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DESIGN THINKING
FOR SUSTAINABILITY



DESIGN THINKING FOR SUSTAINABILITY

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**O1. An active methodological learning framework for
building sustainability skills through design
thinking (FINAL V1.0)**





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INTRODUCTION

Sustainable development challenges are both urgent and complex. They are urgent because they affect quality of life and safety at a local or global scale. They are complex because the introduction of actions towards their mitigation or prevention is often expected to be the result of the integration of knowledge from diverse scientific fields, problem solving capacity, collaborative work, brainstorming, solution ideation, innovative design, as well as taking into account cultural and community factors.

The DT4S project aims to build problem solving skills, collaboration ability, and capacity to integrate knowledge among secondary students aged 12-16 for preparing them to actively engage in sustainable development and business practices in the future as young professionals.

Methodologically, the project will introduce an active problem-based learning approach that challenge learners to identify the parameters of a given challenge and the experiences of individuals affected by it. The D4TS active learning framework is grounded on the design thinking principles of empathy, ideation, prototype, design, and evaluation encouraging students to come up with innovative ideas towards introducing sustainable practices for society and industry.

Design thinking encourages students to understand the actual needs of specific groups of users that will be the recipients of the solutions they will design. Design thinking helps introducing solutions even to the most difficult problems, to which none seems to exist at first glance. This is achieved by understanding, through empathy, the actual needs of users by keeping an open mind and focusing on user experiences. Ideation helps brainstorm and generate a broad range of ideas, from which the final solution will be selected. Prototyping focuses on simple designs that can demonstrate the viability of a proposed idea. Finally, evaluation ensures that the final result addresses user needs.

Active learning helps build knowledge that is retainable and can be transferred to the real world through activities that challenge students to design and innovate. It may take several forms, such as role playing, inquiry, collaboration in small groups, problem solving, and more. Active learning promotes the links between education and the world of work, demonstrating the relevance of education to real life, putting students to the center of the learning process, and thus promoting engagement with learning and avoidance of early school leaving. In addition, the transferability of skills will promote the future employment of students.

The DT4S learning framework combines all these methodological approaches to introduce students to activities inspired by real life. In these activities students will collaborate to design solutions to real world problems deploying the design thinking



principles, while gamification elements will help develop positive interaction in the classroom and enrich experiences through active engagement.

The proposed framework also applies game-based learning, which is an approach that contributes significantly to motivation and engagement of students. Gaming principles in learning contexts go beyond the more traditionally understood concept of rewards and may include mechanisms such as social recognition, mission, affiliation, role playing, and more.

The DT4S active learning framework was designed by following a well-defined path, including stages related to...:

- A. The establishment of a map of stakeholders that stand to gain from the enhancement of secondary education in the area of sustainability. This includes direct stakeholders, namely students and educators, and indirect stakeholders like policy makers and the society in general;
- B. The proposal and identification of the most relevant sustainability skills desirable for secondary education students;
- C. The analysis of the current situation in secondary education in terms of building sustainability skills through on-line and off-line resources. That included the analysis of policies, strategies, initiatives, and good practices at the national level in each of the participating countries;
- D. The setup and implementation of the identification of needs analysis of direct stakeholders, namely students and educators, in order to establish learning requirements on which the development of the proposed digital learning service will be designed;
- E. The review of past work in the area of sustainability education through digital resources to inform the design and implementation of the proposed digital learning service for sustainability education in the scope of the D4TS project;
- F. To design, as a general consequence of the previous items, the DT4S active methodological framework that is based on design thinking, active learning and game-base learning and aims at building sustainability skills in secondary education students.

The DT4S methodological framework was also designed in a manner that allows its deployment in wide secondary education settings in Europe. This was ensured by performing a European level analysis, so that the learning requirements take into account diverse economic, cultural, and educational environments.



Task 1.1. Stakeholders' map

The stakeholders' map provides a clear representation of the user groups that are engaged in the project and the relationships between them. On the educational domain, direct stakeholders include students and educators and indirect stakeholders include schools and policy makers. Indirect stakeholders in other contexts have been included as well.

Direct stakeholders	DT4S impact
Secondary education students	<p>Sustainability-minded students will become civically active young adults.</p> <p>Promoting student engagement through game-based approaches that build motivation.</p> <p>Promoting employability of students through the development of sustainability skills highly demanded by society and industry.</p>
Secondary education teachers	<p>Promoting the development of highly skilled instructors that are capable of integrating emerging technology and pedagogy into their existing educational practices.</p> <p>Higher career satisfaction of teachers as a result of new pathways for personal and professional growth.</p> <p>Supporting the continuing education of teachers through the development of best practices on upgrading pedagogical design through technology-enhanced learning and active, experiential learning approaches.</p> <p>Building the skills of educators in terms of digitally-enabling their practices.</p> <p>Promoting educator career development through lifelong learning skill building.</p> <p>Promoting the use of open educational resources through the design and implementation of digital learning solutions that will be freely available to all.</p>
Secondary education managers	<p>Strengthening basic and key competencies in secondary education like sustainability skills that are highly demanded by employers that</p>





	<p>wish to enrich their business practices and align them to sustainable growth policies.</p> <p>Promoting learner engagement and thus avoiding early school leaving by aligning skills built in secondary education to emerging 21st century societal and industry needs.</p>
Indirect stakeholders	DT4S impact
Secondary education schools	<p>Promoting the uptake of innovative pedagogical practices in the digital era.</p> <p>Avoiding early school leaving by demonstrating the links between education and the real world.</p>
Educational policy makers	<p>Modernizing education and ensuring quality and efficiency through innovative pedagogical methods that combine technology with emerging active, game-based approaches that help link educational outcomes to goals, taking into account industry and societal needs.</p> <p>Aligning educational practices to global challenges, thus demonstrating the links between education and the real world and the relevance of education in students' lives now and into the future.</p> <p>Contributing to the modernization of education through the integration of emerging ICT enabled solutions and active, problem-based learning approaches into educational practices.</p> <p>Empowering educational policy makers to make informed decisions on best ICT enhanced educational practices through access to evaluation data on how to effectively integrate emerging pedagogies in wide educational initiatives.</p>
Children and Youth	<p>Promoting European priorities on high quality education for all and on avoiding early school leaving.</p> <p>Creating a pool of young talent that is better equipped to address the 21st century sustainability challenges.</p>
Non-Governmental Organizations	<p>Contributing to social inclusion through a) high quality education, b) fighting of unemployment and c) avoiding early school leaving.</p>





Local Authorities	<p>Introducing solutions that target very specific and actual industry needs, namely making business practices more environmentally friendly.</p> <p>Contributing to growth at the regional level by developing desirable qualifications for the young generation.</p>
Workers and Trade Unions	<p>Fighting of unemployment through the aligning of skills built to industry and societal needs; as a result of that, promoting social cohesion in local communities.</p>
Business and Industry	<p>Providing opportunities for growth based highly trained individuals. By building coveted sustainability skills the project facilitates the development of a young workforce that has the capacity to tackle challenging emerging societal and business issues.</p> <p>Linking education to the world of work by building industry demanded sustainability skills.</p>
Scientific and Technological Community	<p>Promoting the deployment of open educational resources by making all project outcomes, including learning design, methodologies, and digital tools openly available to all interested educational institutions as well as other parties.</p> <p>Making openly available the applications to be developed to all interested parties will act as good practice examples for inviting additional development on ICT-enabled learning solutions.</p>
Society at large (people)	<p>Improving the general quality of life as a result of a well prepared professionals that can introduce solutions to societal challenges.</p> <p>Alleviating brain drain by building the skills that young individuals needs to become successful professionals by staying in their regions.</p> <p>Promoting employability of the next generation through relevant and comprehensive skill sets for addressing 21st century sustainability challenges.</p>





Task 1.2. Identification of sustainability skills

This task defined what sustainability skills are required for secondary education students therefore identifying the learning objectives of the proposed digital learning framework. Initially, in the proposal, the identified sustainability skills included: innovative thinking, empathy, collaboration ability in multidisciplinary teams, ability to effectively research and inquire, ability to evaluate potential solutions, good communication skills, financial literacy for ensuring that solutions are feasible within limited budgets, good presentation and storytelling skills to help students become influencers, the ability to view a problem from a high level point of view, effective information research skills, and more. However, following a literature research, partners' contributions and also as a result of the other tasks, this list has been extended to include a holistic set of skills.

Skill	Description/Justification
Digital literacy	Ability to find, evaluate, and compose clear information through writing and other media on various digital platforms.
Information and media literacy	Ability to show and make informed judgments as users of information and media, as well as to become skillful creators and producers of information and media messages.
Willingness to learn	Readiness to know new things and to improve oneself.
Independent and autonomous learning	Ability to learn independently and autonomously.
Integrating information from diverse areas	Ability to compare, combine and generate a consistent message based on multiple, sometimes conflicting, sources of information.
Innovative thinking	Ability to look at problems or situations from a fresh perspective that could provide "out-of-the-box" solutions.
Critical thinking	Ability to break down complex information into fundamental parts and assess and judge that information.
High level thinking	Ability to apply all the previous skills, that is analysis, evaluation and synthesis/creation of new knowledge.
Emotional Intelligence	Ability to recognize one's own emotions and those of others, discern between different feelings and label them appropriately, use emotional information to guide thinking and





	behavior, and manage and/or adjust emotions to adapt to environments or achieve one's goal(s).]
Creativity	Ability to perceive the environment, to find hidden patterns, to make connections between seemingly unrelated facts, and to generate solutions. Ability to turn new and imaginative ideas into reality.
Open mindedness	Ability to being receptive to a wide variety of ideas, arguments, and information.
Openness to criticism/feedback	Ability to accept negative feedback about oneself or one's work without reacting overly emotionally.
Openness to others' ideas and thoughts	Ability to be willing to consider ideas and opinions that are new or different from the own.
Flexibility and adaptation to change	Ability to adapt to changing circumstances and environments and to adopt new ideas and concepts.
Initiative	Ability to assess and initiate things independently.
Being positive	Ability to focus on the things that one can control.
Ability to prioritize	Ability to identify critical tasks and resources and to establish priorities systematically, differentiating between urgent, important, and unimportant processes.
Sense of quality of work	Ability to analyze, judge and critique a piece of work in such a way that leads to an improved version of that piece of work.
Good communication skills	Ability to communicate one's thoughts clearly and concisely, but also being able to create focus, energy, and passion.
Empathy	Ability to understand others feelings, ideas and actions and to communicate with them by providing them with your own feelings, ideas and actions.
Being a listener	Ability to consciously focus on the speaker message to be able to get a deep understanding of that message.
Negotiation	Ability to reach a compromise in a discussion by using communication, persuasion, strategy and cooperation.
Storytelling skills so that students become influencers	Ability to compose and tell compelling and motivating stories.
Collaboration in multidisciplinary teams	Ability to productively work with our persons on common tasks to reach a certain goal.





Leadership	Ability to organize and motivate other people to reach a shared goal.
Good presentation skills	Ability to deliver information clearly and effectively to a specific audience.
Transferring knowledge to the real world	Ability to apply the acquired knowledge, skills and competences in a different context or in a different way.
Problem solving	Ability to understand a problem, use generic or ad hoc methods in an orderly manner to find solutions for that problem, identify the most suitable ones and test them.
Following systemic design processes	Ability to understand and apply methods that combine systems thinking and human-centered design to cope with complex design projects.
Ability to effectively research and inquire	Ability to determine that processes and resources are appropriate, conclusions are based on supporting evidence and problems are solved and decisions made following the achieved results.
Ability to view a problem from a high level point of view	Ability to perceive or understand the problem in the surrounding contexts and to identify the main characterizing aspects.
Provide clarity to problems	Ability to analyze a fuzzy problem and identify suitable objectives for solving that problem.
Ability to evaluate potential solutions	Ability to compare potential solutions and assess their efficiency.
Analysis of the factors that contribute to an unwanted situation	Ability to identify events, conditions or other aspects that created an immediate cause for an undesired situation.
Working with limited resources	Ability to design a strategic plan and implement decisions to respond to changing circumstances and demands that lead to scarcity of resources.
Implementing and assessing the effectiveness of a solution	Ability to implement the solution and evaluate the achieved results from an efficiency point of view.
Validating solutions from the perspective of the end users	Ability to involve end-users in the implementation of the solutions and assess their level of satisfaction in a non-intrusive way.
Project planning	Ability to accurately identify and organize systems and resources (including time) required to complete a task in an efficient way.
Project management	Ability to plan, procure and execute a project with an efficient use of all the resources.





Positive attitudes that lead to responsible behavior	Adopting attitudes and behaviors that are environmentally responsible by promoting an efficient use of resources.
Global mindset	Ability to keep openness towards other cultures, other people, and other ways of doing things.
Ethics	Ability to understand, apply and assess the moral principles that govern a person's behavior or the conducting of an activity towards the environment.
Commitment to sustainable solutions	Ability to promote and sustain responsible practices that support a sustainable, secure, prosperous and environmentally responsible problem solving process.
Ability to inspire others to invest in a sustainable vision	Ability to adopt an environmental leadership.
Responsible consumption	Ability to adopt a responsible practice in the acquisition of products and services by understanding, acknowledging and consenting to the product's behind-the-scenes practices and ensuring the highest efficiency approach to the use of those products and services.
Responsible production	Ability to promote resource and energy efficiency, sustainable infrastructure, and provide access to basic services, green and decent jobs and a better quality of life for all.





Task 1.3 Analysis of the status quo in secondary education in terms of building sustainability skills

This task focused on the review of existing good practices, initiatives, policies, and strategies on sustainability education at the regional and national level. It was performed for all countries that are represented in the consortium through partners and will inform the design of the proposed online, design thinking educational framework. The following are examples of aspects that were included in a good practice but are not exclusive:

- Innovative teaching/learning practices in sustainability education
- Commitment to sustainability education among senior staff and managers
- Adoption of sustainability in the learning/educational environment
- Achieving positive social, economic and environmental outcomes (eventually outside of the school) as a result of the initiative
- Considering the school environment as a tool to learn about sustainability issues





TITLE	
<i>Rohepegel.ee (Green Mirror)</i>	
SUMMARY	
<i>Rohepegel (Green Mirror https://rohepegel.ee/) is a self-assessment platform for green activities in educational institutions, which allows assessing the current situation and mapping one's own development within the framework of teaching, school administration and inclusion activities.</i>	
EDUCATIONAL ORGANIZATION	
<i>Tallinn University</i> <i>Estonian Environmental Education Association</i> <i>Tartu Nature House</i>	
DESCRIPTION	
<i>The idea of the Green Mirror to create a green mirror came from the example of digipeegel.ee and comes from Tallinn University. The tool, born in 2018 in the Negavat project led by Romil Rybhchenkov, is a self-assessment platform for green activities in educational institutions, which allows assessing the current situation and mapping one's own development within the framework of teaching, school administration and inclusion activities. The further development of the Green Mirror is coordinated by the Estonian Environmental Education Association and Tartu Nature House also participates as the coordinator of the Green School program. The goal of the Green Mirror is to evaluate educational institutions through 10 metrics: Biodiversity, Climate Change, Wetlands, Water, Energy, Garbage and Waste, Transportation, Community, Health and Well-Being, Global Education. Unfortunately at the moment this project has not active stage, but there are plans to finalise it.</i>	
MORE INFORMATION	
https://rohepegel.ee/	
DATE	<i>14-05-2020</i>
AUTHORS	<i>Tallinn University</i>





TITLE
<i>Avastusrada.ee (Discovery Trail)</i>
SUMMARY
<p><i>Avastusrada.ee (Discovery Trail) is a digital platform for showing user-oriented content in a predefined geographical location in various playful ways. Target groups of Avastusrada are schoolchildren but also general audience through the environmental education centres network and schools. Avastusrada, as location-based GPS adventure game, gives a possibility to use location-specific interactive content designed particularly for all target audience (based on age, education, interests, nationality etc), offering a better learning experience. Avastusrada allows to integrate the subjects of natural sciences and other disciplines taught in schools through practical activities surrounded by the real environment and inquiry learning and to enhance general competencies in sustainability. Avastusrada.ee is a good example of the usage of sustainability as a cross-curricular objective in formal and non-formal education.</i></p> <p><i>Avastusrada.ee was founded 2013 as the tool for environmental education centres, but is now widely used also in schools.</i></p>
EDUCATIONAL ORGANIZATION
<p><i>Currently, 135 educational institutions (schools and environmental education centres) are using the Avastusrada.</i></p> <p><i>There are available over 500 trails with over 5000 questions.</i></p>
DESCRIPTION
<ul style="list-style-type: none"><i>● The Discovery Trail (Avastusrada) is a browser-based application that helps you create interactive outdoor trails www.avastusrada.ee, where players can follow marked interactive trails, answer questions, get information, do exercises, study surroundings.</i><i>● Created for centres of environmental education with focus on teaching environmental and sustainability issues. Now also used by schools and some companies (e.g. for language learning).</i><i>● Educators can create trails for everyone (topics, age, surroundings, language etc) and everyone who has smartphone or tablet with any operation system, GPS and mobile data (at least 3G) can follow it.</i>





- *The trailpoint can be information board, multiple choice test, open text responses or picture.*
- *The application allows to integrate the subjects of natural sciences and humanities through practical activities and inquiry learning and to enhance general competencies.*
- *The educator can create the trail either in office or directly on the landscape.*
- *The educator has real-time overview of “explorers” progress (safety).*
- *The educator get responses in real-time, semiautomatic control - depending on the task type it may be already marked as correct/incorrect.*
- *Pictures, photos, music files or videos can be used as a question or information.*
- *The player has to find the way from one trailpoint to an other, interactive map showing players location in realtime.*
- *The task opens only if the player is in predefined radius from trailpoint.*
- *The players are encouraged to use other applications or information sources for solving the tasks (IT competences).*
- *With specific design of the tasks the educator can evaluate the effectiveness of learning processes and the role of the Discovery Trail on it.*
- *Applications like the Discovery Trail are cheaper and flexible alternatives for physical information boards of outdoor learning trails.*
- *As the digital devices are part of everyday life of the younger generation therefore they are more motivated to learn outside using applications like Discovery Trail.*
- *Creating Discovery Trails is easy and it gives opportunity to consider the current characteristics of surroundings and players.*
- *With specific design of tasks it is possible to evaluate the player development and effectiveness of the trail.*

MORE INFORMATION

<https://avastusrada.ee/en>

DATE

14-05-2020

AUTHORS

Tallinn University





TITLE
<i>Estonian environmental education database</i>
SUMMARY
<i>On the initiative of the Ministry of the Environment, a web-based database (https://keskkonnaharidus.ee/en/) has been created, where one can find study programmes that support the national curriculum as well as contact details of institutions that offer environmental education - and this irrespective of the affiliation or form of ownership. Teachers can search and compare programs and sort them according to the topics. Under the topic "Environment and sustainable development" this database consists of over 500 study programs.</i>
EDUCATIONAL ORGANIZATION
<i>Estonian Environmental Education Association</i> <i>Bureau of the Environmental Awareness Environmental Board</i> <i>State Forest Management Center</i>
DESCRIPTION
<i>There are over 150 Environmental Education Centres in Estonia. 35 centres are managed by governmental institutions (Environmental Board and State Forest Management Center). Others are private or municipal. Around 100 of them are working actively on everyday basis - they are offering study programs and conducting teaching activities.</i> <i>Study programs are varying from sustainability and environment to physics and chemistry. Ministry of the Environment Bureau of the Environmental Awareness works closely with all environmental centres and with the Estonian Environmental Education Association.</i> <i>The Estonian Environmental Education Association unites environmental educators who want to develop a cooperation network and increase the quality of environmental education. Estonian Environmental Education Association also organises the Summer Academy, to bring together Estonian environmental educators and thereby develop the</i>





network.

