching/learning activities;
- The tertiary target group will include educational leaders, teacher trainers, academics, corporations, policymakers, entrepreneurs, and other stakeholders interested in sharing their knowledge and experiences and providing input on the Climateracy project's deliverables.

1.4 Intellectual Outputs

The consortium of the Climateracy project will develop three intellectual outputs during the 24-month project duration in order to achieve the aim and specific objectives mentioned in the previous section above:

- Educational Framework (EF): The 1st intellectual output (IO1) of the Climateracy project is the development of the educational framework which will then be used to create e-content for the open online course (OOC as IO-2) for secondary school teachers in every discipline with the aim to equip them with the innovative teaching methodologies to teach climate literacy to students aged 14-18;
- Open Online Course (OOC): The 2nd intellectual output (IO2) of Climateracy project is to design and pilot an open online course (OOC) for secondary school teachers which will empower them to implement Climate Literacy Education effectively in their teaching environment;
- Online Teacher Community (OTC): The 3rd intellectual output (IO3) of Climateracy project is to create a network for teachers which will allow them to share experiences, exchange ideas and materials to Climate Literacy Education across European schools.

2. The Background of the Climateracy Project

Climate change is often regarded as one of the most pressing issues of our day. There is significant evidence of anthropogenic impact on the global climate, and its consequences may be seen in both developed and developing countries.

Current trends are alarming: global greenhouse gas emissions are increasing, and hundreds of millions of people throughout the globe are seeing their livelihoods and incomes threatened by climate change, or have been harmed by extreme weather events. Furthermore, because climate change has a detrimental impact on critical industries such as agriculture, it is linked to malnutrition.

As a result, it is critical that climate change be given the attention it deserves. Also, it is critical to promote a greater awareness of what climate change is, how it affects humans and the physical environment, and how it may affect human and ecological well-being. In other words, we need a higher awareness of climate change in order to adequately handle the tremendous issues it offers.

The 2030 Agenda associates Objective 13 to the development of the United Nations Framework Convention on Climate Change (UN 1992) as the main international and intergovernmental frame in order to achieve a consensual response to the climate crisis. It expresses the necessity to include, in the policies of response to climate change, programs of "education, training and public awareness," with two specific lines of action: one aimed at creating "public awareness" on the climate threat – at a time when this was irrelevant in the public agenda – and another recommending the integration of climate change into every country's educational and formative system.

Education is an essential element of the global response to climate change. It helps people understand and address the impact of global warming, increases "climate literacy" among people, encourages changes in their attitudes and behaviour, and helps them adapt to climate change related trends. Although the role of education in addressing the challenges of climate change is increasingly recognized, the curriculum and teaching in schools still is far from being effective in equipping young generations with strategies to deal with the climate change challenges of today and the future. Not only do we need to place climate change at the centre of the curriculum, but also, we need to reinforce educational resources that do not belong to the formal education system, by activating social learning systems, as suggested by Heras (2014), and by creating peer-to-peer knowledge networks in order to involve all kinds of public to take action against climate change.

3. The Development of the Educational Framework

The AIM of this intellectual output (IO1) of Climateracy project is to develop the Educational Framework (EF) for the open online course which will enhance teachers' knowledge and competences on the promotion of the Climate Literacy at secondary schools across Europe. In order to achieve this AIM, the following OBJECTIVES will be achieved:
- identify Learning Outcomes and the Open Online Course Plan;
- introduce the teaching and learning strategies for implementation;
- define the assessment strategy;
- describe the content of the training modules.

The TARGET AUDIENCE of this Educational Framework are broadly the teachers in secondary schools of European countries who commonly teach 13–19-year-old students usually from 7th or 8th grade upwards from different subject areas such as
-Natural sciences: geography, biology, physics and chemistry;
-Social sciences: history, politics, media and humanities, including ethics and philosophy;
-Project-based management and entrepreneurship courses (these may vary strongly from country to country).
Using this framework, the Open Online Course (IO-2) and the Online Teacher Community (IO-3) for the teachers of each partner country will be developed.
Throughout the development of this framework, project partners have collaboratively conducted the following activities:
1) Primary Research-Needs Analysis
2) Course Content Description
3)CourseWriting

3.1 Primary Research (Needs Assessment)

A needs assessment in the partner countries was the first step in developing the Educational Framework for the open online course on the promoting of Climate Literacy. For this purpose, we developed a questionnaire including close and open-end questions through the review of the relevant literature and the discussions that took place in our online meetings with the representatives of the project partners. The survey (see Appendix 1) involved eight

questions on expectations from teaching on climate literacy, students´ current knowledge of climate literacy, teaching and learning activities currently used in schools on climate literacy, examples from good practices and teachers´ needs in teaching climate literacy on their schools which activities and online tools they would like to have access to.

The survey was translated into the respective languages used in the five partner countries and distributed to the teachers in partner and other schools that the partners have access to both as an online and paper and pencil tool. Teachers were explained that a new teacher training program was being developed to teach climate literacy more effectively in schools, and their responses to the questionnaire would be used as a database for this course content development effort.

A total of 138 teachers from lower and upper secondary schools in the five partner countries (Sweden=7, Germany=32, Estonia=19, Turkey=53, Belgium=27) participated in the needs assessment study. The distribution teacher participants represented various subject areas ranging from natural sciences to social sciences, from languages to arts and music. Despite this great variance among teachers in the sample, most of the participants came from science subject areas. The respondents also varied in terms of the type of schools they worked at ranging from general/academic high schools to secondary schools with more specific orientations such as science, vocational, social sciences and religious orientations. Both novice and experienced teachers participated in the study, and their teaching experience ranged from 1 year to 40 years. On average, they roughly represented 11-15 years of teaching experience.