MORE INFORMATION

<https://keskkonnaharidus.ee/en>

DATE

14-05-2020

AUTHORS

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TITLE
<i>Interdisciplinary LIFE projects in TLU</i>
SUMMARY
<i>LIFE (Learning in Interdisciplinary Focused Environment) is a study course of 6 ECTS (=156 working hours) and it is focused on project- and problem-based learning, where students from different study areas collaborate with academics and partners from outside the university to carry out projects focusing on interdisciplinary problems. Inter- and transdisciplinary approach give ample opportunities to work with real-life problems, quite often connected with sustainability issues. LIFE is a university-wide project-based course, which is compulsory for all Bachelor and Master level students (with the exception of students from the following study programmes: Film Arts, Art Teacher, Music Teacher, Cinematography, Digital Library Learning, Mathematics Teacher, Vocational Teacher, Teacher of Several Subjects, Adult Education for Social Change). All six academic units are responsible for supervising LIFE (BFM, School of Digital Technologies, School of Educational Sciences, School of Humanities, School of Natural Sciences and Health, School of Governance, Law and Society) and Haapsalu College, with the aim to ensure that all the students could participate in the LIFE course, which is included in the study programmes.</i>
EDUCATIONAL ORGANIZATION
<i>Tallinn University</i>
DESCRIPTION
<i>Learning activities in LIFE are carried out in teams of 6-8 members. Tasks are assigned on the basis of a certain division of roles defined during the first or second meeting. Students are expected to choose which role and which tasks they wish to be responsible for. In order to make sure that the teamwork is efficient, sufficient number of face-to-face meetings is planned and suitable environments (e.g. Facebook, GoogleDrive, Trello etc.) are agreed on, as well as means of getting feedback. Students have to gather background knowledge to be able to participate in group work (brainstorms, discussions, debates). For that, supervisors can recommend additional materials and students themselves are</i>





encouraged to find additional sources. LIFE project brings together students of different levels of education (Bachelor as well as Master level students) with different cultural backgrounds, timetables and experience. LIFE creates a relationship among students, as learners are the ones who are responsible for creation of new knowledge and for project's success. Learning activities of LIFE include: asking questions, discussions with other participants, searching information, trying out something new, analysis of activities, reflections. It is therefore important to learn problem solving, reasoning and critical thinking skills in addition to the project's content.

Project-based learning is the most suitable method for solving interdisciplinary problems. Learning happens in the context of activities. Students who have joined a LIFE project need to combine the knowledge from different fields, which requires finding time to get together, agreeing on goals and activities and determining a realistic timeframe. Students acquire the following competences during project-based learning – creativity, teamwork, leadership skills, adaptability, critical and interdisciplinary thinking – each of them being basis of the student's professional development.

LIFE ideas can be proposed by students, members of the academic staff or partners from outside the university (entrepreneurs, NGO-s, organisations etc.). To participate in the course, students need to choose a project they like on LIFE webpage and join the project.

MORE INFORMATION

<https://elu.tlu.ee/>

DATE

14-05-2020

AUTHORS

Tallinn University





TITLE
<i>Nature Academy at Tallinn University/ Looduse akadeemia</i>
SUMMARY
<i>In Tallinn University, some of the natural scientists noticed the lack of science based and quality extracurricular activities in Tallinn, Estonia. So they created Looduse Akadeemia (Nature academy) which is a weekly meeting for school children. The hosts are scientist and their weekly guest are also either scientist or top experts of different fields in natural sciences.</i>
EDUCATIONAL ORGANIZATION
<i>Tallinn University</i>
DESCRIPTION
<p><i>Academy of Nature is a place where each meeting is new and interesting and conducted by various Tallinn University researchers, lecturers, doctoral students, alumni and professionals in their field. In order to give younger people (age 7-11) an idea of what science means and how to understand the different processes that take place in nature and what their connections are to our everyday life and how to study it all, Tallinn University hosts the Academy of Nature.</i></p> <p><i>The aim of the Academy of Nature is to expand children's horizons through practical, creative and playful activities and discussions, to develop a sense of nature and observation skills, to show the connections between the processes taking place in nature and our daily decisions and activities.</i></p> <p><i>Activities: environmental games; nature observations; experiments and tests in laboratories; crafting; process monitoring; outdoor training, etc.</i></p> <p><i>Researchers, doctoral students and experts in the field of the Institute of Natural and Health Sciences of Tallinn University supervise the circle of the Academy of Nature and answer the questions of young people.</i></p> <p><i>Each year has a central topic, in 2020 it was Forest.</i></p>
MORE INFORMATION
<p>https://www.tlu.ee/looduseakadeemia</p> <p>https://www.facebook.com/pg/TLULTI/photos/?tab=album&album_id=1110218385721641</p>





DATE	14-05-2020
AUTHORS	Tallinn University





TITLE
<i>EnvKids - Environmental Sustainability Training for Children through on-line Simulation, Exploration, and Collaboration</i>
SUMMARY
<p><i>ENVKIDS is a multidisciplinary project that introduces innovation in a number of areas.</i></p> <p><i>In terms of didactical models, ENVKIDS introduces explorative learning for young children. Explorative learning takes advantage of a child's natural curiosity, rendering it an effective method for developing problem solving skills. Furthermore, a collaborative learning approach will allow children to share experiences with peers in other countries under the guidance of their teachers and in the context of a school network.</i></p> <p><i>In terms of technology, ENVKIDS introduces state of the art virtual experimentation as an educational tool. On-line experiments will be available through the web and will be developed through appropriate technologies for information management and presentation such as Web 2.0 and flash. The virtual experiments will be tied to well-defined, step-wise tasks that enable children to complete age-appropriate activities. An additional advantage of virtual experimentation is that it can be used to demonstrate worst case scenarios that cannot be observed in real life, as for example the impact of future severe pollution that could be the result of irresponsible environmental management. It should be noted that virtual experimentation is currently not widely used among the selected age group. ENVKIDS aims to validate virtual experimentation as a didactical tool, draw conclusions with respect to its effectiveness and acceptability among children and teachers, and publish good practice guidelines for teachers based on evaluation findings.</i></p> <p><i>Finally, ENVKIDS proposes innovative methodologies for documenting good practice recommendations: ENVKIDS aims to use video as a means of vividly presenting examples of successful deployment of the technology and the educational methodologies and errors to avoid. It is expected that video as a presentation medium will be significantly more effective than simple text for demonstrating benchmark educational activities. ENVKIDS is a multidisciplinary project that introduces innovation in a number of areas.</i></p>
EDUCATIONAL ORGANIZATION
<i>The project run from December 2009 to November 2011 and is partly funded by the Comenius action of the Life Long Learning programme as project ID 502390-LLP-1-2009-GR-COMENIUS-CMP.</i>
DESCRIPTION





ENVKIDS deploys explorative pedagogy and a game-based approach through age-appropriate virtual and practical experimentation as part of wider educational activities. Mostly graphical user interfaces are deployed to overcome language barriers expected among the project's linguistically diverse target audience. Educational activities are designed as a series of simple to follow steps that children can follow with relative independence building critical thinking, discovering concepts, and developing individual perceptions on environmental sustainability.

Blended learning delivery combines in-class instruction, virtual demonstrators, site visits, and on-line collaboration. This approach enables children to build on each-other's experiences under teacher mediation within a European school network. ENVKIDS promotes the involvement of a wider community of experts in the development of didactical activities, including both scientists and teachers.

Acceptance of environmentally-friendly practices, such as renewable energy solutions, is still low facing high resistance by local communities. This points to the urgent need for environmental education, especially targeting the next generation.

The stakes are high: modern society cannot afford failure in the environmental education of children. ENVKIDS aims to raise awareness on environmental sustainability and climate change mitigation activities among elementary school youngsters through age-appropriate on-line educational activities.

ENVKIDS does not aim to compete with existing environmental education curricula. Instead, it aims to provide value-adding on-line tools that complement existing practices and promote collaboration among European schools. At the same time the activities will promote children's' ICT skills.

The specific goals of the ENVKIDS project are:

- To develop a school network for cross-border collaboration on good practices in environmental education.*
- To develop age appropriate explorative and collaborative didactical methodologies for environmental and more generally science education targeting elementary school children.*
- To encourage experimentation and critical thinking among youngsters on environmental sustainability and environmentally-friendly behavior.*
- To develop proof of concept on-line explorative educational applications targeting youngsters and taking advantage of internet technology facilitating vivid presentations and easy to use interfaces and hiding underlying computational complexity.*
- To build collective knowledge among teachers on science instruction through Web 2.0 technology-enabled community-building and know-how sharing services.*
- To support the teaching process on environmental education through good practice didactical guidelines targeting instructors.*





- *To widely disseminate the proposed methodologies and services throughout the European educational and ICT services communities.*

“My home” game

The player should try to build a house without polluting!

First, he has to select a location and a house model. Then he has to select how to heat/cool the house, while keeping in mind that all the choices made have a pollution impact. There is a green indicator on the side that shows how ecological the house is. Player should keep it as high as possible.

After building the house, the player should try and find out all the good practices to minimize pollution. The player can also click on different devices and learn how they can be used without polluting too much.

“My town” game

First of all, the player should choose a landscape where he wants to build his city. There are different options of climate, cold/temperate/mediterranean. Once selecting a building in the interface, the player can click on the landscape to build it. The player can build roads, industrial buildings, as well as commercial buildings.

The player should manage the city, make it greener and make the citizens happy! There is a green meter that shows how green the city is, as well as an energy meter that shows how much power the city produces and how much it consumes. The happiness meter reflects the mood of your citizens.

The player can choose between six different power sources: windmills, hydroelectric, solar, coal, gas, nuclear. He can also modify the buildings in order to make them energy efficient.

MORE INFORMATION

<http://ohmpro.org/envkids/>

DATE

20-04-2020

AUTHORS

University of Thessaly





TITLE
<i>Learning about Forests</i>
SUMMARY
<p><i>The aim of the Program "Learning about Forests" is to raise awareness, education and change students' behavior on environmental issues and, in particular, in the forest. Students learn about the importance of the forest in our lives and develop interest and respect for it. They realize the value of forests as a refuge for life and they realize the problems that arise from their destruction. The Program encourages collaboration between students, teachers, parents and the local community to achieve effective environmental action.</i></p> <p><i>"Learning about Forests" is a timeless program. The proposed activities can be implemented in more than one school year. Thus, children better understand the importance and richness of the forest. It is desirable to plant a tree with the cooperation of a scientific body (eg Forest Service), provided that the conditions are met.</i></p> <p><i>This Foundation for Environmental Education (FEE) international Programme started in Greece in 2001.</i></p> <p><i>Its goal is to encourage schools and teachers at all levels to include forests in their educational activities, providing them with the necessary tools and incentives to reach forests and learn from them.</i></p>
EDUCATIONAL ORGANIZATION
<p><i>The Programme started in 1996 at the primary and secondary school level in 15 European countries, and since then it has expanded continuously to other countries.</i></p> <p><i>In Greece it started in 2001 having received the approval of the Ministry of Education, Research and Religious Affairs (Ministerial decision, No. 223916/Γ7/ 30-12-2016).</i></p> <p><i>In our country, 115 schools participated in 2016-2017 and 230 have been awarded since the commencement of the Network.</i></p>
DESCRIPTION
<p><i>Schools of all educational levels have the opportunity to participate in the programme. Educational material is offered gratis for all the subject areas covered in the Programme. Any school interested in joining the programme should contact the HSPN.</i></p> <p><i>In each participating school an Environmental Group is set up that plans and implements all activities in the forests and in places where forest products are used.</i></p> <p><i>Students, under expert guidance, participate in tree planting activities executed during the appropriate season. At the end of the school year summer camps may be held in a forest area.</i></p>





The educational material of the Program consists of:

- 1. the Instructions for the implementation of the Program*
- 2. the book "Proposals for Educational Activities and Environmental Education Programs"*
- 3. the book "Forests in Greece"*
- 4. The book "The rocks in a few words"*
- 5. the book "With the forest guide I act, act, create"*
- 6. the Poster of the program*
- 7. the guidelines for charting an environmental path*

The training material includes theoretical and practical activities that can be carried out in the classroom and in the forest. The forest is used as a training ground for them to learn from and within. Through the various suggested activities, children gain a comprehensive picture of the various forest issues and problems.

The main steps of the Program are:

- 1. Organization of the Environmental Team (teachers and students of the school).*
- 2. Selection of the forest, and its specific section, where it will the work is done. Choose a forest that belongs to the network NATURA 2000 areas if you have the opportunity to visit it.*
- 3. Selection and organization of activities by teachers*
- 4. Determining the space and time of meetings between students and teachers.*
- 5. Divide work into groups of students.*
- 6. Visit the forest (for young children a close one is recommended at school woods).*
- 7. Recording of the most important vital and abiotic elements of the forest ecosystem.*
- 8. Cooperation with local Bodies, Services and specialists*
- 9. Investigate the views of the local community on the forest and record proposals.*
- 10. Suggestions for the preservation, protection or improvement of the forest*
- 11. Contacts with agencies for the implementation of your Environmental proposals Group*
- 12. Presentation of the results of the Environmental Team*

Coordinators

International coordinator: Fee (Foundation for Environmental Education)

The HSPN is the National Operator for Greece. It cooperates with the Primary Education of B' Area of Athens.

MORE INFORMATION

<https://www.eepf.gr/en/project/education/learning-about-forests>

DATE

20-04-2020

AUTHORS

University of Thessaly





TITLE
<i>Eco(logical) Schools</i>
SUMMARY
<p><i>The objective of the Programme "Eco Schools" is to change the behavior of everyone within the school community so that the school will become a real "Eco School". This is achieved through the formulation and implementation of an "Ecocode" (a set of environmental behavior standards), and the implementation of an Environmental Action Plan (which involves all the surrounding area of the school and its conversion into a clean, attractive, and friendly space).</i></p> <p><i>This Foundation for Environmental Education (FEE) international Programme started in Greece in 1995.</i></p> <p><i>When a school has completed its Action Plan, it is evaluated by the appropriate committee and if the results are favorable it is awarded with a Green Flag.</i></p>
EDUCATIONAL ORGANIZATION
<p><i>The Network has received the approval of the Ministry of Education, Research and Religious Affairs (Ministerial Decision No.13918/Δ2/27-01-2017).</i></p> <p><i>Schools of all educational levels have the right to participate.</i></p> <p><i>More than 300 schools are currently active in the network throughout Greece.</i></p> <p><i>387 schools have been awarded Green Flags since 1995.</i></p>
DESCRIPTION
<p><i>The "Ecological Schools" Program is aimed at the entire school community (students, teachers, parents, school staff) and is designed to encourage the whole school to mobilize and take action on the environment. It also encourages collaboration between students, teachers, parents and the local community to achieve more effective environmental action.</i></p> <p><i>The aim of the program is to raise awareness, education and change the attitude of students in environmental issues, through participatory processes in decision making, planning and implementation of actions, so that schools become communities of sustainable coexistence in pedagogy, but also a practical level. This is achieved by the formulation and implementation of the "House Code" (a set of rules of environmental behavior), as well as the implementation of an Environmental Action Plan (concerns the surrounding school space and its transformation into a clean, beautiful, human and friendly).</i></p> <p><i>In each school the Environmental Committee is formed, by students and teachers, which deals with the issues of energy, waste and water. (Later they can deal with the issues: transportation, healthy living, biodiversity, consumerism, etc.). At the same time, it takes</i></p>





care of the implementation of the "Action Plan" and the "House Code" with the participation of the whole school community (See the 7 steps).

At the same time, the Committee oversees the implementation of the "Action Plan" and the "Ecocode" with the participation of the whole school community. Finally, in order to achieve links with the local community and ensure the raising of public awareness, the school organizes activities and events in cooperation with the local government and authorities.

Educational material is provided for all subjects dealt with by the Network.

Finally, for the opening to the local community and the sensitization of the citizens, events and activities are organized in collaboration with the Local Government. Educational material is offered for all thematic sections of the Network.

When the school completes the Action Plan and after being evaluated by the Pedagogical Team of the Network, it is called "Ecological School" and is rewarded with the Green Flag of the Network that bears the mark of the Network. Two years after his award, he is re-evaluated so that he can continue to earn his title.

The Seven Steps to Green Flag success

Step 1 Eco-Committee. The heartbeat of an Eco-Schools action and learning

Step 2 Environmental Review. Investigating the school's environmental performance

Step 3 Action Plan

Step 4 Curriculum Links

Step 5 Informing and Involving

Step 6 Monitoring and Evaluation

Step 7 Eco-Code

MORE INFORMATION

<https://www.ecoschools.gr/>

<https://www.eepf.gr/en/project/education/eco-schools-network>

DATE

20-04-2020

AUTHORS

University of Thessaly





TITLE
Green Corners
SUMMARY
<p><i>The goal of the programme “Green Corners” is to promote the study of the flora, fauna and geology of a neighbourhood, and to discover the relationship between these factors and their general role in the eco-system. Using educational materials available, and employing the suggested activities of the programme, the study groups inquire and learn about their “green” neighbourhoods and the ways to protect them. As well they try to develop cooperation with the green services of the Municipality and with other environmental groups such as the Forestry Service.</i></p> <p><i>“The Green Corners” is a timeless program. The proposed activities can be implemented in one school year or more. In this way, children better establish the importance and richness of their green corner.</i></p> <p><i>The Programme started by the Hellenic Society for the Protection of Nature in 1999, and is aimed at schools of all education levels.</i></p> <p><i>Students choose some small green corner of their urban area and their environmental awareness and study its fauna and flora of the urban environment. By doing so, they become more aware of natural values.</i></p>
EDUCATIONAL ORGANIZATION
<p><i>33 schools took part in the programme in 2016-2017.</i></p> <p><i>50 schools participated in 2018-2019.</i></p> <p><i>A total of 93 schools participated in the programme since the beginning.</i></p>
DESCRIPTION
<p><i>The programme is aimed at young people (aged 6 to 16) as well as at organizations and groups who want to help protect the green refuges in their neighbourhoods. It has been approved by the Ministry of Education in its decision of January 2017. All educational material is given free. Interested groups should apply to the HSPN.</i></p> <p><i>Every year these groups present the results of their activities, and the best of these are given prizes, and are presented on the website.</i></p> <p><i>The goal is to develop ecological awareness in children as well as to change behavior and attitude towards the environment. Observing the rocks, plants and animals, they discover their interactions and their role in ecosystems and in our lives. Children learn to recognize the value of even the smallest green space, because it is a refuge for a living organism. They see the need to protect and preserve ecosystems. The Program encourages</i></p>





collaboration between students, teachers, parents and the local community to achieve more effective environmental activities.

The main steps of the Program are:

- 1. Organization of the Environmental Team in the school which consists of students and teachers.*
- 2. Touring the neighborhood and locating green spaces.*
- 3. Selection of "Green Corner".*
- 4. Divide students into small groups and divide the work.*
- 5. Determining the space and time of the meetings of teachers and students.*
- 6. Selection and organization of activities by teachers.*
- 7. Activity evaluation.*

The coordinators are the HSPN and the Direction of Primary Schools in Chios.

MORE INFORMATION

<https://www.eepf.gr/en/project/education/green-corners>

DATE

20-04-2020

AUTHORS

University of Thessaly





TITLE
<i>Nature Without Garbage</i>
SUMMARY
<p><i>The "Nature Without Garbage" program is addressed to students, teachers, parents, sensitized adults as well as the Local Government. The goal is to raise awareness and change the attitude of our fellow citizens about a nature without garbage, through information and training on proper waste management.</i></p> <p><i>The Programme was designed by the HSPN and started in 1996, initially with the help of a volunteer group.</i></p> <p><i>Its aim originally was the collection of waste, but it has since expanded to include awareness-raising of students, and through them of the public, about waste management issues and the need for a clean, tidy environment.</i></p> <p><i>Awards and citations are being given to those groups which come up with inventive ideas for the sensitizing of local communities.</i></p>
EDUCATIONAL ORGANIZATION
<p><i>The Network has been approved by the Ministry of Education, Research and Religious Affairs (Ministerial decision, No. 19864/Δ2/7-02-2017).</i></p> <p><i>Schools of all educational levels have the opportunity to participate. Educational material is offered for all the subject areas of the Network.</i></p> <p><i>Today the idea of "Nature without Garbage" is spreading all over Greece.</i></p> <p><i>61 voluntary Groups participated in 2016-2017 and 184 voluntary groups have been awarded prizes since the initiation of the Programme.</i></p>
DESCRIPTION
<p><i>The Program is based on the close cooperation and joint action of students, volunteers, citizens, Institutions and Authorities in order to free the Greek nature from the garbage and to protect the natural environment.</i></p> <p><i>The Voluntary Teams send data and work indicative of their actions, which are evaluated and awarded by the Coordinating Committee of the Hellenic Society for the Protection of Nature.</i></p> <p><i>In the programme the role of young people will be particularly significant. As they are made more sensitive to all the problems they will encounter, they should become more actively involved in pursuing the goals of the programme.</i></p>





Volunteer groups will receive brochures and other printed material, and will be able to choose from a variety of activities they might like to pursue:

- *the adoption, research and protection of some small area or small wood*
- *the presentation of some relevant theatrical production for schools and the local community*
- *research to determine how much citizens are in fact aware of and sensitive to the question of garbage through the use of a questionnaire*
- *research into and an estimate of the degree the city is “clean” by soliciting answers from inhabitants*
- *creating and artistic construction from recycled materials*
- *preparing of a message or an attractive slogan about the subject of the programme*

The main steps of the program are:

1. *In each Municipality or Community, Groups of Volunteers are created that consist of students, adults, Guides, Scouts, etc.*
2. *Each Group shall appoint one of its members as the Head of the Group, who shall coordinate the actions and communication of the Group.*
3. *The Team locates and adopts a space that is loaded with waste.*
4. *In cooperation with the local Authorities and Services, it takes care to remove the waste and to restore the space it has adopted. He also makes sure that this space does not become a recipient of garbage again.*
5. *The Group organizes activities related to the protection and preservation of the space. The printed material of the Program proposes a series of actions.*
6. *The Group organizes in collaboration with the Local Authorities an event to raise awareness of the local community.*
7. *The Head of the Voluntary Group regularly informs the EEPF about the progress of the Group's activities.*

The HSPN and the Alpha Bank, the sponsors of the programme, call on all municipalities and local authorities to use the opportunity given by the programme to support volunteer groups in their attempts to free natural areas from the scourge of garbage and to help them sensitize people to this need.

Coordinators

The HSPN coordinates the Programme in cooperation with the Direction of Primary Education of Western Attica.

MORE INFORMATION

<https://www.eepf.gr/en/project/education/nature-without-garbage>

DATE

20-04-2020

AUTHORS

University of Thessaly





TITLE
<i>Projecto Eco-Escolas</i>
SUMMARY
<p><i>Eco-Schools is an international program, coordinated by the FEE - Foundation for Environmental Education. Currently the program is implemented in 67 countries, developed in more than 50.000 schools, reaching and involving more than 19 million students.</i></p> <p><i>In Portugal, the numbers register the participation of 1500 schools, 230 municipalities and more than 650.000 students and has been implemented since 1996, by the hands of the Blue Flag Association of Europe (ABAE). This Association, a non-governmental and non-profit organization, is dedicated to education for sustainable development as well as to the management and recognition of good environmental practices. By encouraging sustainable actions for the environment, the Eco-Schools project recognizes and rewards the work developed by schools based on the principles of improving environmental performance, the way in which the school space is managed and how awareness is raised for the community.</i></p> <p><i>For this best practice it was selected the implementation in the Escola do Prado as an example.</i></p>
EDUCATIONAL ORGANIZATION
<i>Escola do Prado (as an example as the program is implemented in many other schools)</i>
DESCRIPTION
<p><i>The Eco-Schools project at JI / EB do Prado, in Vila Real, Portugal started in 2006 having meanwhile obtained the Eco-School award. The whole project dynamic revolves around the environment by promoting responsible citizenship, involving the participation of children and young people in decision-making and contributing to a more sustainable community. 'Students' involvement with nature is real by taking them out of the classroom and giving them the opportunity to try and experience some of the things that appear in books outside like a living laboratory.</i></p> <p><i>There are three themes that must be worked on annually and are mandatory: sustainable level of water, waste and energy. In addition, there is always a theme that is added and worked on throughout the year which. For this year, JI / EB do Prado added outdoor spaces, biodiversity, food and organic farming as optional themes.</i></p> <p><i>To achieve the proposed objectives, regular meetings are held both with students and with parents and the tasks are distributed by all. In a systematic way, the discussed information reflects what is good, what is bad, what they want to do and what they actually did for this cause. In addition, these children are also responsible for growing a biological garden and managing animals with a view to a self-sustainable project. Food re-education turns out to be very rewarding for everyone. Family involvement is also important for everyone to move in the same direction. The promotion of a healthy diet is a constant concern and with</i></p>





natural resources within the school, and it has been established for some time that birthday cakes are homemade.

The realization of activities open to the community, with the sale of animals (they have ducks, chickens and rabbits) and products from organic farming, allows to finance other costs, the maintenance and improvement of the space and the acquisition of necessary tools.

The Eco-Schools councils invite to participate all those who, in one way or another, have an active participation in this project: parents, students, teachers, staff and institutional representatives from the City Council and Parish Council, SEPNA, Quercus, Alvão Natural Park and the University of Trás-os-Montes.

MORE INFORMATION

<https://ecoescolas.abae.pt>

DATE	4 May 2020
AUTHORS	Carlos Vaz de Carvalho (Virtual Campus Lda)





TITLE	
Short film contest " Freshwater Invasive Species and estuarine systems: Awareness and Prevention"	
SUMMARY	
<p><i>The Portuguese Association for Environmental Education (ASPEA) is a non-governmental, non-profit environmental organization, founded in June 1990, whose main objective is the development of Environmental Education in formal and non-formal education. As part of the Life Invasaqua project, the association organized the short film contest "Freshwater Invasive Species and estuarine systems: Awareness and Prevention" which aims to promote the dissemination and compilation of audiovisual documentation on the presence of invasive exotic species in sweet water environments in the Iberian Peninsula and its consequences on society and the environment.</i></p>	
EDUCATIONAL ORGANIZATION	
<p><i>Associação Portuguesa de Educação Ambiental</i></p>	
DESCRIPTION	
<p><i>The Portuguese Association for Environmental Education (ASPEA) is a non-governmental, non-profit environmental organization, founded in June 1990, whose main objective is the development of Environmental Education in formal and non-formal education. To achieve this objective, several strategies / actions are carried out by the members of the association and by its partners, namely:</i></p> <ul style="list-style-type: none"><i>• an annual conference for teachers and other stakeholders interested in Environmental Education;</i><i>• seminars and continuing education courses for teachers and environmental monitors;</i><i>• school networks, fostering national and international cooperation;</i><i>• development of pedagogical resources;</i><i>• organization of field trips and summer programs for children / young people;</i><i>• cooperation with local authorities;</i><i>• dissemination of its activities and environmental education in specialized magazines and through presentation of communication and participation in national and international conferences;</i><i>• semiannual newsletter edition.</i> <p><i>The contest is part of the association's activities and teachers were invited to create short films with their students.</i></p>	
MORE INFORMATION	
<p>https://aspea.org/</p>	
DATE	4 May 2020
AUTHORS	Carlos Vaz de Carvalho (Virtual Campus Lda)





TITLE	
<i>Educação Ambiental da Liga para a Protecção da Natureza</i>	
SUMMARY	
<p><i>LPN (Liga para a Protecção da Natureza) is a Non-Governmental Environment Organization, of national scope, founded in 1948, being the oldest environmental protection Association in the Iberian Peninsula. It is a non-profit association with Public Utility status. They have an Environmental Education program for the support of the schools in their sustainable approach.</i></p>	
EDUCATIONAL ORGANIZATION	
<i>Liga para a Protecção da Natureza (multiple schools)</i>	
DESCRIPTION	
<p><i>LPN is based in Lisbon, and the Environmental Training Center and the Special Studies and Activities Center (CEAE) also operate at the headquarters. In Castro Verde (Alentejo), LPN has six estates, covering a total area of around 1800 ha, and the Vale Gonçalves Environmental Education Center (CEAVG). In Évora, LPN has the Wild Animals Reception and Recovery Center (CARAS) managed by the LPN Delegation - Alentejo. In Vila Nova de Poiares, LPN owns an estate, Quinta da Moenda, managed by Núcleo LPN - Centro.</i></p> <p><i>LPN supports several environmental projects with schools and has a yearly training program for teachers in environmental education. The program on Environmental Education in schools is an essential and structural tool to promote responsible and conscious behavior by children and young people towards the environment and nature conservation. The promotion of ludic-pedagogical activities, associated with the environmental issue, promotes an awakening of interest and sensitivity towards the natural environment that surrounds it. The activities should serve as a starting point or as a practical example of a continuous work carried out in the school, where the teacher / educator has the key role to establish, structure and complement all the information acquired on the topic addressed.</i></p>	
MORE INFORMATION	
http://lpn.pt	
DATE	<i>11 May 2020</i>
AUTHORS	<i>Carlos Vaz de Carvalho (Virtual Campus Lda)</i>





TITLE	
<i>Manual de Boas Práticas Sustentáveis em Escolas</i>	
SUMMARY	
<i>The Handbook of Sustainable Practices for Schools appears in the scope of the urban regeneration process of the city of Estarreja, which has the challenge of being recognized as an “ECOCITY”. The development of the Handbook for schools as well as their counterpart directed at citizens and traders aims to involve the three fundamental groups of the community in improving local levels of sustainability.</i>	
EDUCATIONAL ORGANIZATION	
<i>Câmara Municipal de Estarreja</i>	
DESCRIPTION	
<i>The Manual identifies good environmental practices in the areas of waste, water, energy and biodiversity, as well as good practices around civic participation and responsible consumption.</i>	
<i>The document starts to explain what is sustainable development and then asks readers to reflect on their habits. Then it addresses environmental and sustainable issues related to water, energy, transports, biodiversity, citizenship and responsible consumption. In each area it also identifies good practices and possible activities that students can do with their teachers or parents.</i>	
MORE INFORMATION	
http://ecocidade.cm-estarreja.pt/Atualizar_Site/quia_escolas.pdf	
DATE	<i>11 May 2020</i>
AUTHORS	<i>Carlos Vaz de Carvalho (Virtual Campus Lda)</i>





TITLE
<i>Projecto de Educação para a Sustentabilidade Alimentar</i>
SUMMARY
<i>Since 2017, the Portuguese Nutrition Association has been running an Awareness and Information Program on Food Sustainability. This Program is based on the five axes of the United Nations Food and Agriculture Organization (FAO). At the same time, it is also in line with certain Sustainable Development Goals (SDGs) and the United Nations (UN) 2030 Agenda.</i>
EDUCATIONAL ORGANIZATION
<i>Associação Portuguesa de Nutrição</i>
DESCRIPTION
<p><i>APN developed an Awareness and Information Program on Food Sustainability adapted to school age. The age range covered is between 15 and 18 years, that is, students from the 10th to the 12th year. This age group is characterized by greater autonomy in food choices by students, as well as greater critical capacity to reflect on the importance of food sustainability and healthy eating in their daily lives.</i></p> <p><i>With this Food Sustainability Awareness and Information Program APN aims to increase reflection and awareness about food sustainability in adolescents, and by increasing their food literacy to improve food choices in your day-to-day. At the same time, the aim is to increase knowledge about food sustainability and a healthy lifestyle, through the dissemination of the message through the students.</i></p> <p><i>The program included the development of a guide for teachers to raise awareness about food sustainability, through materials built by nutritionists. The project brings together a set of resources that can be used as work tools in the classroom, integrating them into the syllabus of the various disciplines (eg: biology and geology, geography, history, English)).</i></p> <p><i>The centerpiece of this school-based project is a documentary made by the Spanish Academy of Nutrition and Dietetics - SustainblEating - translated into Portuguese by the APN, which serves as a base for the activities to be promoted after viewing this documentary.</i></p> <p><i>The e-book “Feeding the future: a reflection on food sustainability”, by APN, is an important informative element. The associated Teacher's Guide presents a compendium with the main concepts associated with the theme, in order to facilitate the understanding of the</i></p>





contents that will be presented, as well as a set of activities, which aim to promote reflection and consolidation of the concepts covered. The activities are divided according to their average duration, assisting the teacher in planning the classroom time spent on activities.

MORE INFORMATION

<https://sustentabilidadealimentar.apn.org.pt/v0C0A/apresentacao>

DATE	18 May 2020
AUTHORS	Carlos Vaz de Carvalho (Virtual Campus Lda)





TITLE
<i>Kızılcahamam Robotics and Coding Atelier</i>
SUMMARY
<i>Ankara Kızılcahamam Public Training Center realized this atelier for secondary school students (from 4th to 9th level). It was aimed to develop coding and robotics skills of students as they are interested in ICT. At first, an old ICT lab is turned into a coding lab with some renovations and new equipment. They used materials from old projects, cardboard, etc. instead of a ready-made kit. Then, it was open to the use of all students.</i>
EDUCATIONAL ORGANIZATION
<i>Ankara Kızılcahamam Public Training Center</i>
DESCRIPTION
<i>[What was the initial problem or challenge? Who were the stakeholders involved – people, institutions? When was it implemented? What was the methodological solution/process adopted? Were there any constraints in implementing the best practice? How was the best practice validated? What was the impact – quantitative and qualitative - of the best practice? What were the success factors? How can the best practice be replicated or extended? Are there any resources that can be reused?]</i>
<i>Students were very interested in ICT, however they did not have coding classes and suitable labs. An old ICT lab is turned into an atelier. It started in March 2018.</i>
<i>At first, 90 students had trainings on 3D game design delivered by specialist of Habitat Asociation. Students developed 2 games and joined the code game contest of Microsoft. In one of these games, students made a research on where human beings can live except the Earth. They selected Mars as the most suitable place. In this game, certain tasks are given to players to get points to reach Mars.</i>
<i>Secondly, it was collaborated by Gazi University-Department of ICT Teaching. Voluntary students gave lessons at the atelier.</i>
<i>Students are expected to find solutions to real-life problems. They learned and applied the steps to design: plan, imagine, apply, test.</i>
<i>In May 2018, 259 students got the trainings on atelier. Each class at different levels have trainings once in a month. The ones who want to develop more are free to come and work on it.</i>
<i>Some examples developed by students:</i>
<i>-Oxygen Farm: Students try to prevent the ozone layer from depleting by clearing the air in the atmosphere of the polluted metropolitan cities.</i>





-Model of Human Hand Muscles: By designing the fibers that enable the fingers to work, she modeled the human hand muscles.

MORE INFORMATION

<http://hbogm.meb.gov.tr/iuo/Ankara.html>

DATE

15.05.2020

AUTHORS

Governorship of İstanbul





TITLE
<i>My Life as a Refugee</i>
SUMMARY
<p><i>My Life as a Refugee is a serious game developed by UNHCR(United Nations High Commissioners for Refugees). This digital game aims to raise players' empathy and awareness on the hard situations that refugees face in their real life. It is available on iOS and Android platforms.</i></p> <p><i>It allows players to contemplate the same life-changing decisions refugees make in a true-to-life quest to try to survive, reach safety, reunite with loved ones and re-start their lives.</i></p> <p><i>It both compels the players to wrestle with dilemmas faced by millions of refugees and educates them via real-life situations given. The app features three stories whose characters are separated from their families while fleeing persecution or armed conflict.</i></p> <p><i>After selecting a character, players face a series of tough decisions and chance events in a quest to reach safety, reunite with loved ones and rebuild their lives. The role play revolves around three main characters who have been displaced and separated from their families. Each story is based on real-life experiences of families torn apart by war or persecution. Months or years of narrative are compressed into each of the stories. Players have to make decisions along the way in order to reach safety. The events and outcome of each story depend on the decisions that the player makes, resulting in a potentially different experience every time.</i></p>
EDUCATIONAL ORGANIZATION
<i>UNHCR-United Nations High Commissioners for Refugees</i>
DESCRIPTION
<p><i>What you can do if you and your family are in the middle of a conflict? What would you do if you were in the middle of a war? Would you stay at home and risk your life? Would you leave your homeland and become refuge in the nearest country, taking the risk of abduction, torture and rape? The risk of torture, abduction and rape, having to migrate from the lands you have been living in for years, leaving everything behind you for fear of death, falling on the roads, not knowing what to eat in tents for the next meal, not being aware of the health of those who are left behind, torture, abduction and rape ...</i></p> <p><i>These are just a few of the problems refugees face. How does it feel to be a refugee? What would you experience if you had to be a refugee?</i></p> <p><i>These are the questions posed to the players to make them face with real-life examples of a refugee. In that way, players understand the situation of refugees in the world, and</i></p>





realize their situation. Empathy , problem solving, sensitivity to social problems, raising awareness against discrimination are the skills to be developed.

How it works:

Players are expected to choose from three real-life situations:

Can you imagine being so desperate to escape that you pay a smuggler to help you?

Can you imagine the terror of being caught by the army you were fleeing from?

Can you imagine the trauma of being separated from your family by war?

Players are expected to choose one of three characters:

Merita, 27

Family: Married, expecting third child.

Seven months pregnant, you are full of hopes for your growing family. Then a civil war erupts, putting your community at risk.

Paulo, 15

Family: Oldest of 4 children.

You dream of becoming a doctor. Yet as conflict spreads to your area, kids your age are being forced to become child soldiers.

Amika, 24

Family: Married, 2 children.

After your best friend is raped, you begin to speak out about women's rights. But the authorities are determined to silence you.

After selecting a character, players face a series of tough decisions and chance events in a quest to reach safety, reunite with loved ones and rebuild their lives. The role play revolves around three main characters who have been displaced and separated from their families. Months or years of narrative are compressed into each of the stories. Players have to make decisions along the way in order to reach safety. The three stories are based on the real-life experiences of millions of refugees fleeing war or persecution. The events and outcome of each story depend on the decisions that the player makes, resulting in a potentially different experience every time.

MORE INFORMATION

<https://mylifeasarefugee.org/>

DATE

15.05.2020

AUTHORS

Governorship of Istanbul





TITLE
Zero Waste Training Project
SUMMARY
<p>The project has started in 2019 by TEMA Foundation(http://www.tema.org.tr/web_14966-2_1/index.aspx) in collaboration with Ministry of National Education and Ministry of Environment and Urbanization. This project provides an online training platform(https://sifiratiktema.org/) which provides teachers training materials. Teachers who are willing to apply the activities at classes register to the platform, get the training materials like posters, training instructions for activities, working sheets, flash cards, etc.</p> <p>It is aimed for children to develop awareness on issues such as protection of natural assets, environmentally friendly consumption habits, waste management and to recognize the “zero waste” approach. Educational materials were designed according to the 5 principles of Zero Waste: Refuse, Reduce, Reuse, Recycle, Rot. In the activities prepared within the scope of the Zero Waste Education Project, it is aimed to introduce the concept of "zero waste" to children with the 5 principles of zero waste, and to raise awareness about how children can reduce wastes in their daily lives, how they consume less and how they can be used in different ways. Within the scope of the project, educational content and materials were prepared, including presentations, posters, worksheets, project proposals and game-based digital activities for teachers at pre-school, primary, secondary and high school levels. By subscribing to the portal, all content and materials can be accessed and developed and applied in the classroom.</p>
EDUCATIONAL ORGANIZATION
<p>It is applied in Turkey by TEMA Foundation in collaboration with Ministry of National Education and Ministry of Environment and Urbanization.</p>
DESCRIPTION
<p>The platform provides training materials for kindergarten, primary school, secondary school and high school students.</p> <p>All the activities are designed based on 5 principles of zero waste and suitable to level of students. Activities include such approaches as blended learning, team working, brain storming, game-based, cooperative learning, etc. and are environmentally-friendly. Students learn by doing. They are expected to raise awareness on environmental issues, get to know where they live, realize the impacts of their way of living on nature. They are active in their learning process and learn not only at school but also out of school. The teachers are leaders at class. They give instructions, ask questions, lead students learning, discovering, and finding solutions.</p>





On the platform, 13 activities for secondary education level and 6 activities for high school level are provided. Some examples are:

-Creative Thinking Circle: This is a game-based activity for secondary school students. it is aimed for children to discover the reuse of different materials. There are yoghurt container, metal box, old t-shirt, glass jar as materials. The students make a circle. The first material is given to a student. The child who takes the object in his hand tells an idea to use that object for a different purpose and gives the material to the child next to him. The object is given sequentially from hand to hand. When every child gives a suggestion, the activity continues using another object.

- Zero waste in my neighborhood: This is a team-based activity designed for secondary school students. It is aimed to enable students to discover places that will make their lives easier according to the zero waste approach. Children are divided into groups before the event. Each group is asked to find places specified by the teacher(2nd hand shop, clothes or goods box, library, recycling bins, bazaar, cobbler, tailor, electronics repair shop, herbalist, bicycle road, green fields) in the neighborhood or district where they live and to collect information. They can take the photos of these places with the support of their families. Then, students come together and are given paper and colorful pencils. They are asked to draw the places they found and mark them on this map. They can share the map with other students when completed.

-The Story of a T-Shirt: This is an awareness raising activity designed for high school students. Students are expected to recognize the production process of a product and realize its effect on nature. Cotton t-shirt is shown to the students and the following questions are asked:

How many t-shirts do you have?

What kind of journey could this t-shirt have made until it came to this class?

Where could it be produced?

What kind of fabric do you think is used?

What could have been used when it was produced(electrics, water, time)?

What do you do with the old t-shirts?

Children are told that the products sold are not only the price tag, but also the nature tag. They are shown the poster on the story of a T-shirt's travel. Students are divided into groups. By giving a product to each group, they are asked to learn the story of this product and turn it into a poster.