Country-based needs assessment reports were written first by the project partners based on the analysis of the survey data they have collected. The results of these reports were summarised here to arrive at suggestions and directions for the course content to be developed on Climate Literacy.

3.1.1 Teachers´ expectations from teaching about climate literacy

There are diverse views of climate literacy among the teachers from the partner countries leading to a rich set of expectations from teaching climate literacy. All teachers are interested in learning more about climate change even though they are not sure how to teach it most effectively. Some emphasise the importance of curriculum and classroom activities while others promote the importance of extracurricular activities and civic movements.

Teachers are interested in collaboration among teachers and schools, and an interdisciplinary approach to teach climate literacy (CL) leading to projects that would cover the requirements of multiple disciplines. They expect an open approach to climate issues in schools, a flexible approach in the curriculum, more time, resources and support to teach it in classrooms and through extracurricular activities. They also highlight the importance of involving parents and the larger community in addressing climate issues and establishing a common understanding for tackling the respective challenges. Teachers expect more awareness on climate change in the larger community of the schools in order to establish an open and honest approach to teach CL in their schools.

The role of curriculum is also highlighted in the expectations of teachers in some countries. Teachers need to follow the curriculum in teaching climate literacy; therefore, more emphasis should be given to CL in the curriculum for teachers to have more time on it in class. The curriculum-based suggestions from teachers also emphasise the need for an interdisciplinary approach to teach CL, collaboration among teachers, and practice-based activities in line with the curricular requirements. Teachers state that various subjects address CL in different ways and in different amounts, and therefore suggest that projects beyond the subject areas could help students to bring together an interdisciplinary understanding to go beyond the limitations of certain subject areas and the superficial coverage of knowledge in some courses.

Some teachers argue that the curriculum is already crowded, and it is difficult to put in more content on CL in subject area courses. Therefore, they highlight the importance of interdisciplinary projects and extracurricular activities to address sustainable development goals in schools. Activities that could be adapted to various target groups and school conditions could be helpful toward this goal.

Some teachers working at public high schools stated that they are expected to participate in national and international projects that focus on teaching CL. For this purpose, they are expected to participate in seminars, and work with teachers from other schools, and countries.

3.1.2 Teachers´ perceptions of students´ knowledge of climate literacy

Although there are differences between the project countries, most teachers who participated in the needs assessment survey indicate that only a small percentage of their students have a very good understanding of climate issues. Most students have a general understanding while a considerable group of students only has limited understanding of

climate issues. Only in one of the countries (Estonia), teachers think around a quarter of their students have a very good understanding of climate issues while this group is very small in other four project countries, according to the responses of the teachers.

3.1.3 Teaching and learning activities teachers carry out on climate literacy

Teachers in different subject areas state that the subject curriculum presents varying levels of coverage of climate issues, but they still try to include activities and projects on CL in their lessons. Teachers state that they try to integrate climate change topics, sustainable use of resources into their lessons through project work, experiments, role-plays, examples of sustainable materials, planting trees in school gardens, and making connections to everyday life in all these processes. Some teachers mentioned the use of certain websites and web tools in relation to climate change.

The activities they use include specific lectures on CL, developing CL lesson plans, reading literature on CL with students, discussion of alternative energy such as solar and wind power, bee houses, nesting boxes, experiments on greenhouse effects, use of CL related worksheets and books, videos, action-oriented projects where students look for solutions to some climate change problems, critical thinking and field trips such as zoos. In addition, they carry out in and out of school projects, interdisciplinary conceptual discussion on CL, alternative thinking on climate issues, student research, measurements in nature, calculation of footprint, essay writing, competitions, guest lectures on CL and group works.

The activities teachers list and emphasise seem to prioritise hands-on and meaningful learning rather than conceptual learning. The linkage between different courses and contexts (in and out of school) is given importance. Furthermore, the connection to students´ daily lives is also prioritised.

3.1.4 Good practices teachers use in their teaching contexts

Teachers emphasise that there are already some good practices tried and implemented in schools that have given good results in relation to raising awareness among students on climate issues and creating interest to act on the challenges brought by climate change. These include field trips to places that could serve as good sources for discussion on climate change such as zoos, museums, industry, waste sites. Carrying out group projects that would involve experimentation, measurement and analysis in real environments was also mentioned as a good practice. Students should be given the opportunity to think for

themselves and act upon problems in their immediate surroundings. For this, they should be provided with the necessary knowledge and facts, start from their own personal experience and environment, and spark a discussion. Students doing research with their peers in authentic contexts, analysing the data they collect, drawing some conclusions, and sharing their results with a larger community would also provide good practices in developing a profound climate literacy.

Teachers argue that sustained learning experiences through projects or activities that lead to some actions can be effective in developing CL with students. Otherwise, short lectures or learning experiences develop some concepts but do not turn into meaningful and long-term learning for students. Activities that would give students ownership of the process and consequences could also be effective.

Teachers also suggest the use of art and drama in teaching CL since they could also heighten their interest and involve their emotional intelligence in the learning process. Cross-curricular teaching activities that take into consideration the time and resources could also be good practices toward CL teaching.

3.1.5 Teachers´ needs in teaching climate literacy

Teachers in different project countries seem to emphasise both similar and different needs in teaching CL more effectively. In Germany for example, teachers' needs primarily include a supportive school environment, good personal knowledge of CL, and relevant national education policy on climate issues whereas in Estonia, motivation of students and teachers´ professional development were prioritised in addition to national education policy.

In general, a national education policy toward climate issues, a supportive school environment and further development of teacher knowledge on climate change seem to be the three common needs for most teachers in the partner countries. Swedish teachers prioritised media focus and public understanding over the other needs since the media coverage could be made use of teaching and learning resources on climate issues from a critical perspective. Turkish teachers highlighted the importance of student motivation as a high priority need implying that the CL curriculum should be geared toward student interest and motivation.

Teachers were also asked about their specific needs in an online environment toward teaching CL in their schools. Their responses provided a rich set of suggestions for such tools to be available online. They include both up-to-date and comprehensive information sources as well as hands-on activities that are activating, challenging, and stimulating for students to

think for themselves. The activities to be developed should be in line with the environment and personal experiences of the students, cover a wide scope of topics, e.g., effect of the food or clothing industry. They should focus on the positive things students can do to make a change, employing multiple senses such as visual and auditory. They should be user friendly, ready to use and applicable for use in their classes. Some specific suggestions for online tools include:

- ✔ put and discover and discuss prejudice in a playful way
- ✔ interactive tools
- ✔ digital self-testing /CO2-footprint tool with remarking points where to improve
- ✔ online-Quiz, motivating tools like Simulation Games
- ✔ concepts and tools that can easily and directly be used, e.g., waste management
- ✔ overview of sustainable development goals and strategies on how to reach them
- ✔ materials for active learning involving whole topic approach
- ✔ combination of the scientific topics and methods
- ✔ videos, slides, games, films, plays, digital content, web 2 tools
- ✔ tools for measuring carbon footprint or other aspects of climate change
- ✔ showing connections between climate change and other environmental challenges and everyday actions
- ✔ content that is presented with suggested labels for each school subject
- ✔ activities that are both cross curricular and within school subjects
- ✔ resources that cover both general and specific themes, e.g., coping with anxiety.

It is important to use digital resources wisely in learning and teaching. Image source: Pixabay

3.1.6 Summary and discussion of the results

The results of the needs assessment survey indicate that teachers in general are interested in learning more about climate change and activities that can motivate students better toward climate issues. They present diversity in the way the official curriculum helps and directs them toward teaching climate change topics in their schools, but most suggest an interdisciplinary, collaborative and active approach to teach CL within a whole school and whole community context.

Teachers find the knowledge of their students about climate literacy is average and general, and think that their students would take advantage of new tools and activities prepared in line with their course objectives as well as the requirements of real-life learning through field trips, experiments in the nature and projects that would imitate real life problems in relation to climate change.

In general, teachers prefer an approach in teaching in climate literacy where students are activated to think for themselves, to conduct research and to discover new things starting from their own experience.

Teachers believe they need more knowledge and experience on CL. They would appreciate scientific knowledge on climate change, as well as ideas for activities that would help them to stimulate and activate their students. In terms of content, the tool should cover a wide scope of themes and topics. The activities should help students think for themselves and motivate them toward solutions, start from their own personal experience and environment, lead them to research on causes and consequences, 4) involve them in lab activities, field trips, permaculture works, assist them in using digital tools to act on climate change.

3.2 Course Content Description

The Course Content Description offers (in the light of the needs assessment report) an overview of the Basic Principles to be followed, the Learning Goals and Outcomes for teachers, the recommended Instructional Strategies and Methodologies and the Assessment Strategy.

3.2.1 Basic Principles to be followed

Throughout the course content, we

- encourage subject integration and offer suggestions for tasks where different subject areas can be considered in the learning process, e.g., in music lessons listening to and analysing songs related to the protection of the Earth or political protest could be integrated to creating a student-led campaign as part of media or social sciences courses. Similarly, easy subject integration can be offered with foreign language and literature courses through reading or listening of various texts, international collaboration, debates and the like. Therefore, we hope to offer an array of educational activities and materials for teachers of all subject areas who are keen to incorporate the topic of climate change in their curriculum;
- combine climate literacy education with citizenship education by encouraging teachers and students to have a "can do" attitude and create change at the local community level (actions are part of learning);
- use and recommend to the teachers the most up-to-date and evidence-based methods and strategies to help make learning and teaching about climate literacy effective;
- offer teachers a flexible, personalised approach to learn and use the materials
- encourage the use different methods and approaches (e.g., learning outside the classroom, field trips, hands on activities, multimedia);
- promote collaboration with existing initiatives locally (e.g. Proovikivi) and also internationally (e.g. promote eTwinning or participation in the Education for Climate Coalition). As written in the application, it is anticipated that the resources developed

during the project will complement and expand existing training initiatives at various educational levels across Europe;

- connect to the European Skills Framework (consider quality criteria); EQVET (consider quality criteria); other frameworks and materials (e.g., UNESCO).

3.2.2 Learning Goals and Outcomes

In order to effectively teach secondary school students, teachers themselves need to understand the essential principles of Earth's climate system, know how to assess scientifically credible information about climate and as a role model lead by example in their actions regarding climate. It is also crucial that teachers know which teaching methods and approaches are effective for helping students grasp the foundational premises of sustainable development, including what it means to be an active and engaged citizen. Thus, the primary goal of the course content is to:

-enhance teachers' capacities to effectively increase climate literacy and teach about climate change for secondary school students by integrating the topics and learning activities into their own subjects and using appropriate methods.