MORE INFORMATION

<https://sifiratiktema.org/>

DATE	15.05.2020
AUTHORS	Governorship of İstanbul





TITLE
<i>Value Education Project in Selçuklu (a district in Konya, Turkey)</i>
SUMMARY
<p><i>The project was applied since 2013 till 2018. Selçuklu Municipality is the coordinator and Necmettin Erbakan University and Selçuklu Regional Directorate of National Education are project partners. It is aimed students studying at preschool, primary school, middle school and high school students studying in Selçuklu district. It aims to develop the knowledge, skills and abilities that will enable students to carry their responsibilities and to make reasonable choices. The 8 skills focused are responsibility, self-control, sympathy, honesty, fairness, respect, helpfulness and perseverance. Since October, till May, each of these skills was chosen to be focused skill.</i></p> <p><i>During that time, this value was highlighted in school-wide studies. Also in the lessons, each of the eight values was referred to through various activities developed in line with the curriculum throughout the entire education and training season. With regard to each value, materials were provided to students, parents and teachers to support the study. Studies that allow students to practice were developed. Thus, students were given the opportunity to experience these values by real volunteering in the light of the information gained.</i></p>
EDUCATIONAL ORGANIZATION
<i>Selçuklu Municipality(Konya in Turkey)</i>
DESCRIPTION
<p><i>It was the challenge the lack of knowledge, skills and abilities that enable students to make choices that they can carry their responsibilities, their level of awareness. Selçuklu Municipality is the coordinator and Necmettin Erbakan University and Selçuklu Regional Directorate of National Education are partners. The project was applied in all schools in Selçuklu district from 2013 till 2018. Every year a new aspect was added to the project through the information gathered from the field.</i></p> <p><i>Material and material support is provided to help values education, and practices and activities related to the value of the month are organized. There were different materials for students, teachers and parents. Jigsaws, coloring books, reading books, etc. were for students; books and letters for parents; guide for teachers.</i></p> <p><i>Here are some examples applied:</i></p> <p><i>STOP - Sustainable Clean School Project:</i> <i>It was aimed to solve the garbage problem, which is one of the important factors that create environmental pollution, with a high sense of responsibility. It was aimed to raise awareness among children on issues related to protection of private assets, environmentally friendly consumption habits and waste management.</i></p> <p><i>Activities;</i></p> <ol style="list-style-type: none"><i>1) Raising awareness among teachers, parents and students</i>





- 2) Keeping "Environmental Cleaning and Health" always on the agenda with posters, exchange and mascots
- 3) Organizing in-service trainings on "A sustainable clean environment" including parents
- 4) Increasing the number of trash cans and making them accessible
- 5) Raising awareness with roof door theater activities
- 6) Create school teams
- 7) Providing recycling (zero waste)

Canteen Without Officer

In the schools where the project is implemented, the "Trust Trust" event was implemented at certain times of the year to contribute to strengthening the feelings of honesty and benevolence among students.

Stop Noise Pollution

It is a continuous cycle of time management, planning / decision making, implementation and supervision processes. Time is life itself. Happiness depends on success and success depends on time. In the schools where the project was implemented, the bell did not ring at the lecture and entrance exits.

MORE INFORMATION

<https://selcukludegerleregitalimi.com/>

DATE	04.06.2020
AUTHORS	Governorship of İstanbul





TITLE
<i>Design Thinking for Teens</i>
SUMMARY
<p><i>Design Thinking for Teens(DT4T) is the community and the name of the project which received Google Education Grant 2018.</i></p> <p><i>DT4T partners with teens, teachers and local nonprofits to bring a FREE design thinking program into schools. It has representatives all over the world and an advisory board.</i></p> <p><i>The project aims to develop design thinking skills of teens, prompt them to provide solutions. It provides workshops, internships, trainings for target groups. Educators, students and non-profits are members of this community.</i></p>
EDUCATIONAL ORGANIZATION
<i>Design Thinking for Teens</i>
DESCRIPTION
<p><i>It was aimed to teach high school students nationwide the Design Thinking method and use it to solve problems in their communities. The developed program was applied in different schools. Students were asked to think, find an everyday problem they face and search for solutions.</i></p> <p><i>Partners are Google Education, Ignite Stem, DF*A, IDEO. The community organizes different events, trainings all over the world. Here are the facilities:</i></p> <p>Train Educators:</p> <p>DT4T has received a Google Education grant to fund high school teachers to attend professional development classes that will help them bring back design thinking to their classrooms.</p> <p>Real World Learning:</p> <p>Design thinking provides chances for students to solve real, important problems empathetically, strategically and realistically using a tried-and-true methodology.</p> <p>Design Thinking Events:</p> <p>Design thinking is a highly collaborative, hands on activity that allows teens to learn by doing</p> <p>One of these design thinking events is Design A-Thon, which help teens develop potential solutions to challenges. That encompasses design thinking workshops, lightning talks, and mentorship. Participants collaborate with team members to develop a solution to a given problem statement over the course of one week using the design thinking process and compete for prizes.</p> <p>Free Start-up Kit</p> <p>This Design Thinking Startup Kit was created by DT4T to help students and faculty jump start Design Thinking at their schools.</p>





MORE INFORMATION	
https://www.dt4t.org/	
DATE	04.06.2020
AUTHORS	Governorship of İstanbul





TITLE
<i>BEACONING - Breaking Educational Barriers with Contextualised, Pervasive and Gameful Learning</i>
SUMMARY
<p><i>BEACONING stands for 'Breaking Educational Barriers with Contextualised, Pervasive and Gameful Learning' and aims to exploit and integrate pervasive, context-aware and Gamified techniques and technologies, framed within the Problem-Based Learning context towards facilitating 'anytime anywhere' learning.</i></p> <p><i>The project sets a forefront in multifaceted education technologies through large-scale piloting of a digital learning platform that blends physical and digital spaces. Beaconing combines opportunities for new ICTs in multiple ways that merge learning acquired in formal, non-formal and informal means, developing the skills for today's abled and disabled learners and workforce.</i></p> <p><i>In terms of didactical models, BEACONING tools facilitate, assess and author gamified learning activities, integrating existing educational solutions and services. Focusing on STEM (Science, Technology, Engineering and Mathematics), the cross-subject approach embedded in a Problem-Based Learning model combines learning within real world problem solving and applications. The role of learners is amplified in the process of filtering and connecting concepts framed under practical, investigative and exploratory scenarios.</i></p> <p><i>In terms of technology, BEACONING offers a solution that exploits advances in user experience design, mobile communication, location based and context aware systems, procedural content generation, pedagogy-driven gamification, learning analytics and cloud technology through innovative integration towards a blended learning space. BEACONING platform delivers a framework that integrates and advances the science and sociocultural technologies required for digital learning ecosystem. BEACONING takes into account the diversity of users, including mental and physical abilities, their specific concerns, and the particularity of the systems' functioning conditions. Advances in user experience design (UX), Future Internet Technologies - mobile communication, location-based and context aware systems, cloud technology, learning analytics, procedural content generation, pedagogy-driven games techniques such as digital games, gamification and game analytics - are exploited through innovative integration towards a blended learning space and context.</i></p> <p><i>BEACONING develops innovative usability and evaluation methodologies, cognitive and pedagogical models and adaptive learning methodologies, validating the processes for designing, applying and measuring learning and skills acquisition in a generalized framework, applicable in a variety of circumstances but with specific focus on learning and skills acquisition.</i></p>





EDUCATIONAL ORGANIZATION

The project run from January 2016 to April 2019 and is co-funded by the Horizon 2020 - EU Programme for Research and Innovation, under grant agreement No 687676.

DESCRIPTION

BEACONING's concept is to digitally enable play-learn in everyday spaces fostering cross-subject learning, facilitated by personified gamified lesson plan where context-aware educational resources and ad-hoc learning in the surrounding environment can be triggered. Such a pervasive approach increases flexibility for learners and expands the boundaries of anytime, anywhere learning, enriching their learning experience. The BEACONING approach fosters the up-skilling of teachers, where they will be able to co-author gamified lesson plans with the learners and parents promoting flexibility in ways lessons are being delivered in informal spaces.

BEACONING anticipates the benefits of making cross subject matter more understandable, fostering the application of subject specialism to other domains. By integrating experiences in a highly engaging, contextualized and personalized manner, learning can go beyond the barriers of space and time.

BEACONING aims to support all learners regardless of their disabilities and the target group includes those with mild to moderate physical and mental impairments. The problem based lesson delivery allows learners to engage in gamified problem solving quests in contextualized scenarios and learners will be able to collaborate in a blended environment, where virtual play is situated in a physical space. Combined with the fact that sustainable growth is driven by innovation-related sectors that have high demand in STEM, digital, and analytical thinking skills, the BEACONING platform provide direct benefit and educational benefits for learners and their teachers with links to the needs of the world of work.

BEACONING does not aim to compete with existing environmental education curricula. Instead, the project aims to set up a pan-European pilot solution that, conjointly with existing national solutions to facilitate EU-wide interoperable public use of its pervasive play-learn scenarios.

The specific goals of the BEACONING project are:

- Technologies, pedagogical and social perspectives integration, using pervasive, context-aware and gamified approaches ensuring that the BEACONING platform is innovative while also extending our scientific understanding and practice-based experiments of engaging a community of learners including those with disabilities with a more inclusive, connected and contextualized learning process.*
- Develop, implement and validate the platform that leverages cutting-edge approaches including the Future Internet technology, mobile, gamification, pervasive gaming, procedural game content generation, game authoring, human-computer interfaces, learning analytics and problem-based learning model; The platform aims to be usable, adaptable, extendable and sustainable.*





- *Exploring and measuring the level of engagement, effectiveness and impact that is enabled by the BEACONING platform towards incentivizing learners and fostering acquisition and transfer of knowledge and skills, validate this through large-scale pilots involving a community of stakeholders and practitioners in Europe, and provide an exploitation and business plan for the platform adoption.*

Beaconing “Save the world” game

- *Description of the game*

The Location based game creates engaging location-based activities that integrate POIs into a narrative flow. The story of the game is built around physical Points of Interests defined in the creation process of the game teacher and offers the possibility to include other mini games in each POI.

The game offers two types of location-based challenges: Follow the path and Treasure hunt, where the player is given a clue where the s/he can find the first POI and the estimated distance until the first POI. As the player starts to walk, the game offers information about the current position of the player and the distance to the POI located on the map. After each movement, the player has the possibility to verify if s/he is nearer or further from that point.

- *Summary of game narrative*

The Earth Special Agency have discovered that a mysterious tycoon runs a double-sided private corporation. Publicly it is dedicated to the research and development on sustainable energies and technologies, but it has been leaked that this corporation have a network of secret installations where is hiding toxic products with which they really make profits illegally.

Several informants from the Earth Special Agency have collected 4 parts of the map that will guide agents to the clandestine underground facilities, but there is a restriction, they cannot be together in the city because of security reasons.

- *Summary of game flow*

The players had to access the treasure-hunt game through their smartphones. Using the GPS location, they had to follow the clues provided by the game, in order to reach different points of interest in their city, to uncover the exact locations of the enemy and finally find the hidden facilities, unmask the villain and save the environment. To obtain the clues the players had to play different mini games, to demonstrate their knowledge on energy & environment in order to unlock the clues.

MORE INFORMATION

<https://beaconing.eu/>

DATE

04.05.2020

AUTHORS

ADVANCED TECHNOLOGY SYSTEMS





TITLE	
WINDFALL	
SUMMARY	
<p><i>WindFall is a strategy game produced by Persuasive Games. Its aim is to build wind farms to create clean energy. Players have to consider profits, energy production, location and social impact of building energy turbines.</i></p> <p><i>The game has different difficulty levels, which offer the player different regions and different energy goals.</i></p>	
EDUCATIONAL ORGANIZATION	
<i>DEVELOPER: PERSUASIVE GAMES & NOBLIS & U.S. General Services Administration</i>	
DESCRIPTION	
<p>Gameplay</p> <p>Fulfill a specified energy offset goal as quickly as possible by building turbines smartly. Research locations carefully for the best wind conditions, and to avoid upsetting the local citizens by building turbines in undesirable places.</p> <p>Build turbines in key locations and connect them to the energy grid. Sell produced energy as renewable energy credits in order to earn profits to grow farm.</p> <p>But be careful—nobody wants to have a big, ugly wind turbine in their backyard. Research land value and average wind speeds to generate as much energy as possible with as little political consequence. When protesters start to disrupt your plans, you will have to dedicate a portion of your income to the costs of political backpedaling.</p> <p>Context: Created to support building wind farms in order to create clean energy.</p> <p>Target group : children, youth</p> <p>Benefits: Emphasizes that it is possible to produce clean energy profitably.</p> <p>Type: online game, browser-based, computer game</p> <p>Genre: strategy</p> <p>Price: Free for non-commercial purpose.</p> <p>Number of players: 1 player</p> <p>Number of moderators: no moderator</p> <p>Duration: 15-30 minutes</p> <p>Languages: English</p> <p><i>The game offers three levels (easy, normal, hard), each in a different region, with a growing energy goal. An in-game tutorial teaches the player how to play. Higher online scores are available for each level.</i></p>	
MORE INFORMATION	
http://persuasivegames.com/game/windfall	
DATE	15.05.2020
AUTHORS	Advanced Technology Systems





TITLE
FOREST APP
SUMMARY
<p>The Problem</p> <p><i>We lose trees at a rate of 50 soccer fields per minute as our food systems destroy our ecosystems. Most of this degradation occurs in the developing tropics of Africa, Latin America, and South and Southeast Asia where hundreds of millions of chronically-hungry, smallholder farming families use destructive and short-sighted agricultural practices that further degrade their communities trees, soil, water and biodiversity, making them even more likely to migrate and more vulnerable to the climate changes that lie ahead.</i></p> <p>The Solution</p> <p><i>The Forest Garden Program is a simple, replicable and scalable approach with proven success. It trains farmers over a four-year period to sustainably revitalize their land. It provides all of the training, seeds, tools, and materials. The farmers come prepared with their own land and ready to change their family's life. Through the Forest Garden Approach, farmers plant thousands of trees that protect and bring nutrients back to the soil. This helps farmers grow a variety of fruits and vegetables. Forest Garden farmers gain increases in income and food security, even in the first year.</i></p> <p>Forest is an app that helps people stay focused on the important things in life.</p> <ul style="list-style-type: none">• <i>Whenever individuals want to stay focused, they can plant a tree.</i>• <i>The tree will grow while they focus on their work.</i>• <i>Leaving the app halfway will cause the tree to die.</i> <p>Access For All</p> <p><i>Training is essential to the sustainability of this work. In the many years of research and development, a methodology to empower communities and project leaders that ends poverty, hunger, and deforestation has been developed. The Forest Garden Training Program was designed to bring the Forest Garden Approach impact to scale.</i></p> <p>LAUNCH DATE MAY 2014</p>
EDUCATIONAL ORGANIZATION
<p>NONPROFIT ORGANISATION</p> <p>TREES FOR THE FUTURE</p> <p><i>Trees for the Future is a Maryland-based nonprofit organization founded in 1989 that helps communities around the world plant trees. Through seed distribution, agroforestry training, and in-country technical assistance, it has empowered rural groups to restore tree cover to their lands, protect the environment and help to preserve traditional livelihoods and cultures for generations.</i></p>
DESCRIPTION
<p>Trees for the Future (TREES) has a solution to some of the world's most pressing challenges – the Forest Garden Approach – but as they continue to work closely with farmers on the ground they are constantly discovering ways to increase our impact. Exploring new methodologies for improving the environment and farmers' lives makes the program even stronger. With a dedication to transparency, they are sharing Trees for the Future's focus</p>





on innovations: areas for growth and a greater understanding of the problems and solutions we face in an effort to meet our mission.

The best cure for phone addiction

Forest is a popular productivity app that helps people beat their phone addiction and manage their time in an interesting and pleasant way. Users can earn credits by not using their cell phones and plant real trees around the world with the credits. With Forest, users can have a delightful experience to spend less time on their cell phones, focus on what's more important in their lives, and keep our environment green.

Grow your own forest

Stay focused daily and turn hard work into a land of lush forest.

- *Working at office*
- *Studying at library*
- *With friends.*

Forest team partners with a real-tree-planting organization, Trees for the Future, to plant real trees on Earth. When their users spend virtual coins they earn in Forest on planting real trees, Forest team donates to its partner and creates planting orders.

805,835 trees planted by Forest (19.06.2020)

*Users take a personality test to choose the type of plants, trees they can plant and care for. Users become responsible, involved, without formal learning, they manage to acquire **sustainable skills**, such as:*

- *thinking skills of systems,*
- *integrated problem-solving skills*
- *collaboration competence*
- *self-awareness competence*

How does the Forest Garden program work?

Trees for the Future (TREES) plant all sorts of trees and plants, and nearly all of the trees they use are either native or naturalized in the environments where they plant them. They partner with farmers to understand their needs and match them with species that will suit their needs and be environmentally benign.

The farmers they work with learn to grow a variety of fast-growing trees, fruit trees, hardwoods and vegetables. They use the fast-growing trees to secure and stabilize degraded lands. Then we help the farmer diversify his field with fruit trees and hardwoods. Farmers intercrop vegetables and field crops among the trees.

TREES Forest Garden Project methodology follows a phased approach that begins with mobilizing resources and stakeholders, then guides farmers through a series of steps, over the course of up to four years, through which they learn to design, establish, and manage their Forest Gardens before graduating from the program. The five-phase approach includes:

Phase I: Mobilization – *In the first phase of the approach they hire project staff and meet with relevant stakeholders (government reps, community leaders, and potential partners) to solicit their support and formalize the project. With the help of stakeholders they identify interested farmer groups, lead farmers, and participants, and host orientation workshops prior to pursuing training and extension activities.*

Phase II: Protection – *Phase II through IV comprise the phases of Forest Garden establishment. In the protection phase they provide farmers with the skills and resources*





needed to protect their forest garden sites. Farmers achieve this by planting green walls – an enhanced version of a living fence that we have developed – around the perimeters of their sites. They then plant fast-growing fertilizer trees throughout their sites, often in alleys among their crops, to further stabilize their soils and enhance fertility.

Phase III: Diversification – *As the green walls grow and soils become increasingly fertile, farmers begin to diversify the products they grow in their Forest Gardens. During this phase, farmers plant higher-value vegetables, fruit, nut, and timber trees. They also learn increasingly advanced skills and techniques that will help them manage their Forest Gardens more effectively and sustainably.*

Phase IV: Optimization – *In the fourth phase, farmers will learn to adopt advanced Forest Garden planting and care, integrated pest management, and conservation techniques that optimize and ensure the long-term health, productivity, and profitability of their land.*

Phase V: Graduation – *The fifth and final phase of TREES Forest Garden approach consists of transitioning ownership of the project to the farmer groups to continue supporting each other as a team in the on-going development and management of their Forest Gardens and marketing of products. Projects are concluded with a graduation ceremony during which their efforts and accomplishments are recognized, staff, and other stakeholders, and present farmers who have completed the program with Master Forest Gardener Certification.*

TREES' technicians and collaborating NGOs work directly with farmer groups. The program empowers lead farmers, identified within farmer groups, to both distribute materials and act as resources to their fellow farmers. They become mentors for their cluster of farmers. Working with lead farmers and local collaborators, we deliver training directly to the farmers, and we also visit each farmer's farm at least once every year.

During site visits, TREES technicians visit the nursery, the family and their forest garden, providing onsite consultation and collecting data on the impact of our program. They work with farmers for a four-year cycle, empowering each family to grow and plant a Forest Garden which will help that family well into the foreseeable future.