By completing the course, teachers can:

- choose the appropriate methods and approaches to teach about climate topics. e.g., the teacher knows when to use integration of subjects, project-based learning, debates, etc;
- engage students and activate their preconceptions, if necessary, also diagnose misconceptions about climate change and related topics;
- create learning situations where learning of complex systems and general competencies (e.g., critical thinking, collaboration, empathy, intercultural communication etc) is enhanced;
- use a variety of digital tools and materials, including the resources from the OOC developed as part of this project;
- acknowledge their role-model status as a teacher.

Furthermore, after completing the course, teachers will be able to:

- articulate what climate change is, why climate change and climate science matters and how to use credible scientific sources (module 1)
- show how climate change affects students' and their own everyday life and their community (including their nation, Europe and the world) and how we affect climate through our behaviour (modules 2-6)
- demonstrate how they can take action to combat and adapt to climate change (modules 2-6).

The course content will be grounded on 6 modules:

1. Module 1 Introduction to Climate Change
2. Module 2 Ecological Footprint
3. Module 3 Sustainable Transport
4. Module 4 Household Energy/efficiency and waste
5. Module 5 Responsible (Sustainable) Consumption
6. Module 6 Sustainable Food

In addition to these six modules, two more modules

1) Module 00: Teaching about climate change and General Guidelines for Teachers;

2) Module 0: Introduction to the Course

have been created to accompany the open online course (OOC) and the Online Teacher Community (OTC).

3.2.3 Instructional Strategies and Methodology

Focus on Teachers

Our primary aim is to help the teachers as adult learners to acquire better competencies on how to teach secondary students about climate change. In view of the needs assessment report, the **course content will use a combination of independent learning where short instructional videos explaining key concepts are integrated with practical learning-enhancing activities** such as trying out new approaches in the classroom and reflecting on one's own practice, or summarising at the end of a learning activity. In supporting learning, we suggest keeping the ICAP model in mind in order to support teachers

in designing active, constructive and interactive learning activities for optimal cognitive engagement (Chi & Wylie, 2014). Having said this, the **teachers' learning community** will play an important role in the overall learning design (see e.g., Sadera et al, 2009; Wenger, 1997). Evidence suggests that the most effective teacher training programmes are sustained over a longer period of time, are job-embedded (meaning teachers do classroom inquiry as part of their job), collaborative, i.e., they use the model of a *professional learning community*, which could be cross-school and also involve university researchers and community members. As Simon & Ruijters (2014) propose: teachers ought to learn through practising, inquiring and creating - all together. The OOC and the teacher community should support this with their design elements.

Our Understanding of Teaching Climate Literacy Effectively

According to the Climate Action - Encyclopaedia of the UN Sustainable Development Goals, climate **change literacy** (synonymous with climate literacy) "is competence or knowledge in the area of climate change, its impacts, and its solutions" (Johnston, 2020, pp. 200). It is important to note that we view competence as more than a simple ability but also the disposition, attitude and willingness to use one's agency to effect change and be good stewards of the Earth (*ibid*).

The activities and learning methods recommended in the course content to the teachers are premised on the idea that there is **no one methodology or strategy that alone is right** for teaching and learning about climate and climate change, therefore there are many types of instruction that can be used, including demonstration and case studies, role play, independent study, project-based learning, debates, etc. Nevertheless, there is a broad consensus that teaching is effective only when it applies **active, participative and experiential learning methods** that engage the learner and make a real difference to their understanding, thinking and ability to act for sustainable development.

Jose, Patrick & Mosely (2017) highlight the need of experiential, location-based activities to address learners' sustainability knowledge related to their local environment. Efficacy of constructivist pedagogical methods for learning for sustainable development have been demonstrated by various studies (e.g., Bardsley & Bardsley, 2007; Pruneau et al., 2003). Furthermore, location-based learning has been used for ESD in early childhood education (Boyd, 2019), primary (Häggström & Schmidt, 2020) and secondary school (Schneider & Schaal, 2017, Schaal & Lude, 2015) as well within citizenship education (Gryl & Jekel, 2018) and higher education (Goralnik et al., 2018). The second consensus concerns the relevance of project-based learning (PBL) and similar methods (e.g., problem and inquiry based-learning).

They have become a promising way to help students develop transferable '21st century' competencies, such as ability to solve problems in novel contexts, develop leadership, social skills, critical thinking, collaboration and creativity among others (Thomas, 2000; Barron & Darling-Hammond, 2008; Bell, 2010).

In other words, learning only happens if students' minds are activated, they have the possibility to construct the new concepts themselves, make mistakes and put in effort. The ICAP hypothesis is a useful one to consider here also as Chi & Wylie (2014) illustrate well with practical examples. As sustainability issues assume understanding complex and abstract topics and non-intuitive relationships and phenomena, teaching methods that enhance conceptual change should be encouraged.

Keeping up high-quality motivation for learning sustainability issues is also important. Teachers should be aware of how to support students' **autonomous motivation**, that is, create the learning environment where the three basic psychological needs - **relatedness, competence and autonomy** - are satisfied at all times (Ryan & Deci, 2017).

Choosing the right instructional methods can make all the difference. Image source: Pixabay

In order to create the optimal context for learning, effective learning assumes that teachers

are aware of

a) the main principles how conceptual development occurs and what kind of methods might support it (Vosniadou, 2013; Luccariello & Neff, 2010); know what is the role and meaning of misconceptions/alternative conceptions in building new, correct ideas;
b) how the memory functions (encoding and retrieval processes), what is the difference between short-time performance and long-term learning (Soderstrom & Bjork); and how the illusion of learning occurs (Bjork, Dunlosky & Kornell, 2013);
c) how to create a classroom where students' autonomous motivation is supported, that is, the teacher nurtures the three basic needs in designing the learning process all the time and during all activities (Ryan & Deci, 2017).
d) how to support metacognitive skills of students during learning complex ideas (Zepeda et al, 2016).