MORE INFORMATION

<https://www.forestapp.cc/>

DATE	06.05.2020
AUTHORS	Advanced Technology Systems





TITLE
<i>E-Learning from Nature</i>
SUMMARY
<i>E-Learning from nature is an project Erasmus +, K2 Schools. Project Number: 2015-1-IT02-KA201-015133, Iași, Romania, The scope of the project is to develop a guide for teachers and lessons in a video format to teach scientific notions bringing students closer to nature.</i>
EDUCATIONAL ORGANIZATION
<i>There are 8 contractual partners and they are based in 7 different European countries. I.I.S. "F. Enriques", Italia, PROJECT SCIENTIFIC COORDINATOR Web site www.isisenriques.gov.it INFOREF is a non-profit association of teachers, technical and educational experts offering services to primary and secondary schools and to adult education.(Belgia) Vocational Training Center (VTC) "Epimorfotiki Kilkis SM Ilc"(Greece) Limerick Institute of Technology (LIT) (Ireland) Pixel is an education and training institution based in Florence (Italy) Trakai Education Assistance Authority (Lithuania) The Polytechnic Institute of Bragança (IPB) (Portugal) EuroEd Foundation (România)</i>
DESCRIPTION
<i>The E-Learning from Nature project is funded by the European Commission and the Italian National Agency for the Erasmus+ Programme with the aims of:</i> <ul style="list-style-type: none"><i>Promoting a proactive students' approach to scientific subjects learning</i><i>Propose innovative teaching methodologies to scientific teachers</i> <i>This web site gives access to:</i> <ul style="list-style-type: none"><i>Database of local areas relevant for the study of scientific subjects</i><i>E-learning lessons related to the local areas</i><i>A teachers guide aiming at:</i><ul style="list-style-type: none"><i>Proposing teaching methodologies based on real life case scenarios.</i><i>Enhancing students' scientific basic skills acquisition through their active involvement in the learning process.</i><ul style="list-style-type: none"><i>Making use of new technologies to promote the scientific knowledge</i><i>Promote transnational cooperation for scientific knowledge in school education.</i> <i>Guide for the teachers</i> <ul style="list-style-type: none">✓ <i>Teaching scientific subjects through problem based and real life case scenarios Contemporary learners and learner-centred learning Non-traditional teaching methods and class management Problem based learning Case study method</i>✓ <i>Enhance students' scientific basic skills through their active involvement in the learning process Peer-learning education Methodologies for peer-learning education Other methodologies for students' active involvement Case studies</i>





<p>✓ <i>Effective use of new technologies to promote the scientific knowledge</i> <i>Hardware tools (Science laboratories, Interactive Boards, Mobile devices) Software tools</i> <i>(Online tools / platforms to be used by teachers to create fun classes) Integrating tools in</i> <i>sciences education</i></p> <p>✓ <i>Transnational cooperation to promote scientific knowledge in school</i> <i>education Scientific education: main obstacles and challenges European Commission's</i> <i>Funding Opportunities for International Cooperation in Science Education Innovation in</i> <i>Science Education and Success Stories</i></p>	
MORE INFORMATION	
https://enature.pixel-online.org/	
DATE	05.05.2020
AUTHORS	Advanced Technology Systems





TITLE
<i>SimCity BuildIt</i>
SUMMARY
<p><i>SimCity: BuildIt is a city-building simulation mobile game. Developed by TrackTwenty and published by Electronic Arts, it was launched in late 2014. The game is part of the SimCity franchise.</i></p> <p><i>SimCity: BuildIt is a game developed for mobile gameplay. It is available for download on iOS, Android and the Amazon app stores. It is a free simulation game in the iOS App Store and Google Play Store.</i></p> <p><i>This game allows users to solve real-life situations like fire, sewerage, pollution, and traffic and helps in dealing with problems that the public faces. Players can connect and compete with other users for more connected gameplay.</i></p> <p><i>The game enables players to be the mayor of the famous SimCity and build step by step the dream city of tomorrow. As a mayor of the SimCity, the player is responsible for countless tasks from building the first residencies to putting together a solid sewage and waste management system.</i></p>
EDUCATIONAL ORGANIZATION
<i>ELECTRONIC ARTS INC.</i>
DESCRIPTION
<p><i>Gameplay</i></p> <p><i>The game is freemium (free-to-play with intrusive advertisements and in-app purchases). It utilizes music and graphics similar to the 2013 SimCity game, although it is slightly down scaled in order to fit in with the iOS and Android devices' graphic capabilities. The game starts with 25,000 simoleons and 50 SimCash on hand. There is no zoning feature in SimCity: BuildIt. Instead, buildings are moved manually. Commercial and industrial buildings produce items, and residential zones require them in order to upgrade to a higher density. Factories can also be upgraded, although it requires demolishing the original building when it is not producing anything, then replacing it with a new one.</i></p> <p><i>There are also special buildings based on Season tournaments; and based on holidays such as Christmas, New Year's Day, Valentine's Day, Easter, Halloween, and Thanksgiving that can be placed in the city. Each season plays every three months, giving the categories of the types of buildings every season for a limited time such as movie studio buildings, amusement park buildings, wild west buildings, special landmark buildings, extra university buildings, parade buildings, and buildings based on real world promotional events such as the promotion of the Lays Max potato chips. Once players have used all the city space available, players can only store or swap these buildings. The game has five additional regions that players can switch to and develop. This extends the gameplay to provide varied new land, buildings, and materials and lets players also use the season buildings.</i></p>





Players can only build two-lane roads using the build tool. Players cannot manually build higher-capacity roads; they must upgrade them instead. Initially, only two, four and six-lane roads are available at launch; three more road types (avenues, boulevards, and streetcar avenues) were introduced in the Disasters update.

The Disasters update allows Players to launch disasters (meteor collisions, earthquakes, etc.) on their own city. Each disaster has three levels players can unlock. Players unlock these levels by launching the disasters. Players can earn gold keys this way.

Users play as the mayor of their city, and make choices in order to keep their townspeople happy. When players do this, players can earn taxes from the City Hall. When players have more people, players earn more taxes (Simoleons). Users can trade, chat, and join clubs with others players for connected online gameplay.

Factories produce metal (1m), wood (3m), plastic (9m), seeds (20m), minerals (30m), chemicals (2h), textiles (3h), sugar and spices (4h), glass (5h), animal feed (6h), electrical components (7h)

Commercial: Building Supplies Store produce nails, planks, bricks, cement, glue, and paint. Hardware Store produce hammer, measuring tape, shovel, cooking utensils, ladder, and drill. Farmers Market produce vegetables, flour bag, fruit and berries, cream, corn, cheese, and beef. Furniture Store produce chairs, tables, home textiles, cupboard, and couch. Gardening Supplies produce grass, tree saplings, garden furniture, fire pit, lawn mower, and garden gnomes. Donut Shop produce donuts, green smoothie, bread roll, cherry cheesecake, frozen yogurt, and coffee. Fashion Store produce cap, shoes, watch, business suits, and backpack. Fast Food Restaurant produce ice cream sandwich, pizza, burgers, cheese fries, lemonade bottle, and popcorn. Home Appliances produce bbq grill, refrigerator, lighting system, tv, and microwave oven.

Contest HQ unlocks at level 17. Club Wars unlocks at level 18.

As of October 2017, the application has seen over 50 million downloads on the Google Play Store and ranks number four all-time in simulation games downloads operating on Android.

In 2018, according to EA Mobile, SimCity: BuildIt has been recorded as the most-played SimCity ever when it stayed in the top 10 in U.S. sim and strategy games on IOS platforms, in the top 100 for U.S. games overall and in the top 150 global.

MORE INFORMATION

https://play.google.com/store/apps/details?id=com.ea.game.simcitymobile_row&hl=en

DATE

15.05.2020

AUTHORS

Advanced Technology Systems



Task 1.4 Questionnaire-based study engaging instructors on sustainability education needs.

A questionnaire was developed and distributed to instructors in all countries represented in the consortium to assess their perception on the importance of the skills and on the relevance of the different pedagogical methodologies to develop these skills. Participants were selected among schools associated to the partners. The results provided insight on their perceptions, attitudes, needs, and expectations in relation to designing the proposed learning intervention.

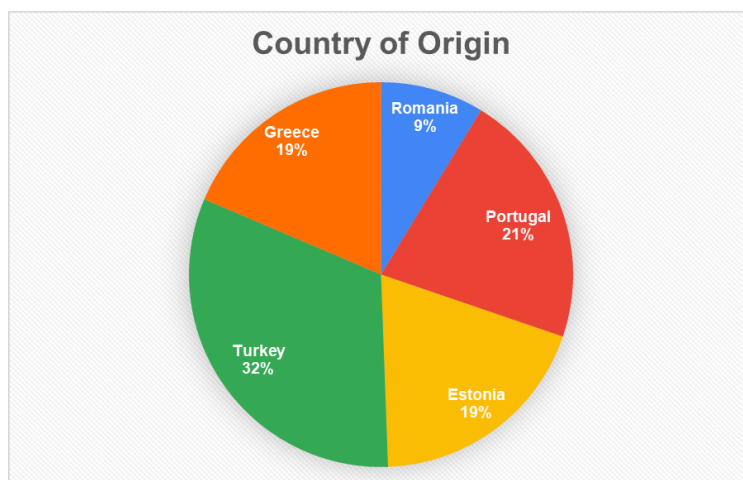
Participant demographics

A total of 172 (37.6 % above the expected 125) participants answered the survey. The demographic distribution is presented next.

Country of Origin

Participants were distributed through all the involved countries in a reasonably balanced way although there is a discrepancy between the country with the highest number of respondents (Turkey with 55 teachers) and the country with the lowest number of respondents (Romania with 15 teachers).

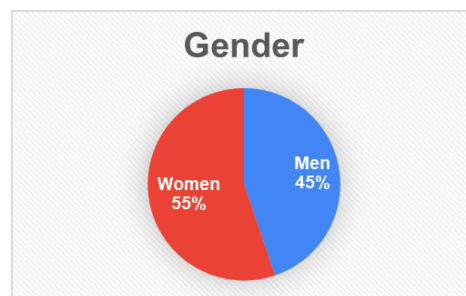
Country of Origin	#
Romania	15
Portugal	37
Estonia	33
Turkey	55
Greece	32
TOTAL	172



Gender

The gender distribution was also reasonably balanced (77 men vs 95 women) although it varied a lot between countries. For instance, in Romania, Portugal and Estonia there was a predominance of women answering the questionnaire while in Greece most teachers were men. In Turkey, there was a balanced distribution.

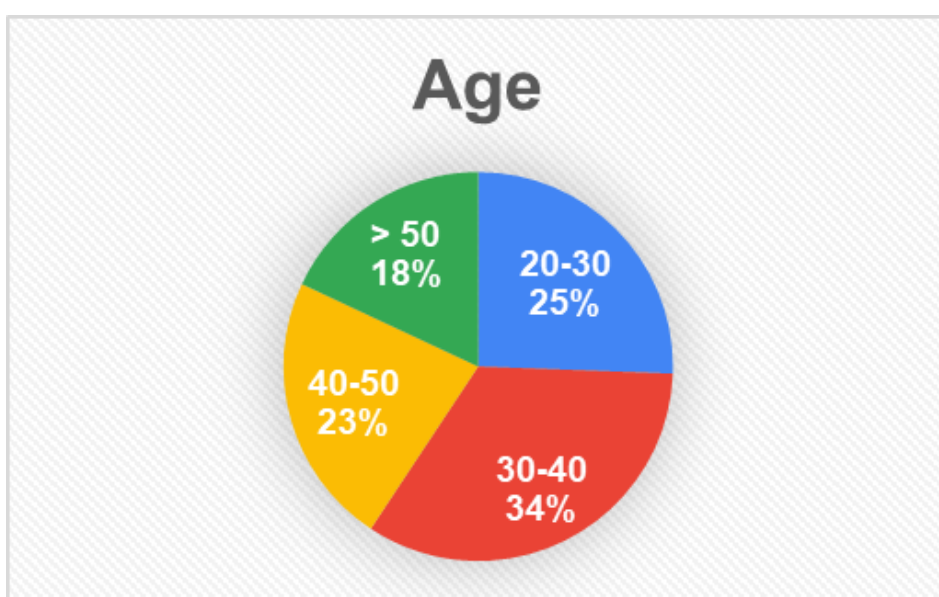
Country of Origin	Male	Female
Romania	3	12
Portugal	14	23
Turkey	28	27
Estonia	7	26
Greece	25	7
TOTAL	77	95



Age

The majority (59.3%) of teachers had less than 40 years of age. Nevertheless, this was again very different between countries. In Estonia there was a clear tendency towards older teachers, something that also happened in Romania but not as strongly. Age distribution among Greek teachers was quite balanced while in Turkey and Portugal teachers were mostly on the young side. In Portugal, the reason was that many respondents were still following graduate studies at the Teacher Training school.

Country of Origin	20-30	30-40	40-50	>50
Romania	1	5	4	5
Portugal	17	17	3	0
Turkey	13	23	15	4
Estonia	1	5	12	15
Greece	12	8	5	7
TOTAL	44	58	39	31



Perceived Importance of Sustainability Skills

Teachers classified each skill in terms of perceived importance, from (1 - Not important at all to 5- Very important). Teachers also had the possibility of choosing “Don’t Know” which explains why the total is not equal for all the skills.

Overall all the skills were considered as relatively important or important (the least scored option got 3.77 rating which is still positive). As such, there was not extreme differences between the highest and lowest scored skills. Overall, *Willingness to Learn* (4.49), *Being a Listener* (4.45) and *Commitment to Sustainable Solutions* (4.41) were the most relevant skills. On the other side of the scale, *Storytelling Skills* (3.77) and *Leadership* (3.85) were the least scored skills.

	1	2	3	4	5	\bar{X}
Digital literacy	1	5	24	35	106	4.40
Information and media literacy	1	8	22	36	104	4.37
Willingness to learn	1	3	22	31	115	4.49
Independent and autonomous learning	2	8	18	41	102	4.36
Integrating information from diverse areas	2	11	24	36	99	4.27
High level thinking	2	14	28	52	73	4.07
Innovative thinking	1	10	34	30	96	4.23
Critical thinking	5	6	21	33	105	4.34
Emotional Intelligence	3	7	40	50	69	4.04
Creativity	3	11	26	52	79	4.13
Open mindedness	1	9	25	45	90	4.26
Openness to criticism/feedback	1	7	22	40	100	4.36
Openness to others’ ideas and thoughts	1	10	17	47	95	4.32
Flexibility and adaptation to change	3	6	17	50	95	4.33
Initiative	1	6	27	64	71	4.17
Being positive	1	5	15	57	91	4.37
Ability to prioritize	2	10	25	36	97	4.27
Sense of quality of work	5	6	13	48	96	4.33
Good communication skills	1	5	22	51	92	4.33
Empathy	1	7	20	57	83	4.27
Being a listener	1	4	16	46	105	4.45
Negotiation	1	7	14	57	91	4.35
Storytelling skills so that students become influencers	1	15	52	53	46	3.77
Collaboration in multidisciplinary teams	1	6	14	51	97	4.4
Leadership	1	9	47	69	43	3.85
Transferring knowledge to the real world	1	4	35	47	84	4.22



Problem solving	1	4	19	51	97	4.39
Following systemic design processes	2	9	19	48	89	4.28
Ability to effectively research and inquire	0	7	29	62	70	4.16
Ability to view a problem from a high level point of view	1	6	18	66	79	4.27
Provide clarity to problems	2	5	26	56	81	4.23
Ability to evaluate potential solutions	3	3	20	49	94	4.35
Analysis of the factors that contribute to an unwanted situation	3	4	16	61	84	4.3
Working with limited resources	4	4	19	54	89	4.29
Implementing and assessing the effectiveness of a solution	3	3	26	59	78	4.22
Validating solutions from the perspective of the end users	2	5	22	60	81	4.25
Project planning	4	7	27	51	82	4.17
Project management	4	9	32	54	70	4.05
Positive attitudes that lead to responsible behavior	2	7	21	48	92	4.3
Global mindset	2	7	23	63	75	4.19
Ethics	2	8	22	51	88	4.26
Commitment to sustainable solutions	0	5	17	52	97	4.41
Ability to inspire others to invest in a sustainable vision	1	4	36	54	77	4.17
Responsible consumption	2	4	29	46	90	4.27
Responsible production	1	10	22	47	89	4.26

Teachers mentioned several other skills that should have been considered:

- Ability to adapt to different, new, complex situations (x2)
- Lifelong/continuous learning (x2)
- The ability to get involved in problem solving, including volunteering
- Reflective capacity
- Collaborative learning;
- Self-assessment and self-motivation;
- Ability to work efficiently and effectively alone;
- Ability to discern between truth and misinformation
- Awareness of own responsibilities
- Open mindfulness, willingness in cooperation
- Learning to learn
- Proactiveness
- Inquisitive mind
- Able to study





- Ability to Dream
- Skills to live in Nature
- Being solution-oriented
- Being responsible citizens
- Know foreign languages (x2)
- Thinking multi-dimensionally
- Social media ethics
- Knowing oneself
- Gaining inner motivation
- Applying
- Participation
- Individual responsibility awareness
- Emotion training
- Training to improve the ability to adapt to social life
- Continuing education
- Social innovation for sustainable development
- Work with social media

The number of provided skills is quite extended and provided interesting contributions for the framework.

Importance of Pedagogical Methods

Teachers were also asked if they thought that the current educational system allowed to develop the skills that they considered more important and which pedagogical methodologies they thought would be more suited (rated from 1-not suited at all to 5-totally suited)

	1	2	3	4	5	\bar{X}
The current Teacher-Centered Lecturing methodology	31	34	57	36	11	2.78
Project/Problem-Based Learning	1	9	21	56	76	4.21
Cooperative Learning	1	12	21	47	85	4.22
Gamification	2	13	27	55	71	4.07
Design Thinking	2	10	23	62	67	4.11
Thinking-Based Learning	1	10	15	47	93	4.33
Competency-Based Learning	1	6	21	52	86	4.3

Clearly teachers did not consider that the current educational paradigm was adequate to develop these skills and they favored other methods namely *Thinking-Based Learning* (4.33), *Competency-Based Learning* (4.3), *Cooperative Learning* (4.22), *Project/Problem-Based Learning* (4.21) and *Design Thinking* (4.11).





Teachers were also asked if other learning methodologies should be considered and the following were provided:

- Peer learning (x4)
- Learning by doing (x7)
- Learning by error
- High Level Thinking
- Individual teaching at schools
- Giving feedback
- Student-centered learning
- For students with a critical attitude, lessons can be taught with brainstorming that will enable them to express themselves.
- Learning by living
- Working independently, continuous support, sharing and solidarity platforms, motivation

Some of the answers were complementary to the ones providing so they will be integrated in the framework.

What skills do instructors require to be able to integrate ICT-enabled solutions for enriching the sustainability skills of their students into their teaching practices?

The answer to this question focused a lot, as expected on the digital skills of the teachers but several other skills were indicated.

- Digital skills (x21)
- The ability to implement digital technologies to increase communication with colleagues and exchange of good practices, skills and knowledge of each individual, in order to individualize the educational resources used, thus focusing the educational process on the student
- Patience (x2)
- Empathy with students (x2)
- Creativity (x4)
- Innovation (x4)
- Didactic design skills (x2)
- Ability to be open to new experiences
- Trace and plan a task to create sustainable projects adjusted to the students' skills
- IT skills, synthesis skills and activity organization skills
- Ability to use and adapt aspects from real world, organizing teaching-learning process with the help of projects, problem solving / case studies
- Resilience, flexibility and adaptability
- IT skills
- Ability to adapt quickly to new trends in the teaching-learning process





- Creating evaluation methods and techniques
- Real partnership, love for children and for their work, trust and clear feedback given immediately when they are asked to help, enjoying what they are doing, smiling
- Flexibility
- Communication skills (x3)
- Participation
- Personal skills (x2)
- Keeping up with innovations and internet literacy
- Ability to install, connect, and use the related system, tools at a basic level; know the applications it can use
- Being solution oriented
- Readiness
- Academic information, internship, practice, guidance
- The need for innovative training
- They must have the competence to apply professional knowledge and skills.
- Media literacy
- The educator should be able to understand the student and give a sense of trust (x3)
- Application/practice
- Cooperation
- Technological and related knowledge and abilities
- Synthesis
- Animation
- Digital competence, mastering new educational approaches, existence of merit management, expert school administrators, ethical work order, open minded and respectful to differences, policy-free school management / climate
- Competence about educational technologies
- Being able to express yourself, turn the event into a game and include the student in it
- Open to new proposals and opportunity to modernize current teaching methods
- Good computer skills and supporting ICT software
- Cognitive and sociocultural approaches are appropriate for the design and development of Learning Activities and Teaching Scenarios in support of ICT
- Distinguishing the personal talents of each student and learning that aims to highlight and optimize these talents.
- Students' behavior to protect the school and the school environment





What resources do instructors require to be able to integrate ICT-enabled solutions for enriching the sustainability skills of their students into their teaching practices?

The focus here was on the availability of equipment but also on training for teachers.