The basic principles of conceptual learning involve thus: a) be aware of the previous knowledge learners have and how to build on it, b) make it relevant and meaningful through making connections to the learners' own experiences, community and motivation(s).

In addition to being aware of the key factors and cognitive mechanisms of effective learning, when it comes to climate literacy and the broader goals of the Climateracy project, it is important to help teachers understand and build on **various misconceptions** both students and teachers might have regarding climate change (e.g. https://www.apa.org/education-career/k12/misconceptions), including developing **critical thinking and media literacy** (e.g. understanding when something is fake news) and **science literacy** (also criticism of science); how to develop the competencies for **systems thinking** and **design** (related to being an active citizen and holistic thinking, i.e. whatever we do we think about different aspects and the big picture (environmental, social and economic aspects).

3.2.4 The Assessment Strategy

The following means will be used for assessment strategy during the implementation of Climateracy project activities:

- In order to guarantee the relevance and the quality of the Open Online Course, as well as the usability and positive impact on student education, the consortium will collect feedback from teachers via online questionnaire;

- Interviews with relevant stakeholders will be conducted during the multiplier events for collecting their feedback and suggestions for improvement;
- User data from the Online Teacher Community (numbers of users, posts, activity like downloads, what resources are popular etc.) will be recorded;
- At the end of each module (1 to 6) will be self-assessment and self-reflection questions/statements, the results of which will provide data about the effectiveness of the Climateracy Modules.

These evaluation activities will be concluded with national reports (one/country) and a European report showing the main evaluation results and recommendations for final fine tuning.

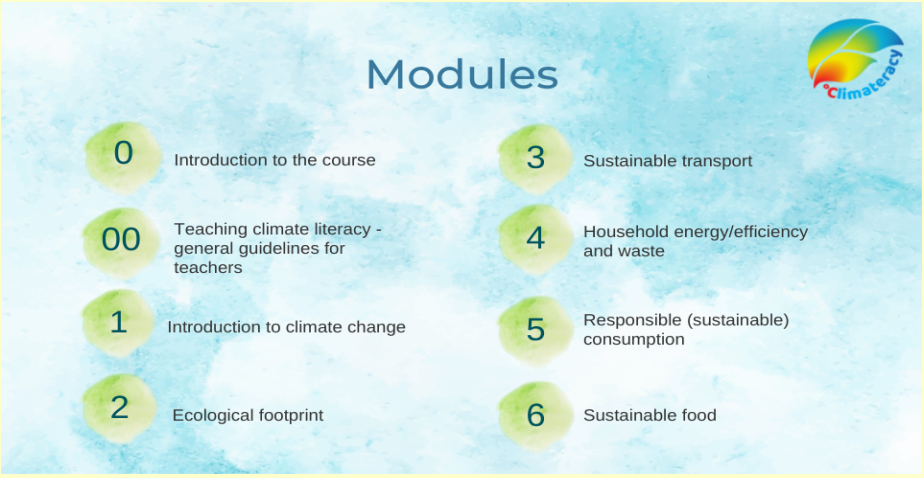
3.3 Course Writing-The Development of Modules' Content

The training topic will be presented as 18 units under 6 themes-modules. However, there will be two more modules at the very beginning (Module 0 and Module 00) to give brief information about the structure of the course and general guideline for teaching climate change. Each themed module is designed to be available on a stand-alone basis comprising a presentation of content, activities, self-assessment/reflection tools to be used on an individual and group basis depending on mode of access. The modules are also integrated with each other to form a cohesive set of knowledge and competences to provide the teachers in order to support their students more effectively dealing with climate change issues in their own classrooms. It is recommended that users complete each unit within a module to ensure completion of the learning outcomes of the module.

Completion of module outcomes provides the learner with a set of assessments and outputs that provide evidence as to the knowledge, skills and attitudes of the learner, building to a portfolio of applied knowledge and competence. The total duration of the training course is twenty-three 40-minute sessions (16 hours) for the theoretical and practical online course via platform, including the self-assessment of knowledge and certification.

The following section includes the content description of each module which will be integrated into online content while designing the open online course as the second

intellectual output of this project, which will then be used by secondary school teachers as part of Climateracy Education Training.



Module 0: INTRODUCTION TO THE COURSE

Module/ Topics Sections of the module	Aim/ Learning Objectives	Learning Outcomes	General Information about the module
Module 0: Introduction to the Course is divided into five parts: A. About the Climateracy Erasmus+ project B. Welcome to the Open Online Course-OOC C. Welcome to the Teacher Community-TC D. Learning Goals E. Overview of the modules in the OOC	**The aim of this module is** to provide teachers with brief information about the Climateracy project and introduce them to the Open Online Course (OOC) and the Online Teacher Community (OTC).	By the end of this module, learners will -Gain a basic understanding of the background of the Climateracy project; -Know about the structure and content of the Open Online Course -Recognize what the Online Teacher Community will offer -Identify the learning Goals of the OOC -Be equipped with knowledge about the modules of the OOC.	This module has been designed to enhance teachers' knowledge and competences to be able to use the Open Online Course more effectively. The first part of this module addresses general information about the Climateracy project. The second part of this module introduces the Open Online Course for teachers and explains how it works, what it involves, etc. In the third part of this module, the Online Teacher Community Platform will be focused on, e.g., how it can be accessed, etc. The learning goals of the course will be dealt with in the fourth part of this module while the teachers will get opportunities to go over each module in the OOC. Each part in the module will be presented with the help of videos.

Module 00: TEACHING ABOUT CLIMATE CHANGE-GENERAL GUIDELINES FOR EDUCATORS

Module/ Topics Sections of the module	Aim/ Learning Objectives	Learning Outcomes	General Information about the module
Module 00: Teaching about the Climate Change-General Guidelines for Educators is divided into three parts: **Submodule 1: The abstract concepts of climate and climate change** A. The learning methods for bringing about conceptual change **Submodule 2: Using systems thinking** A. The Iceberg Model **Submodule 3: Supporting students' psychological well-being and autonomous learning when teaching about climate change** A. Climate Anxiety B. What it all means for educational practice	**The aim of this module** is to reassure teachers that it makes sense to teach about climate and give some general pointers that teachers as an educator can keep in mind as they move forward with bringing the topic of climate and climate change more into their classroom.	By the end of this module, learners will 1. Recognize the abstract nature of climate change and help student address any misconceptions; 2. Gain a basic understanding of systems thinking and its relevance for climate change; 3. Explain how the topic of climate change can affect students' mental health and be aware of strategies to help students stay realistic and positive; 4.Use appropriate pedagogical approaches when teaching about climate change in order to support students' autonomous motivation to learn.	Teaching about a topic such as climate change can be daunting for many educators. Perhaps they feel it is not so relevant for their subject area or it may not be explicitly included in the curriculum, as is the case still in many countries. Or maybe they feel the topic is too difficult and only mention climate change in passing as they teach something else. Whatever the reason, This module has been designed to reassure teachers/educators that it makes sense to teach about climate and they can do it well! The first part of this module addresses the abstract nature of climate change and suggests some methods to deal with abstract concepts. The second part of this module provides teachers guidance to help their students to understand complex phenomena like climate change and its influences. In the third part of this module, teachers will find answers to this important question: How can you as an educator help ease the students' minds and emotions regarding climate change? Each part in the module will be presented with the help of videos, quizzes, etc.

Module 1: INTRODUCTION TO CLIMATE CHANGE

Module/ Topics Sections of the module	Aim/ Learning Objectives	Learning Outcomes	General Information about the module
Module 1: Introduction to Climate Change is divided into three submodules: **Submodule 1: The ABC of Climate** A. What is the difference between weather and climate? B. What is climate literacy? **Submodule 2: Understanding the basic natural mechanisms behind the formation of climate** A. What are the factors forming the global, regional and local climate, what is the spatial framework of the climate? B. What is the temporal framework of climate? C. What astrophysical factors shape the Earth's climate? D. What is the role of land and ocean morphological parameters in the formation of the Earth's climate? E. What is the role of atmospheric composition in the formation of the Earth's climate? F. What is the role of biota in climate formation?	**The aim of this module** is to provide teachers with an opportunity to let students understand what climate change is and why climate change and climate science matters.	By the end of this module, learners will be able to -Explain what factors are forming the climate system; -Demonstrate the ability to find information about climate change and are able to critically analyse the sources of information; -Demonstrate the conceptual understanding of paleoclimate and relevance of timeframe when considering the climate changes.	The main focus of this module is on introducing what climate change is and why climate change and climate science matters. Addressing the climate topic in schools is a challenge as it is a phenomenon that cannot be perceived by the senses. The climate is characterised by meteorological indicators and we need to have meteorological data covering at least 30 years in order to say something about the climate. Thus, the data on climate are rather statistical in nature and we cannot physically sense the change in the present moment. Therefore, due to their age, students cannot have experience with the climate. The climate system that affects all of our lives is shaped by a combination of very different factors, making it a complex system that students need to understand, applied with adequate pedagogical techniques and state-of-the-art climate knowledge. 99.99% of research papers about climate change report that global warming has been triggered by human activities, exacerbated by natural processes. According to current estimates, the Earth's average temperature is 1.8C higher than before the Industrial Revolution. This means major changes in both terrestrial and marine ecosystems, accelerating species extinction

Submodule 3: Understand how we get information about the climate and its variability and looking at climate change from a historical perspective			and changes in the cycle of matter. This has a significant impact on people's food supply and well-being, which is why changing circumstances are causing major societal shocks.

Module 2: ECOLOGICAL FOOTPRINT

Module/ Topics Sections of the module	Aim/ Learning Objectives	Learning Outcomes	General Information about the module
Module 2: Ecological Footprint is divided into three submodules: **Submodule 1: Global warming** A. Is it caused by our ecological footprints? B. How do scientists measure climate change? C. Ecosystem shift D. Climate Change and social systems **Submodule 2: The effects of Climate Change** A. How is climate change affecting our planet? B. How is climate change affecting human wellbeing? **Submodule 3: How are we affecting the climate - our 'ecological footprint'?** A. Measuring our ecological footprint B. Reducing our 'ecological footprint'	**The aim of this module is** to provide teachers with an opportunity to let their students understand the concept of ecological footprint, its relationship with climate change and the effects of our lifestyles on ecological footprint.	By the end of this module, learners will: - Find out what is the ecological footprint and how is it related to climate change; - Understand the development of the ecological footprint and our and society's conscious role in it; - Know how our daily choices, consumption habits and lifestyle affect the world climate; how the rules of economy and decisions of governments affect the world climate.	In addition to our physical footprints when we walk, we also leave behind a number of different invisible traces that change the environment and the climate around us both in short and long term. How can we be sure that climate change is caused by humans? How to measure our carbon footprint? What are the effects of climate change on our ecosystems and does climate change also affect our daily lives? Find out more in this module!