- In-service training
- Equipping teachers on this subject.
- Professional development courses
- IT equipment and internet access (x8)
- Best practice guides
- Computers (x4), printer
- Material resources (computers / tablets / mobile / wi-fi)
- Support from other people around (other teachers, school management, parents)
- Logistics base
- Laptops, graphics tablets, smart tablets
- Educational platforms (x2)
- Time, the teaching methods to be adapted to the current situation, materials - ICT technology
- Learning management systems, intelligent platforms, logistics
- E-learning platforms; Educational games; IT infrastructure
- Software applications, educational games, methodologies
- Abilities to use educational IT solutions
- Computers
- Applications and games for sustainability
- Computer lab resources
- Learning management systems
- Infrastructure
- Technical support
- Tablets (x2), wifi
- Training
- Educational games
- E-learning platforms
- Social media
- Hardware and software
- Technical books
- Application-based tools
- Materials of non-governmental organizations working in the field of sustainability.
- Variety of applications it can use, hardware in the educational environment, rich content prepared with easy-to-use materials
- Technical equipment
- Interest





- First of all, infrastructure, technical support. Then the usability in the process of teaching
- Family, school and environmental support
- A good infrastructure first
- Real life resources
- Technological resources (x4)
- Audiovisual and applied
- Social media
- Basic hardware and supporting software variety
- Book, internet
- Technological equipment and materials that appeal to age
- Written and visual sources
- Digital and printed publications, online trainings, non-emptied, functional in-service trainings, supportive and merit managers, students have equal opportunities in terms of resources.
- Educational psychology, sociology, etc.
- Technological education and tools
- Written and visual materials
- Internet, decor, smart board
- They should turn to research and project content sources.
- Supporting material and infrastructure
- Expert support, seminars on ICT solutions
- School environment is the most important element of education
- Schools need to be organized to support lifelong learning.
- Adopting sustainability in the learning / educational environment

Are you familiar with any relevant practices, initiatives, policies, and strategies on sustainability education that could be used as an example? If so, can you provide a link or a reference to that practice?

Teachers presented a few examples and comments on this subject:

- I think that what has been done until now are only attempts
- <https://sustainabilityinschools.edu.au/why-teach-sustainability>
- My school has interesting practices
- Our city hall has sustainability projects
- Unicef Sustainable Development Goals or UNHCR had an online strategy game for kids. You put yourself there as refugees and in many difficult situations, you have to make very important decisions. Children learn to empathize while playing this and develop awareness of refugees and their difficult lives.
- Farming applications
- Eba (<https://www.eba.gov.tr/>)





Are you familiar with any relevant ICT-based solutions in sustainability education? If so, can you provide a link or a reference to that practice?

Teachers provided the following examples:

- Using learning platforms such as: padlet.com, Kubbu.com, kahoot.it, Google Classroom
- <http://www.sustainabilityaware.com/tablet/index.html>
- Kahoot.it has several questionnaires on sustainability education
- For empathy training, the game My Life as a Refugee UNHRC)
- Eba (<https://www.eba.gov.tr/>) (3x)
- Webex cisco

Any other comments or suggestions?

- I would like to follow your project
- Nice idea
- Please send me the results of the project:ana.silva.209@gmail.com
- The survey seems to have always considered positive situations
- Teachers should be allowed to learn in these areas
- Cognitive and sociocultural approaches are appropriate for the design and development of Learning Activities and Teaching Scenarios in support of ICT



Task 1.5 Analysis of the use of ICT-based solutions in sustainability education.

The topic of sustainability has received a lot of attention on large scales in the whole world. The United Nation has a list of 17 Sustainable development goals, to end poverty, fight inequality and injustice, and tackle climate change by 2030. Many of these goals and 169 targets are related to ICT and education. For instance: Goal 4.4 “By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship.” And goal 4.7 “By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture’s contribution to sustainable development”.

In the report “The role of ICT in realising education for all by 2030. Achieving Sustainable Development goal 4” they provide a lot of ideas how ICT will help to achieve sustainable education. ICT will play an important role in moving towards sustainable development in the region. In their #SystemTransformation report, the Global e-Sustainability Initiative states that digital solutions in all areas of life can directly contribute to achieving all 17 goals and over 50 percent of the 169 established targets. Used strategically, ICT can dramatically enhance education equity, quality and efficiency through its ability to facilitate fast, synergetic and scalable change. ICT is accelerating positive change. Initiatives include working to strengthen collaboration between the ICT and education sectors, providing more students with access to ICT-based learning opportunities and advocating for ICT education from an early age. The Masterplan also includes a discussion of how ICT could be better integrated into the planning, design and implementation of education curricula, assessments and teaching methodologies to enrich the learning environment for students and equip them with the competencies needed to succeed in a knowledge economy. ICT in education can be used to build borderless networks and facilitate innovative peer learning around the world. The interactive multi-dimensional education experience that ICT makes possible can inspire and encourage students by providing them with opportunities to gather knowledge, explore ideas and express themselves using channels and tools that suit their individual preferred learning modalities. ICT is already transforming the concept of classrooms by moving learning online, offering new options for information delivery and creating new ways to provide in-service teacher training and support.

They state in “ICTs as a catalyst for sustainable development” that “The 2030 Agenda for Sustainable Development recognizes that the spread of information and communication technology (ICTs) and global interconnectedness has great potential to accelerate human progress, to bridge the digital divide and to develop knowledge societies, as does scientific and technological innovation across areas as diverse as medicine and energy. ICTs are

already empowering billions of individuals around the world – by providing access to education resources and healthcare, and services such as mobile banking, e-government and social media, among others.”

In the publication “The role of technology in the UN SDGs” by Megan Crawford says “One sector that will play a crucial role is the Information and Communications Technology (ICT) sector. The UN itself acknowledges that leveraging ICT will play a vital role in their efforts. The UN Assembly sees ICT infrastructure as a cross-cutting ‘means of implementation,’ underpinning the achievement of every goal. All three pillars of sustainable development – economic prosperity, social inclusion and environmental protection –need ICT as a key catalyst. Only ICT, particularly broadband, can provide this surge in development.” “How Information and Communications Technology can Accelerate Action on the Sustainable Development Goals,” a joint report by Ericsson and the Earth Institute, presents the possible role of ICTs in each of the SDGs. For education, the 4th goal, they say: “With connectivity, students can access learning resources and opportunities even in remote or low-income areas. Teachers can prepare for classes anytime or anywhere. ICT opens up access to education to underserved populations for whom improved educational opportunities lead to improved economic opportunities.”

Darine Ameyed in her publication “How ICT Can Accelerate Implementation of the Sustainable Development Goals” states that successful integration of technology to enable smart global sustainability requires a deep understanding of the potential of technologies and their socio-technical impacts, as well as their cultural and ethical influence, plus the identification of additional existing or emerging enablers for sustainable development to accelerate action on SDGs. As an example, such tools can help many sectors like education, healthcare, energy, cities, etc. To achieve the SDGs, ICT needs to be combined with innovative policies, services, and solutions. It can be a powerful means of implementation in many significant ways: Accelerate upscaling services in health, education, financial services, smart agriculture, and low-carbon energy systems and to Accelerate institutional learning through online communities. Also UNESCO pledges to contribute to the SDGs through education: As the lead United Nations Organization for education, UNESCO guides international efforts to help countries understand the role such technology can play to accelerate progress toward Sustainable Development Goal 4. UNESCO shares knowledge about the many ways technology can facilitate universal access to education, bridge learning divides, support the development of teachers, enhance the quality and relevance of learning, strengthen inclusion, and improve education administration and governance. The Organization scans the world for evidence of successful ICT in education practices – whether in low-resource primary schools, universities in high-income countries, or vocational centres – to formulate policy guidance. Through capacity-building activities, technical advice, publications, fieldworks, and international conferences such as the International Conference on Artificial Intelligence and Education and Mobile Learning Week, and fieldwork, UNESCO helps governments and other stakeholders leverage technology for learning.



UNESCO also provides a study programme of “Information Communication Technology (ICT in Education for Sustainable Development(ESD): Aswan University and Heliopolis University in cooperation with Frederick University in Cyprus bring contemporary – pioneer programs in the field of postgraduate studies in Education. The Master ICT in ESD was initiated by the UNESCO Chair ICT in ESD and developed through the collaboration of seven European Universities including Frederick University and funded by The European Commission Lifelong Learning Erasmus Program. Blended learning version will be offered in Egypt in cooperation with Frederick University through face to face classes at Heliopolis University and Aswan University Premises.

Some countries, like Guyana have proposed whole strategies how to implement the Sustainability Education goals in their educational practices. In their Education For Sustainable Development policy they state that Information and Communication Technologies (ICTs) is an essential and powerful tool in enabling the development of innovations that promote and maintain sustainability. Deliberate attempts must be made to utilise this tool effectively. It is critical to ensure that education relevant to the modern technological world can be delivered. The infusion of ICT into the teaching environment is, therefore, of critical importance. Teachers must effectively use ICT to innovate and solve problems, and deliver curriculum in new and more effective ways. The success of ICT is largely dependent on how effectively the tool is implemented and used. Research into ICTs best suited to this purpose must be conducted in order to encourage the development of new methodologies and strategies to aid teachers in the delivery of the curriculum. ICT also allows for global collaboration with other countries where similar issues are being tackled. For example, ICT can help quickly overcome emerging problems such as disaster management. Pedagogical innovations must take into consideration the needs of the specific context - learning environment, readily available resources and students’ cognitive abilities. Teachers will need to constantly evaluate the learning needs and abilities of their students and use a combination of approaches as required. The formation of a local ESD teachers’ network is recommended as a professional learning community will provide the platform for coherent activities of professional development and shared practices through a high level of collaboration.

Enabling digital sustainability website points out that ICT can play a significant role in enabling us to live more sustainably and move to a more intelligent use of our time, energy and resources. Raising awareness and providing information need to go hand in hand with providing adequate products, infrastructure and facilities.

Examples

“We Energy” game (<https://www.mdpi.com/2071-1050/10/10/3639>)

Energy transition is key to achieving a sustainable future. However, in this transition, an often neglected pillar is raising awareness and educating individuals on the benefits, complexities, and urgency of renewable energy supply and energy efficiency. This paper

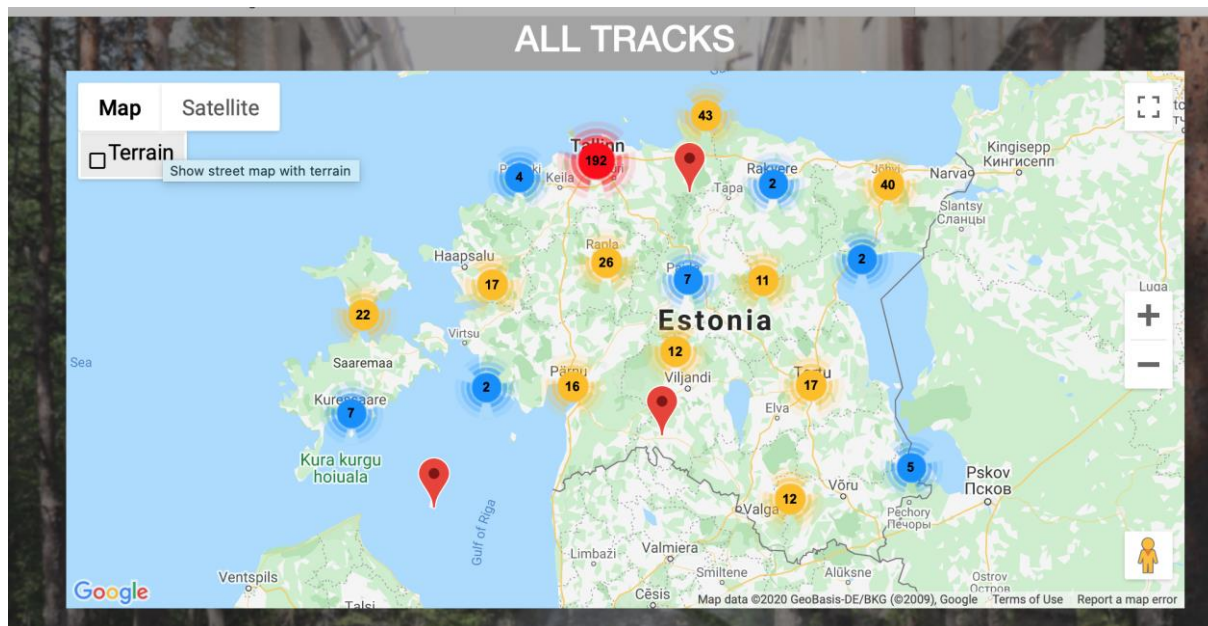


exemplifies an educational practice to create awareness on sustainable energy transition by playing a “serious” game, the We Energy Game. This study aims to analyze communicational and educational aspects of the game by making use of a validated framework for serious games analysis, and to expose the opinion of players after maintaining group discussions. The analysis reveals a detailed insight of narrative elements, messages, and gameplay mechanisms, but also educative aspects to be considered by teachers if they are interested in putting the game into practice in their classes. The group discussion reveals that the game has been more successful in achieving cognitive (understanding/knowledge) and affective (emotion/interest and concern) engagement than in motivating attitudinal or behavioral engagement.

Paper: “Preparing Public Pedagogies with ICT: The Case of Pesticides and Popular Education in Brazil”

(<https://www.mdpi.com/2071-1050/10/10/3377>) This article analyzes the conditions through which it is possible to launch a project of public pedagogy with information and communications technologies (ICT) on environmental education and pesticides. This is a public pedagogy that is agreed between diverse actors (universities, environmental agencies, local authorities, schools, and farmers) and adapted to their needs and demands, based on the study of an ongoing project. The methodology is qualitative, with interviews with key informants and a Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis developed with the contestants. In the development of the project, the conditions in which the theme of the project is lived and worked by the different actors who were included have been highlighted. The discussions that were held offered different points of view about the priorities of public health, environmental problems, and social and economic outputs. Among the conclusions, some difficulties came up about how to start public pedagogies that are managed by citizenship. The idea came from the community.

Avastusrada.ee is a browser based app that enables to follow trails in nature and in GPS identified spots answer questions on your smartphone. There are three categories of trails: Environmental education that is for visitors of Environmental centers; School education - trails for schools and Recreation trails are for adventure and edutainment.



Rohepegel.ee is an app that lets you evaluate your education institution on how “green” you are and search for green innovation educational institutions. The areas that you can test your solutions are: biodiversity, climate change, health and wellbeing, household and infrastructure, consumption and waste management, community and world education.



Rohemeeter.ee is an application developed by University of Tartu to value the biodiversity of any given location. The Green Meter identifies and then visualizes areas in the landscape that are more or less supportive of biodiversity by 100x100 meter analysis squares and provides a 0-100 variable Green Meter aggregate index for the observed location based on the surrounding 500 meter radius landscape. The application can be used by individuals, companies and local governments as well as schools and kindergartens for teaching. With the help of the green meter, it is possible to make exactly those choices and decisions when designing a home yard or public space that keep the environment suitable for both humans and other species around us. In addition, the Green Meter makes recommendations for maintaining or increasing the biodiversity of each area.



TARTU ÜLIKOOL



Rohemeeter

Maastiku sobivus elurikkuse
püsimiseks:



Valitud asukoht:

Nurmsi küla, Lääneranna vald, Pärnu
maakond

58.586 N, 23.716 E

Aeg: 27.04.2020

Ümbruskonnas on metsad, põllumaad
ning niidud. Maastiku sobivust
elurikkuse säilimiseks hindab
Rohemeeter siin väga heaks.





Analysis of ICT solutions that support the development of sustainability skills

		Game 1 - Future Quest Island-Explorations	Game 2 – Eye of the Donkey	Game 3 – Number Shire	Game 4 – Swipe and Seek	Game 5 – RoboCode
1	Target Group	11-14 <i>* Kids with special needs</i>	14-18	5-11	11-14 14-18	11-14 14-18
2	Type of Game	Strategy	Simulation	Logic	Quiz	Simulation
3	Purpose	Align 21st-century skills with college and career readiness goals	Learn about forensic science	Early math learning	Testing knowledge in different domains by	Learn about the the fundamental concepts of direction
4	Objectives	Recognize and identify academic strengths and desires Explore and prioritize college and career options Develop increased social skills Collect and organize digital materials to construct an electronic portfolio (ePortfolio)	Knowledge testing Problem solving Critical thinking skills Instructional decision-making	Knowledge testing Problem solving Critical thinking skills Supported practice, and independent practice	Knowledge testing Strengthen reading and vocabulary skills Problem solving	Develop logical reasoning and spatial awareness Improve the abilities of reasoning, hypothesizing, inferring, and prediction. Problem solving Practice position and direction recognition





		Game 1 - Future Quest Island-Explorations	Game 2 – Eye of the Donkey	Game 3 – Number Shire	Game 4 – Swipe and Seek	Game 5 – RoboCode
	Description	The Future Quest Island – Explorations is an accessible game-based college and career readiness tool and uses the principles of universal design for learning and motivation strategies to engage all players in developing a portfolio for individualized learning plans and transition plans for IEPs.	The Eye of the Donkey is a knowledge testing quiz game in the field of the forensic science where the player must use the basic principles of the PCR methods to copy a DNA in order to collect enough material to use as evidence in a crime	The NumberShire is math game that focuses on whole-number critical concepts and skills, which uses a narrative arc to motivate and teach students in kindergarten through second grade, especially those at risk for math difficulties	The Swipe and Seek is knowledge testing quiz game where the answers can be formed by dragging a line between letters. The Swipe and Seek is a time based game and provides hints which highlight a letter and offers the option to stop the time for a few seconds.	The RoboCode is a follow the path game where the player is asked to use three types of directions: move, climb or jump, with their specific options: left, right, up or down, to reach the final destination. The player is asked to drag and drop the directions into the programming panel to create the path.
	Narrative flow	Choose an avatar and set sail to one of the island locations: About Me Mountain, College Coast, Career Cove, & Social Sanctuary, to complete activities. Arriving at the location, it is presented to you your future forecast. You need to complete multiple activities so that the forecast will not come true.	A crime took place in a Museum. Unaware of it you attend the last lecture at a Forensic Lab course. After the lecture, you leave the auditorium when you hear a car which stops next to you. You are asked to help the Forensic Lab to collect	In a fairytale-inspired medieval kingdom of Tally-ho, the village elder is stepping down and is handing over the mantle of leadership to a young member of a Renaissance-style village. In each village buildings are hidden math related mini-	The game does not have a story based narrative flow. The player must answer correctly to a number of questions, provided by the teacher in order to finish the game. At the end of each question, the player can view answered correctly or wrong answer and at	You are asked to guide a robot drone through the city's pipes, until it reaches the enemy agency's base where they are threatening to release a technological super virus worldwide.