Module 3: SUSTAINABLE TRANSPORT

Module/ Topics Sections of the module	Aim/ Learning Objectives	Learning Outcomes	General Information about the module
Module 3: Sustainable Transport is divided into 3 Submodules: **Submodule 1: Urban Growth and Transport** A. Transport, Economy and Society B. Transport and Health C. Transport and the Environment D. Transport and Climate Change **Submodule 2**: **Sustainable Transport** A. The modes of Sustainable Transport B. The 2030 Agenda and Sustainable Transport C. Case studies aiming to achieve Targets of 2030 Agenda in Sustainable Transportation **Submodule 3**: **Action for Sustainable Transport** **A.** How can you reduce your Carbon Footprint for Transportation? **B.** Good Practices of Sustainable Urban Transport in some cities **C.** The Future of Transportation	**The aim of this module** is to develop the competencies of teachers to provide their students opportunities to understand different ways of reducing Carbon Footprint for sustainable transport to combat climate change and examine the sustainable transport practices of some green cities and finally, analyse the future of transport. **The objectives** of this module: 1. To identify the transport's development with urban growth, its benefits for society and its harmful impacts on health, environment, ecosystems and climate change; 2. To demonstrate conceptual understanding of sustainable transport, different modes of sustainable transport and examine international policies and practices supporting the targets of Agenda 2030 to combat climate change; 3. To discuss and analyse the practices of how to take action to transform to sustainable transport to combat climate change.	By the end of this module, learners will: -Know the benefits and harmful effects of transport -Recognize the different modes of sustainable transport; -Analyse the international policies combating climate change and supporting green cities; -Develop skills to reduce Carbon footprint for transportation.	This module has been designed to develop teachers' competences to teach climate literacy, with particular emphasis on the impact of transportation on climate change and inspire their students to use sustainable transportation. The first part of this module addresses and examines the relationship between urban growth and the increase in transport with a special focus on the benefits and harmful effects of transport for societies. The second part of this module analyses both different modes of sustainable transport and international policies and agendas which target sustainable transport to combat climate change. In the third part of this module, the aspects of reducing carbon footprint are analysed in terms of daily practical tips and good practices from the world. The topics in the module will be presented in various online activities such as videos, quizzes, etc. The module will also provide suggestions for learning activities that stimulate consideration

			of alternatives that can lead to students to use more sustainable transportation.

Module 4: HOUSEHOLD ENERGY/EFFICIENCY AND WASTE

Module/ Topics **Sections of the module**	**Aim/ Learning Objectives**	**Learning Outcomes**	**General Information about the module**
Module 4: Household Energy/efficiency and waste is divided into 3 Submodules:	**The aim of this module** is to develop the competencies of teachers to	By the end of this module, learners will:	This module has been designed to develop teachers' competences to teach climate literacy, with

Submodule 1: Energy Use A. Household energy supply, rating and consumption B. Energy generation - renewable and non-renewable sources C. Energy saving building materials D. Energy use and our ecological footprint E. Technology and energy **Submodule 2:** Energy and politics A. Energy policy and politics B. Government debate regarding energy C. Energy activism - young people influencing energy policy **Submodule 3:** Energy Waste A. Energy 'waste', wasted energy. B. How do we use energy in dealing with other forms of human waste? C. Sustainable Energy Sources	provide their students opportunities to consider in their local context that relate to how energy consumption, and the human need for energy is contributing to climate change. **The objectives of this module:** 1. To demonstrate an understanding of how energy is used by people in different settings, how energy use can be measured and how energy can be wasted; 2. To identify how energy and its use in a political and social issue; 3. To define the importance of sustainable energy sources, the ethical use of energy, and how energy can be wasted.	• Recognize the energy needs, production and consumption on a personal and societal level, and how different forms of energy are considered sustainable or unsustainable. • Know that energy is conceived at a global level and how policies are tools used to support the targets of Agenda 2030 to combat climate change; • Realise the different ways of reducing energy consumption, pollution and waste.	particular emphasis on the impact of household energy on climate change and inspire them to reduce energy consumption and use sustainable energy sources. The first part of this module will help with activities related to understanding energy supply to buildings, energy ratings and consumption. It will look at how different technologies and building materials help save energy, and reduce energy waste. The second part of this module will explain how energy is debated in politics and policy at both global and local levels. The third part of this module will deal with the ethical use of energy and different types of sustainable energy sources. The topics in this module will be presented in various online activities such as videos, quizzes, etc. This module will also provide suggestions for learning activities that stimulate consideration of alternatives that can lead to students to reduce energy consumption.

Module 5: RESPONSIBLE (SUSTAINABLE) CONSUMPTION

Module/ Topics Sections of the module	Aim/ Learning Objectives	Learning Outcomes	General Information about the module
Module 5: Responsible (Sustainable) Consumption is divided into 3 Submodules: **Submodule 1: Why consume?** A. Survival B. Identity, belonging C. Habit D. Curiosity, novelty	**The aim of this module** is to develop the competencies of teachers to provide their students an opportunity to understand different reasons for consumption, comprehend the concept of responsible consumption and learn to act as responsible, climate-friendly consumers. **The objectives** of this module:	By the end of this module, learners will: ● Understand the concept of responsible consumption ● Recognize the impact of overconsumption on climate change ● Know the reasons why SDG-12 is important ● Be able to act for responsible	This module has been designed to develop teachers' competences to teach climate literacy, with particular emphasis on the impact of overconsumption on climate change and inspire them to become more responsible (sustainable) consumers.