		Game 1 - Future Quest Island-Explorations	Game 2 – Eye of the Donkey	Game 3 – Number Shire	Game 4 – Swipe and Seek	Game 5 – RoboCode
			evidences to solve the crime.	games ready to be discovered.	the end of the game session, the player can see the play time, the number of correct and incorrect answers and skipped questions	
	Game mechanics	Character creation Treasure Chest to open activities Writing prompts by typing, use speech to text, and/or use sentence starters Choose from different options which affects the game flow Fill in forms Surveys Build huts Object acquisitions from shops Coins reward by finalizing activities (bronze, silver, gold) Image creations Spin the Wheel Quotes and Tips Storytelling	Role-playing Choose the correct answer Hidden objects detection by identifying and dragging them in a location Storytelling	Role-playing Objectives reaching Click, Drag and drop, pattern recognition actions to form the answers for equations Pets/points/objects reward Levels to reach Immediate feedback to answers Storytelling	Dragging line for word formation Timer Skip the question Immediate feedback to answers	Timer Tutorials Immediate feedback to answers Drag and drop actions Levels to reach Keycards to open doors Collecting items (crystals)





Skills and competences		Game 1 Future Quest Island- Explorations	Game 2 Eye of the Donkey	Game 3 Number Shire	Game 4 Swipe and Seek	Game 5 RoboCode
Technical skills and competences	Digital literacy	x	x	x	x	x
	Information and media literacy	x	x	x	x	x
Meta cognitive skills and competences	Willingness to learn	x	x	x	x	x
	Independent and autonomous learning	x	x	x	x	x
	Integrating and synthesizing information	x	x			
	High level thinking	x				
	Innovative thinking	x				
	Critical and analytical thinking	x	x	x		x
	Emotional intelligence	x				





Skills and competences		Game 1 Future Quest Island- Explorations	Game 2 Eye of the Donkey	Game 3 Number Shire	Game 4 Swipe and Seek	Game 5 RoboCode
Intrapersonal skills and competences	Creativity	x	x	x		x
	Open mindedness					
	Openness to criticism/ feedback	x		x	x	x
	Openness to others ideas and thoughts					
	Flexibility and adaptability	x				
	Initiative	x	x	x		x
	Being positive	x				
	Ability to prioritize	x			x	x
	Sense of quality of work	x			x	





Skills and competences		Game 1 Future Quest Island- Explorations	Game 2 Eye of the Donkey	Game 3 Number Shire	Game 4 Swipe and Seek	Game 5 RoboCode
Interpersonal skills and competences	Good communication skills	x				
	Empathy	x				
	Being a listener	x	x	x	x	x
	Negotiation					
	Storytelling skills	x	x	x	x	x
	Collaboration and teamwork, sometimes in multidisciplinary teams	x				
	Leadership					
	Good presentation skills	x				
	Transferring knowledge to the real world	x	x	x	x	x





Skills and competences		Game 1 Future Quest Island- Explorations	Game 2 Eye of the Donkey	Game 3 Number Shire	Game 4 Swipe and Seek	Game 5 RoboCode
Problem solving skills and competences	Problem solving	x	x	x	x	x
	Following systemic design processes	x	x	x	x	x
	Ability to effectively research and inquire	x	x	x	x	x
	Ability to view a problem from a high level point of view					
	Providing clarity to problems					
	Ability to evaluate potential solutions	x	x			x
	Analysis of the factors that contribute to an unwanted situation	x				





Skills and competences		Game 1	Game 2	Game 3	Game 4	Game 5
		Future Quest Island-Explorations	Eye of the Donkey	Number Shire	Swipe and Seek	RoboCode
	Implementing and assessing the effectiveness of a solution	x	x	x	x	x
	Validating solutions from the perspective of the end-users					
	Project planning	x	x			x
	Project management	x	x	x	x	x
Sustainability skills and competences	Positive attitudes that lead to responsible behavior	x	x			
	Global mindset	x	x			x
	Ethics	x	x	x	x	x
	Commitment to sustainable solutions	x				





Skills and competences		Game 1 Future Quest Island- Explorations	Game 2 Eye of the Donkey	Game 3 Number Shire	Game 4 Swipe and Seek	Game 5 RoboCode
	Ability to inspire others to invest in a sustainable vision					
	Responsible consumption	x				
	Responsible production	x				
Pedagogical methodologies to develop the listed skills and competences	Project/Problem-Based Learning: PBL allows students to acquire key knowledge and skills through the development of projects/solutions that respond to real-life problems	x	x	x	x	x
	Cooperative Learning: The main characteristic is that it is structured based on the formation of groups of 3-6 people, where each member has a specific role and to reach the objectives it is necessary to	x				





Skills and competences		Game 1 Future Quest Island- Explorations	Game 2 Eye of the Donkey	Game 3 Number Shire	Game 4 Swipe and Seek	Game 5 RoboCode
	interact and work in a coordinated manner					
	Gamification: The integration of game mechanics and dynamics (points, badges, etc.) in non-ludic environments such as education	x	x	x	x	x
	Design Thinking: Industrial designers' methods to solve problems and satisfy the needs of their clients. Applied to education, this model makes possible to identify the individual problems of each student	x	x	x		x
	Thinking-Based Learning: This pedagogical approach is meant to show students how to work with the information they receive and to teach them to	x	x	x	x	x





Skills and competences		Game 1 Future Quest Island- Explorations	Game 2 Eye of the Donkey	Game 3 Number Shire	Game 4 Swipe and Seek	Game 5 RoboCode
	contextualize, analyze, relate, argue					
	Competency-Based Learning: Instead of focusing only in the acquisition of information, teachers can go through the academic curriculum without significant deviations but focusing it in a different way, putting into practice real examples and, thus, transmitting to their students a more tangible dimension of the lessons	x	x	x		x





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Task 1.6 Learning needs analysis for students

This task will focus on the documentation and analysis of learning needs for students in terms of sustainability education. It will be based on the results of tasks 1.3 and 1.4 and may include items such as building sustainability skills for employability, developing civic mindsets, building analytical and critical thinking skills, promoting collaboration capacity, and more.

Introduction to Design Thinking

Design thinking is an approach that enables students to offer innovative and creative solutions to daily problems. It facilitates students :

- to develop empathy and understandings
- to define problems
- to generate creative solutions
- to develop prototypes
- to test and evaluate solutions

In contemporary education, it is aimed to educate students not as exposed to the knowledge as in conventional education but as individuals with 21st century skills who produce, contribute to economic and social developments. It is becoming more and more important to be able to raise individuals who have gained 21st century skills, can think questioning, do research, find innovative solutions to problems and develop products and catch the era.

With the changing world, students have to find solutions to problems they have never seen before. For this reason, students should be flexible and develop their skills to produce adaptable solutions to different problems.

Besides, while some professions disappear with modern digital technologies, they also bring new professions. Even, it is said that 85% of the jobs that will exist in 2030 have not been invented yet. So, how can we make our students ready for this future? How can we teach them to adapt to innovations, to be creative, innovative and problem solving to develop in a rapidly changing world?

Benefits of Design Thinking Skills

Design thinking is also an approach that requires such a lot of horizontal skills as problem solving, innovative and creative thinking, empathy, etc. With this approach, students are active in their own learning. They develop solutions for problems encountered with empathy and rationality. They test the solutions and question their effectiveness. They develop new strategies to solve problems. So students learn to think out of the box.





What are the benefits of design thinking approach for students?

- Defining problems and their framework as a chance
- Cooperation and empathy
- Self-confidence and perseverance
- Thinking out of the box and creativity
- Community-minded point of view
- Flexibility and resilience

In addition, the skills gained with this approach are not limited to the classroom environment. They have a process-oriented way of thinking that they can use in their future profession. This adds a value to the sustainability of all these skill developed through design thinking.

An Analysis of Skill Development Needs for Students

Problem Solving

Problem solving is the base of all new inventions, social and cultural development. It is the basis for constant development, communication and learning.

At the basis of design thinking lies a problem and solutions found to it. Problem solving process consists of 4 steps: what is, what if, what solutions are, what works. This can be followed as a self-renewing cycle.

This is different from a scientific method that offers a single solution to a major problem. It focuses on the desired result and the process is then evaluated. In addition, not only analysis but also synthesis is used. Many ways of thinking are used to achieve many potential solutions. It is aimed to add value with the most appropriate solution.

Students need to improve their skills in finding and applying solutions to problems that are new to them. These skills push students to be active in their own learning processes. It is a skill that is necessary for students both in their academic and professional lives.

DT4S will contribute students to acquire these skills by providing real-life problems and simulations. It will contribute to the development of confidence, independence, resilience, perseverance and decision making skills by providing students with problem solving skills.

Learning to Learn

Learning to learn involves using such knowledge and skills as researching, testing, receiving feedback and evaluating them at different stages of design thinking. This improves students' awareness of their own learning needs, observation of learning processes, awareness of their success or failure, and their ability to overcome obstacles in the learning process. Curiosity, observation and perseverance are three characteristics of 'Learning to learn'.





This skill can mainly be used in the steps defining prototype and testing steps of design thinking.

Since design thinking is an iterative process, it requires constant learning. For this reason, students need to discover their own learning style and realize their learning needs. DT4S will help students to raise this awareness through the training contents and gamification to be developed. It will contribute to students to acquire this skill with research tasks that encourage learning.

Collaboration

Difficult problems can be solved more easily thanks to cooperation with people with different experiences, knowledge and skills. In order to achieve this cooperation, students need to communicate well with each other, to understand each other's perspectives and needs, to develop a common idea and to develop a product, to improve their distribution of tasks.

Students need to develop their skills to collaborate with different people so that they can develop creative ideas, increase their level of knowledge, and understand people's needs and problems. This improves higher level of thinking skills.

This skill can mainly be used in all steps of design thinking: empathize, define, ideate, prototype and test.

DT4S contributes to increasing the cooperation and participation of students with its educational content and activities.

Creativity

Creativity leads students to find innovative solutions to defined problems, create products by developing strategies to add value to them. Design thinking provides a constant motivation to reinforce the creativity of students. Students often have to face the problematic situation, involve in it, create alternatives to deal with it and test them. They need to provide useful and contributing solutions. In this case, they always need to be out of box, have a wide perspective and be innovative.

There is a need to improve the emotional and social skills of students, to increase their thinking capacity, to encourage problem solving skills, and to encourage innovative thinking among students through creativity.

This skill can mainly be used in ideate, prototype and test steps of design thinking. Design thinking supports employ, discover and test creativity. It allows to use both the intuitive and logical side of the brain.

DT4S will contribute to creativity of students via open-ended questions, creative team building activities, brainstorming sessions and debates.





Flexibility

Students need to be flexible while trying to find solutions to problems non-encountered before. As well as the students, the adaptability of the ideas is an important aspect of design thinking. Flexibility is also needed to understand different people and their perspectives and to communicate with them while defining the problem and producing solutions.

This skill can mainly be used in define, ideate, prototype and test steps of design thinking.

Students need to be able to adjust their thinking and use different problem solving strategies, open themselves to new experiences, tolerate change, use different problem solving strategies and shift perspectives when learning about new cultures.

The DT4S will promote the development of flexibility and ability to adapt to ICT skills and virtual experiment simulations to be introduced.

Social and Cultural Awareness

Students need to be empathetic and active members of society who can provide solutions to such issues as environmental, natural, social, etc. , which is of great importance in terms of sustainability.

Design thinking is based on interdisciplinary approach. Diversity is promoted as an important part of it. Students need to adapt to the new environment, to create an atmosphere of inclusivity, to understand needs from different cultures, to be aware of certain differences and problems.

This skill can mainly be used in all steps of design thinking: empathize, define, ideate, prototype and test.

This is an holistic part of sustainability education. DT4S will contribute with the training contents to be developed.

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Task 1.7 Skill development needs analysis for educators

This task focused on the analysis of skill building skills for educators with the objective of ensuring that they are in a position to integrate into their activities ICT-enabled solutions for enriching the sustainability skills of their students. Needs may include increased awareness, access to good practices material, increased communication with peers and exchange of good practices, ability to deploy ICT technologies, skill building for career development and satisfaction, and more.

Acquaintance with the Design Thinking methodology and its tools

Design thinking is a non-linear, iterative process which seeks to understand users, challenge assumptions, redefine problems and create innovative solutions to prototype and test. The method consists of 5 phases—Empathize, Define, Ideate, Prototype and Test and is most useful for tackling problems that are ill-defined or unknown. [1]

Over recent decades it has become crucial to develop and refine skills which allow individuals to understand and act on rapid environmental changes and to adapt behavior towards addressing sustainability goals. The world has become increasingly interconnected and complex and design thinking offers a means to address change in a more human-centric manner.

Design thinking offers the means to think outside the box and dig that bit deeper into problem solving. It helps designers carry out the right kind of research, create prototypes, and test out products and services to uncover new ways to meet users' needs.

Design thinking improves the world every day because of its ability to generate ground-breaking solutions in a disruptive and innovative way. It is more than just a process; it opens up an entirely new way of thinking and offers a collection of hands-on methods to help designers apply this new mindset.

Stage 1: Empathize

The first stage of the design thinking process allows designers to gain an empathetic understanding of the problem at hand, typically through user research. Empathy is crucial to a human-centered design process such as design thinking because it allows individuals to set aside their own assumptions on the world and gain real insight into users and their needs.

Stage 2: Define

In the Define stage, individuals accumulate information created and gathered during the Empathize stage. Designers analyze their observations and synthesize them to define the core problems that must be addressed. Designers introduce a problem statement that provides their own perspective integrated with the information gathered during the





Empathy phase. Designers should always seek to define the problem statement in a human-centered manner that addresses real as opposed to perceived needs.

Stage 3: Ideate

Designers are ready to generate ideas as they reach the third stage of design thinking. The solid background of knowledge from the first two phases means they can start “thinking outside the box”, look for alternative ways to view the problem, and identify broad innovative solutions that can range from mainstream to extreme.

Stage 4: Prototype

This is an experimental phase in which the aim is to identify the best possible solution for each of the problems identified during the first three stages. Design teams produce a number of inexpensive, scaled-down versions of the product (or specific features found within the product) in the form of prototypes that are aimed to be deployed by users for investigating the problem solutions generated in the previous stage.

Stage 5: Test

Designers or evaluators rigorously test the complete product using the best solutions identified in the Prototype phase by engaging users that experience the prototyped solutions. This is the final phase of the model but, in an iterative process such as design thinking, the results generated are often used to redefine one or more further problems. Designers can then choose to return to previous stages in the process to make further iterations, alterations and refinements to rule out alternative solutions.

An analysis of skill development needs for educators

1. Promotion of problem-solving skills

It is really important nowadays for educators to understand that learning approaches-based theory is fundamental. Moreover, educators need to develop awareness that accompanying theoretical teaching with practical applications for real world needs allows students to build deeper understanding of the knowledge they acquired during the course [2]. Instructors are in need to build their capacity to introduce problem-based learning design in their classrooms for developing tomorrow’s innovative thinkers. Building problem-solving skills is important for children as it helps them gain confidence in their ability to make good decisions for themselves. Using effective problem-solving techniques can also strengthen children beginning to develop empathy skills. Furthermore, it can help children learn more positive attributions about other persons’ intentions. Problem solving is essential for school readiness and academic success.





DT4S promotes problem-based approaches among instructors by developing understanding of theoretical concepts as well as practical skills for applying problem-based learning processes in the classroom. These skills will ultimately benefit students empowering them to build knowledge by synthesizing solutions to real world problems.

2. Ability to integrate the concepts of design thinking and sustainability into educational practices

Educators are in need of building their capacity to apply emerging methodologies, such as design thinking, in order to better prepare students to enter the world of work and to become active citizens [3] in a global environment in which prioritizing sustainability objectives is important for inclusive, environmentally responsible growth. Teaching young students design thinking helps them develop a growth mindset as well as important problem-solving, analytical, and spatial thinking skills. Instructors are in need of good practice guidelines on how to best integrate design thinking methodologies. Moreover, sustainability education can be fun, engaging and empowering for students. It allows them to take responsibility for their actions and to contribute their vision for a sustainable future. It enables them to develop knowledge, skills, values, and motivation for action allowing them to maintain their own wellbeing in an increasingly interconnected world.

DT4S equips educators with the tools, knowledge, and support they need to embrace creativity and making in education for improved student performance, engagement, and learning. DT4S addresses this need by providing instructional support content.

3. Awareness on the benefits of integrating ICT technologies in education

Educators can significantly benefit from the deployment of ICT, and more specifically serious games, in the context of the educational offerings. Furthermore, it is important for educators to understand that these methodologies allow students to learn in a more active way that allows the transferability of knowledge from the school environment to real life. In addition, it promotes among students the ability of lifelong learning and knowledge development throughout their career. And it empowers students to think innovatively. [4] The use of ICT in education adds value to teaching and learning by enhancing the effectiveness of education through experimentation, feedback loops, and motivational aspects that promote engagement. Moreover, it adds a dimension to learning that was not previously available through complementary to traditional instruction digital learning tools. ICT leads to positive attitudes to education as students find technology-enhanced environments more stimulation and engaging than traditional classrooms. Instructors have the capacity to inspire students to be open-minded in ICT technologies as learning tools. ICT provides interactive learning experiences that foster student motivation, especially when educators empower students to experiment with virtual environments that simulate the workplace, contributing to their preparation to engage in their future careers and promoting their adaptability to change.





4. Enriching course content and activities

Relevance of educational activities is a key aspect that motivates student learning. Establishing both personal and real-world relevance provides students with an important opportunity to relate the course subject matter to the world around them, and to assimilate it in accordance with their previously held assumptions and beliefs [5]. Relevance is a key factor in providing a learning context in which students construct their own understanding of the course material.

Involving students in activities that are inspired by real-life helps address the issue of content relevance, or significance in an educator's classroom. Educators can demonstrate to students that what they are learning can be applied. They can further demonstrate that, as they find ways to use knowledge to create new ideas, plans, operations, or designs, they build high level skills that are demanded by industry. Content becomes relevant not only because there is a link to real world situations but because it can be the key to effective, enhanced performance not only in the classroom but also in the workplace. If students understand that they can use the knowledge and skills they have gained to better themselves and the lives of those around them they will feel a sense of empowerment and will be motivated to learn.

Educators can benefit from educational approaches, such as active learning and design thinking that help link course content to real world contexts enriching the learning experiences of their students and building skill sets that are demanded by industry and society.

Serious games and simulations, such as the DT4S services for sustainability education, offer students the opportunity to be actively involved in solving real-life, open-ended problems that have potential for provoking extensive research, discussion among and between classmates and teacher, contributions from career and life experiences, and critical thinking.

5. Preparing students to actively engage in sustainable development practices

High quality education is an essential tool for achieving a more sustainable world. Education for sustainable development promotes the development of knowledge, skills, understanding, values, and actions required to create a sustainable world, which ensures environmental protection and conservation, promotes social equity, and encourages economic sustainability.

Sustainability education provides an alternative approach to building environmental awareness and skills aiming to educate students as global active citizens that possess the knowledge and positive attitudes to contribute to growth while preserving the environment. Students need new perspectives to be able to understand the rapidly changing world they live in. In addition, they need to participate in this world. Many of them



also want to help reduce poverty, protect the environment and create inclusive societies. To realize this ambition, a new approach to education is needed.

Educators are in need to becoming familiar with and able to apply in practice sustainability education activities that foster innovative thinking through emerging pedagogical design, such as design thinking and active learning. DT4S introduces a learning framework through which educators can cultivate the entrepreneurial capacity of students to introduce solutions to complex, real-world sustainability challenges. The proposed design thinking framework can further be deployed by educators not only in sustainability educational contexts but in wider learning scenarios where thinking out of the box and synthesizing human centered solutions is applicable.

6. Skill building for career development and satisfaction as a result of new pathways for personal and professional growth

Educators, like every other professional, are in need of making continuous progress in their careers. [6] Career satisfaction is important as it is a motivating factor for educators to stay active in their profession and to strive to enrich their skill sets and teaching. Building professional knowledge throughout their careers is key to career satisfaction for educators, as is of course for other professionals. Educators should understand that self-development provides them with a variety of advantages in relation to personal and professional growth. Through DT4S, they will understand the need for their continuous development. They will broaden their horizons, and their students' as well, since educators' success is reflected on student success. By deploying emerging active learning design combined with gamified learning approaches, educators will develop of sense of career development and satisfaction as a result of delivering high quality education to their students.

7. Promoting career development through lifelong learning skill building

If the educators decide to apply the design thinking methodologies in their courses, they will modernize their instructional practice. Furthermore, they will make their course more appealing and effective for their students. Education for sustainable development empowers learners to take informed decisions and responsible actions for environmental integrity, economic viability and a just society, for present and future generations, while respecting cultural diversity. It is about lifelong learning, and is an integral part of quality education. ESD is holistic and transformational education which addresses learning content and outcomes, pedagogy and the learning environment. It achieves its purpose by transforming society.

DT4S aims to build instructor skills on emerging pedagogical design through good practice guidelines and training content that they can use directly in their classrooms or refer to for inspiration when designing additional learning activities for their students. The instructor training content in DT4S will focus both on sustainability educational activities and on the deployment of design thinking in secondary education more broadly. Instructor training will

further focus on the DT4S gamified learning environment through which instructors will be able to structure sustainability activities and students will be able to access educational content and to collaborate in groups on sustainability challenges. DT4S will also empower educators and students to be 'global citizens' who engage and assume active roles, both locally and globally, to face and to resolve emerging societal and industry challenges and ultimately to become proactive contributors to creating a more just, peaceful, tolerant, inclusive, secure and sustainable world.

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Task 1.8 The DT4S active, design thinking, and game-based learning framework for building sustainability skills in secondary education

The topic of sustainability has received a lot of attention in the whole world. The United Nation has a list of 17 Sustainable development goals, to end poverty, fight inequality and injustice, and tackle climate change by 2030. Many of these goals are related to education. For instance, goal 4.4 indicates that “by 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship.” And goal 4.7 states that “by 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture’s contribution to sustainable development”

The D4TS active and game-based learning framework follows these intentions and is grounded on the design thinking principles of empathy, ideation, prototype design, and evaluation encouraging students to come up with innovative ideas towards introducing sustainable practices for society and industry.

Design thinking encourages students to understand the actual needs of specific groups of users that will be the recipients of the solutions they will design. Design thinking helps introduce solutions even to the most difficult problems, to which none seems to exist at first glance. This is achieved by understanding, through empathy, the actual needs of users by keeping an open mind and focusing on user experiences. Ideation helps brainstorm and generate a broad range of ideas, from which the final solution will be selected. Prototyping focuses on simple designs that can demonstrate the viability of a proposed idea. Finally, evaluation ensures that the final result addresses user needs.

Active learning helps building knowledge that is retainable and can be transferred to the real world through activities that challenge students to design and innovate. It may take several forms, such as role playing, inquiry, collaboration in small groups, problem solving, and more. Active learning promotes the links between education and the world of work, demonstrating the relevance of education to real life, putting students to the center of the learning process, and thus promoting engagement with learning and avoidance of early school leaving. In addition, the transferability of skills will promote the future employment of students.