E. Advertising F. Peer pressure **Submodule 2: Responsible (Sustainable) Consumption** A. The concept of 'Managing with Less' B. The methods for reducing consumption C. Overconsumption and Climate Change D. SDG-12: Responsible Consumption and Production E. Sustainable Consumption Policies **Submodule 3: Action for Responsible (Sustainable Consumption)** A. The concept of 'Ethical Consumption' B. Climate-friendly shopping choices C. Being an active consumer	1. To demonstrate an understanding of why we consume; what makes us buy; 2. To identify the concept of managing with less and analyse the relationship between overconsumption and climate change; 3. To define the importance of ethical consumption on the planet and become motivated to engage in climate-friendly patterns of consumption.	consumption, reflect on their own consumer behaviour and come up with ideas for alternative behaviours to meet their needs (for example- utilising the sharing economy sharing instead of buying.	The first part of the module gives a brief introduction to the topic by explaining the variety of reasons why people buy. In the second part of the module, learners will learn the concept of responsible consumption by analysing its impact on climate change. The third part of this module will inspire the learners to act for climate change by gaining responsible consumer behaviours. The topics in this module will be presented in various online activities such as videos, quizzes, etc. This module will also provide suggestions for learning activities that not only shed light on why we buy, but also stimulate consideration of alternatives that can lead to more sustainable consumption.

Module 6: SUSTAINABLE FOOD

Module/ Topics Sections of the module	Aim/ Learning Objectives	Learning Outcomes	General Information about the module
Module 6: Sustainable Food is divided into 3 Submodules: **Submodule 1: The Effect of Food Choices for Climate Change** A. Eat Local: Does it reduce carbon footprint? B. Processed Foods' Environmental Impact C. How Green is Your Food? Eco-labels D. Water in Food Production E. Food Security and Biodiversity Conservation F. Food Waste **Submodule 2**: **Different Perspectives on Sustainable Food** A. Sustainable Food and Health B. Sustainable Food and Economy C. Sustainable Food and Climate Change D. Sustainable Food and Environment **Submodule 3**: **Action for Sustainable Food** A. The 2030 Agenda and Sustainable Food	**The aim of this module** is to develop the competencies of teachers to provide their students an opportunity to understand the impact of food consumption patterns on climate change and become more acquainted with the concept of sustainable food. **The objectives** of this module: 1. To define the effect of food choices for climate change; 2. To demonstrate conceptual understanding of sustainable food and its different perspectives; 3. To examine the targets of Agenda 2030 to combat climate change and	By the end of this module, learners will: •Obtain initial knowledge regarding the relationship between food choices and the climate change; •Learn different perspectives of sustainable food concerning health, economic, environment and climate change; •Develop skills to reduce Carbon footprint by taking action for more sustainable food.	This module has been designed to develop teachers' competences to teach climate literacy, with particular emphasis on the impact of food on climate change and inspire their students to use sustainable food. The first part of this module addresses and examines the relationship between food choices and climate change. The second part analyses the sustainable food in terms of health, economic, climate change and environment; The third part of this module analyses the international agenda which targets sustainable food to combat climate change

B. The Future of Food **C.** How can we change our carbon footprint for food? D. How can we apply pressure to change political decisions related to food consumed locally? E. How can we stop/minimise food waste? F. How can we grow more food ourselves?	inspire learners to take action for sustainable food choices.		in terms of daily practical tips for sustainable food. The topics in the module will be presented in various online activities such as videos, quizzes, etc. The module will also provide suggestions for learning activities that stimulate consideration of alternatives that can lead to students to consume more sustainable food.

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Appendix 1

Climateracy Education Needs Assessment Survey

This survey is designed to ascertain teachers' needs in relation to teaching about climate change. Data will be used for this Erasmus+ project only, and will be safely stored with partners. Participation is voluntary and responses are anonymous. By completing this survey, you consent to participation.

1. What subject area/s do you teach? (e.g., mathematics, geography, biology, history, science, physical education or art)

   _____

   _____.
2. How long have you been teaching in schools?

   _____.
3. What is expected of you by other school stakeholders (e.g., school leadership, curriculum, parents, students, community etc.) in regards to teaching about the topic of climate change?

   _____

   _____.
4. How much knowledge of climate change do you think your students generally have?
   A. comprehensive understanding of climate change
   B. good understanding
   C. general understanding
   D. little understanding
5. How do you address climate change content and issues in your classes or extracurricular activities (what types of methods, materials, activities, projects, etc. have you used)?

   _____

   _____

   _____.
6. What activities and strategies seem to work best in relation to teaching about climate change content and issues with your students?

   _____

   _____

   _____.

7. I think the most needed things to teach about climate change effectively are:
    - supportive school environment
    - teachers around me playing an active role
    - personal knowledge of the accepted science of climate change
    - when my students show they are engaged
    - support of parents
    - community support
    - national education policy (curriculum time and space, focus)
    - professional development
    - media focus and public understanding of climate change
    - Other_____

8. What is your expectation from an online tool to make climate literacy teaching more effective (e.g., content, activities, tools and resources)?
   _____
   _____
   _____.