Game-based learning is an approach based on the use of specifically designed games that contributes significantly to motivation and engagement of students. Gaming principles in learning contexts go beyond the more traditionally understood concept of rewards and may include mechanisms such as social recognition, mission, affiliation, role playing, and more.



The DT4S learning framework combines all these methodological approaches to introduce students to activities inspired by real life. In these activities students will collaborate to design solutions to real world problems deploying the design thinking principles, while gamification elements will help develop positive interaction in the classroom and enrich experiences through active engagement.

The DT4S active and game-based learning framework was designed by following a well-defined path, including stages related to...:

- The establishment of a map of stakeholders that stand to gain from the enhancement of secondary education in the area of sustainability. This includes direct stakeholders, namely students and educators, and indirect stakeholders like policy makers and the society in general;
- The proposal and identification of the most relevant sustainability skills desirable for secondary education students;
- The analysis of the current situation in secondary education in terms of building sustainability skills through on-line and off-line resources. That included the analysis of policies, strategies, initiatives, and good practices at the national level in each of the participating countries;
- The setup and implementation of the identification of needs analysis of direct stakeholders, namely students and educators, in order to establish learning requirements on which the development of the proposed digital learning service will be designed;
- The review of past work in the area of sustainability education through digital resources to inform the design and implementation of the proposed digital learning service for sustainability education in the scope of the DT4S project;
- The DT4S methodological framework was designed in a manner that allows its wide deployment in secondary education settings in Europe.

DT4S Stakeholders

The direct (and most relevant) DT4S stakeholders identified were the following:

- Secondary education students: Sustainability minded students will become civically active young adults. DT4S will allow promoting student engagement through game-based approaches that build motivation and promoting the employability of students through the development of sustainability skills highly demanded by society and industry.
- Secondary education teachers: DT4S will allow promoting the development of highly skilled instructors that are capable of integrating emerging technology and pedagogy into their existing educational practices therefore resulting in higher career satisfaction of teachers as a result of new pathways for personal and

professional growth. DT4S will allow building the skills of educators in terms of digitally-enabling their practices and promoting the use of open educational resources through the design and implementation of digital learning solutions that will be freely available to all.

- Secondary education managers: DT4S will allow strengthening basic and key competencies in secondary education like sustainability skills that are highly demanded by employers that wish to enrich their business practices and align them to sustainable growth policies. DT4S will also allow promoting learner engagement and thus avoiding early school leaving by aligning skills built in secondary education to emerging 21st century societal and industry needs.

The indirect DT4S stakeholders identified were:

- Secondary education schools: DT4S will allow promoting the uptake of innovative pedagogical practices in the digital era and avoiding early school leaving by demonstrating the links between education and the real world.
- Educational policy makers; DT4S will allow modernizing education and ensuring quality and efficiency through innovative pedagogical methods that combine technology with emerging active, game-based approaches that help link educational outcomes to goals, taking into account industry and societal needs. DT4S will also contribute to the modernization of education through the integration of emerging ICT enabled solutions and active, problem-based learning approaches into educational practices. DT4S will empower educational policy makers to make informed decisions on best ICT enhanced educational practices through access to evaluation data on how to effectively integrate emerging pedagogies in wide educational initiatives.

Other DT4S stakeholders:

- Children and Youth: DT4S will promote European priorities on high quality education for all and on avoiding early school leaving and will create a pool of young talent that is better equipped to address the 21st century sustainability challenges.
- Non-Governmental Organizations: DT4S will contribute to social inclusion through high quality education, fighting of unemployment and avoiding early school leaving.
- Local Authorities: DT4S will allow introducing solutions that target very specific and actual industry needs, namely making business practices more environmentally friendly therefore contributing to growth at the regional level by developing desirable qualifications for the young generation.
- Workers and Trade Unions. DT4S will allow fighting of unemployment through the aligning of skills built to industry and societal needs and, as a result of that, promote social cohesion in local communities.
- Business and Industry: DT4S will provide opportunities for growth based on highly trained individuals, a young workforce that has the capacity to tackle challenging emerging societal and business issues.



- Scientific and Technological Community: DT4S will promote the deployment of open educational resources by making all project outcomes, including learning design, methodologies, and digital tools openly available to all interested educational institutions as well as other parties.
- Society at large (people): DT4S will improve the general quality of life as a result of a set of well-prepared professionals that can introduce solutions to societal challenges, therefore promoting employability of the next generation through relevant and comprehensive skill sets for addressing 21st century sustainability challenges.

DT4S skills for the 21st century

DT4S will directly tackle the identified sustainability skills required for secondary education students. The DT4S active learning framework and activities will be focused around learning objectives that will develop these skills and competences.

Technical skills and competences:

- Digital literacy: Ability to find, evaluate, and compose clear information through writing and other media on various digital platforms.
- Information and media literacy: Ability to show and make informed judgments as users of information and media, as well as to become skillful creators and producers of information and media messages.

Meta-cognitive skills and competences:

- Willingness to learn: Readiness to know new things and to improve oneself.
- Independent and autonomous learning: Ability to learn independently and autonomously.
- Integrating information from diverse areas: Ability to compare, combine and generate a consistent message based on multiple, sometimes conflicting, sources of information.
- Innovative thinking: Ability to look at problems or situations from a fresh perspective that could provide “out-of-the-box” solutions.
- Critical thinking: Ability to break down complex information into fundamental parts and assess and judge that information.
- High-level thinking: Ability to apply all the previous skills, that is analysis, evaluation and synthesis/creation of new knowledge.

Intrapersonal skills and competences:

- Emotional Intelligence: Ability to recognize one’s own emotions and those of others, discern between different feelings and label them appropriately, use emotional



information to guide thinking and behavior, and manage and/or adjust emotions to adapt to environments or achieve one's goal(s).

- Creativity: Ability to perceive the environment, to find hidden patterns, to make connections between seemingly unrelated facts, and to generate solutions. Ability to turn new and imaginative ideas into reality.
- Open-mindedness: Ability to being receptive to a wide variety of ideas, arguments, and information.
- Openness to criticism/feedback: Ability to accept negative feedback about oneself or one's work without reacting overly emotionally.
- Openness to others' ideas and thoughts: Ability to be willing to consider ideas and opinions that are new or different from the own.
- Flexibility and adaptation to change: Ability to adapt to changing circumstances and environments and to adopt new ideas and concepts.
- Initiative: Ability to assess and initiate things independently.
- Being positive: Ability to focus on the things that one can control.
- Ability to prioritize: Ability to identify critical tasks and resources and to establish priorities systematically, differentiating between urgent, important, and unimportant processes.
- Sense of quality of work: Ability to analyze, judge and critique a piece of work in such a way that leads to an improved version of that piece of work.

Interpersonal skills and competences:

- Good communication skills: Ability to communicate one's thoughts clearly and concisely, but also being able to create focus, energy, and passion.
- Empathy: Ability to understand others' feelings, ideas and actions and to communicate with them by providing them with your own feelings, ideas and actions.
- Being a listener: Ability to consciously focus on the speaker message to be able to get a deep understanding of that message.
- Negotiation: Ability to reach a compromise in a discussion by using communication, persuasion, strategy and cooperation.
- Storytelling skills so that students become influencers: Ability to compose and tell compelling and motivating stories.
- Collaboration in multidisciplinary teams: Ability to productively work with our persons on common tasks to reach a certain goal.
- Leadership: Ability to organize and motivate other people to reach a shared goal.
- Good presentation skills: Ability to deliver information clearly and effectively to a specific audience.
- Transferring knowledge to the real world: Ability to apply the acquired knowledge, skills and competences in a different context or in a different way.

Problem solving skills and competences

- Problem solving: Ability to understand a problem, use generic or ad hoc methods in an orderly manner to find solutions for that problem, identify the most suitable ones and test them.
- Following systemic design processes: Ability to understand and apply methods that combine systems thinking and human-centered design to cope with complex design projects.
- Ability to effectively research and inquire: Ability to determine that processes and resources are appropriate, conclusions are based on supporting evidence and problems are solved and decisions made following the achieved results.
- Ability to view a problem from a high-level point of view: Ability to perceive or understand the problem in the surrounding contexts and to identify the main characterizing aspects.
- Provide clarity to problems: Ability to analyze a fuzzy problem and identify suitable objectives for solving that problem.
- Ability to evaluate potential solutions: Ability to compare potential solutions and assess their efficiency.
- Analysis of the factors that contribute to an unwanted situation: Ability to identify events, conditions or other aspects that created an immediate cause for an undesired situation.
- Working with limited resources: Ability to design a strategic plan and implement decisions to respond to changing circumstances and demands that lead to scarcity of resources.
- Implementing and assessing the effectiveness of a solution: Ability to implement the solution and evaluate the achieved results from an efficiency point of view.
- Validating solutions from the perspective of the end users: Ability to involve end-users in the implementation of the solutions and assess their level of satisfaction in a non-intrusive way.
- Project planning: Ability to accurately identify and organize systems and resources (including time) required to complete a task in an efficient way.
- Project management: Ability to plan, procure and execute a project with an efficient use of all the resources.

Sustainability skills

- Positive attitudes that lead to responsible behavior: Adopting attitudes and behaviors that are environmentally responsible by promoting an efficient use of resources.
- Global mindset: Ability to keep openness towards other cultures, other people, and other ways of doing things.
- Ethics: Ability to understand, apply and assess the moral principles that govern a person's behavior or the conducting of an activity towards the environment.

- Commitment to sustainable solutions: Ability to promote and sustain responsible practices that support a sustainable, secure, prosperous and environmentally responsible problem solving process.
- Ability to inspire others to invest in a sustainable vision: Ability to adopt an environmental leadership.
- Responsible consumption: Ability to adopt a responsible practice in the acquisition of products and services by understanding, acknowledging and consenting to the product's behind-the-scenes practices and ensuring the highest efficiency approach to the use of those products and services.
- Responsible production: Ability to promote resource and energy efficiency, sustainable infrastructure, and provide access to basic services, green and decent jobs and a better quality of life for all.

DT4S Learning Framework

With the changing world, students have to find solutions to problems they have never seen before. For this reason, students should be flexible and develop their skills to produce adaptable solutions to different problems.

The DT4S active, game-based learning framework is grounded on the principles of Design Thinking. Design thinking is a non-linear, iterative process which seeks to understand users, challenge assumptions, redefine problems and create innovative solutions to prototype and test. The method consists of 5 phases—Empathize, Define, Ideate, Prototype and Test and is most useful for tackling problems that are ill-defined or unknown.

- **Stage 1 - Empathize:** The first stage of the design thinking process allows designers to gain an empathetic understanding of the problem at hand, typically through user research. Empathy is crucial to a human-centered design process such as design thinking because it allows individuals to set aside their own assumptions on the world and gain real insight into users and their needs.
- **Stage 2 - Define:** In the Define stage, individuals accumulate information created and gathered during the Empathize stage. Designers analyze their observations and synthesize them to define the core problems that must be addressed. Designers introduce a problem statement that provides their own perspective integrated with the information gathered during the Empathy phase. Designers should always seek to define the problem statement in a human-centered manner that addresses real as opposed to perceived needs.
- **Stage 3 - Ideate:** Designers are ready to generate ideas as they reach the third stage of design thinking. The solid background of knowledge from the first two phases means they can start “thinking outside the box”, look for alternative ways to view the problem, and identify broad innovative solutions that can range from mainstream to extreme.



- **Stage 4 - Prototype:** This is an experimental phase in which the aim is to identify the best possible solution for each of the problems identified during the first three stages. Design teams produce a number of inexpensive, scaled-down versions of the product (or specific features found within the product) in the form of prototypes that are aimed to be deployed by users for investigating the problem solutions generated in the previous stage.
- **Stage 5 - Test:** Designers or evaluators rigorously test the complete product using the best solutions identified in the Prototype phase by engaging users that experience the prototyped solutions. This is the final phase of the model but, in an iterative process such as design thinking, the results generated are often used to redefine one or more further problems. Designers can then choose to return to previous stages in the process to make further iterations, alterations and refinements to rule out alternative solutions.

Design Thinking enables students to offer innovative and creative solutions to daily problems. It facilitates students:

- to develop empathy and understandings
- to define problems
- to generate creative solutions
- to develop prototypes
- to test and evaluate solutions
- to collaborate
- to persevere
- to be self-confident

Design Thinking thus responds clearly and directly to the identified D4TS skills and competences. In addition, the skills gained with this approach are not limited to the classroom environment. They have a process-oriented way of thinking that they can use in their future profession. This adds a value to the sustainability of all these skills developed through design thinking.

Based on the survey with teachers, a set of different learning methodologies were identified as fundamental for D4TS.

Problem solving

At the basis of design thinking lies a problem and solutions found to it. Problem solving process consists of 4 steps: what is, what if, what solutions are, what works. This can be followed as a self-renewing cycle.

This is different from a scientific method that offers a single solution to a major problem. It focuses on the desired result and the process is then evaluated. In addition, not only





analysis but also synthesis is used. Many ways of thinking are used to achieve many potential solutions. It is aimed to add value with the most appropriate solution.

Students need to improve their skills in finding and applying solutions to problems that are new to them. These skills push students to be active in their own learning processes. It is a skill that is necessary for students both in their academic and professional lives.

DT4S will contribute students to acquire these skills by providing real-life problems and simulations. It will contribute to the development of confidence, independence, resilience, perseverance and decision making skills by providing students with problem solving skills.

Learning to Learn

Learning to learn involves using such knowledge and skills as researching, testing, receiving feedback and evaluating them at different stages of design thinking. This improves students' awareness of their own learning needs, observation of learning processes, awareness of their success or failure, and their ability to overcome obstacles in the learning process. Curiosity, observation and perseverance are three characteristics of 'Learning to learn'.

This skill can mainly be used in the steps defining prototype and testing steps of design thinking.

Since design thinking is an iterative process, it requires constant learning. For this reason, students need to discover their own learning style and realize their learning needs. DT4S will help students to raise this awareness through the training contents and gamification to be developed. It will contribute to students to acquire this skill with research tasks that encourage learning.

Collaboration

Difficult problems can be solved more easily thanks to cooperation with people with different experiences, knowledge and skills. In order to achieve this cooperation, students need to communicate well with each other, to understand each other's perspectives and needs, to develop a common idea and to develop a product, to improve their distribution of tasks.

Students need to develop their skills to collaborate with different people so that they can develop creative ideas, increase their level of knowledge, and understand people's needs and problems. This improves higher level of thinking skills.

This skill can mainly be used in all steps of design thinking: empathize, define, ideate, prototype and test.

DT4S contributes to increasing the cooperation and participation of students with its educational content and activities.





Creativity

Creativity leads students to find innovative solutions to defined problems, create products by developing strategies to add value to them. Design thinking provides a constant motivation to reinforce the creativity of students. Students often have to face the problematic situation, involve in it, create alternatives to deal with it and test them. They need to provide useful and contributing solutions. In this case, they always need to be out of box, have a wide perspective and be innovative.

There is a need to improve the emotional and social skills of students, to increase their thinking capacity, to encourage problem solving skills, and to encourage innovative thinking among students through creativity.

This skill can mainly be used in ideate, prototype and test steps of design thinking. Design thinking supports employ, discover and test creativity. It allows to use both the intuitive and logical side of the brain.

DT4S will contribute to creativity of students via open-ended questions, creative team building activities, brainstorming sessions and debates.

Flexibility

Students need to be flexible while trying to find solutions to problems non-encountered before. As well as the students, the adaptability of the ideas is an important aspect of design thinking. Flexibility is also needed to understand different people and their perspectives and to communicate with them while defining the problem and producing solutions.

This skill can mainly be used in define, ideate, prototype and test steps of design thinking.

Students need to be able to adjust their thinking and use different problem solving strategies, open themselves to new experiences, tolerate change, use different problem solving strategies and shift perspectives when learning about new cultures.

The DT4S will promote the development of flexibility and ability to adapt to ICT skills and virtual experiment simulations to be introduced.

Social and Cultural Awareness

Students need to be empathetic and active members of society who can provide solutions to such issues as environmental, natural, social, etc. , which is of great importance in terms of sustainability.

Design thinking is based on interdisciplinary approach. Diversity is promoted as an important part of it. Students need to adapt to the new environment, to create an atmosphere of inclusivity, to understand needs from different cultures, to be aware of certain differences and problems.





This skill can mainly be used in all steps of design thinking: empathize, define, ideate, prototype and test.

This is a holistic part of sustainability education. DT4S will contribute with the training contents to be developed.

DT4S learning platform

The DT4S active and game-based learning framework is pedagogically-oriented and digitally-supported. Used strategically, ICT can dramatically enhance education equity, quality and efficiency through its ability to facilitate fast, synergetic and scalable change. ICT in education can be used to build borderless networks and facilitate innovative peer learning around the world. The interactive multi-dimensional education experience that ICT makes possible can inspire and encourage students by providing them with opportunities to gather knowledge, explore ideas and express themselves using channels and tools that suit their individual preferred learning modalities. ICT is already transforming the concept of classrooms by moving learning online, offering new options for information delivery and creating new ways to provide in-service teacher training and support.

The UN itself acknowledges that leveraging ICT will play a vital role in their efforts. The UN Assembly sees ICT infrastructure as a cross-cutting ‘means of implementation,’ underpinning the achievement of every goal. All three pillars of sustainable development – economic prosperity, social inclusion and environmental protection –need ICT as a key catalyst. Only ICT, particularly broadband, can provide this surge in development.

Darine Ameyed in her publication “How ICT Can Accelerate Implementation of the Sustainable Development Goals” states that successful integration of technology to enable smart global sustainability requires a deep understanding of the potential of technologies and their socio-technical impacts, as well as their cultural and ethical influence, plus the identification of additional existing or emerging enablers for sustainable development to accelerate action on SDGs.

As the lead United Nations Organization for education, UNESCO guides international efforts to help countries understand the role such technology can play to accelerate progress toward Sustainable Development Goal 4. UNESCO shares knowledge about the many ways technology can facilitate universal access to education, bridge learning divides, support the development of teachers, enhance the quality and relevance of learning, strengthen inclusion, and improve education administration and governance. UNESCO also provides a study programme of “ICT in Education for Sustainable Development(ESD)”.

Some countries, like Guyana, have proposed whole strategies how to implement the Sustainability Education goals in their educational practices. In their Education For Sustainable Development policy they state that Information and Communication Technologies (ICTs) is an essential and powerful tool in enabling the development of innovations that promote and maintain sustainability. Deliberate attempts must be made



to utilize this tool effectively. It is critical to ensure that education relevant to the modern technological world can be delivered. The infusion of ICT into the teaching environment is, therefore, of critical importance. Teachers must effectively use ICT to innovate and solve problems, and deliver curriculum in new and more effective ways. The success of ICT is largely dependent on how effectively the tool is implemented and used. Research into ICTs best suited to this purpose must be conducted in order to encourage the development of new methodologies and strategies to aid teachers in the delivery of the curriculum. ICT also allows for global collaboration with other countries where similar issues are being tackled. For example, ICT can help quickly overcome emerging problems such as disaster management. Pedagogical innovations must take into consideration the needs of the specific context - learning environment, readily available resources and students' cognitive abilities. Teachers will need to constantly evaluate the learning needs and abilities of their students and use a combination of approaches as required. The formation of a local ESD teachers' network is recommended as a professional learning community will provide the platform for coherent activities of professional development and shared practices through a high level of collaboration.

DT4S platform specification

The DT4S platform should be designed to support teachers and students of age 12-16 to work on sustainability related issues using the Design Thinking methodology. This methodology that fosters collaboration and innovation will be deployed on a digital tool to increase it's flexibility and facilitate the lives of both students and teachers.

The DT4S platform will be a fully online platform using the latest web technologies and accessible from any desktop laptop or mobile device. Students will be able to collaborate from anywhere anytime using any device they see fit. In order to guarantee the most stable experience it will be recommended to use a Google Chrome browser or any browser based on its webkit.

An account will be required to use the DT4S platform but creating it will be very simple. No personal information will be required from the user, but in order to facilitate the life of teachers managing the courses it is recommended that the users fill in their actual names and surnames when creating an account. As no email address is required a special system of One-Time-Password (OTP) will be created to ensure a smooth day-to-day management of accounts. At the time of registering, teachers will be able to create specific teachers account thanks to the special code which will be given to them.

The basic element of the DT4S platform is an activity. An activity consists of a certain topic which is treated by students following the Design Thinking methodology which requires issues to be divided in logical steps. As a result, an activity is comprised of 1 to 14 different steps, each of them offering communication tools to help the students gather ideas to tackle the specific step ahead of them. The main idea here is to reproduce fully the Design Thinking methodology of gathering ideas and make them evolve and mature in the most



innovative and collaborative fashion. Usually this process is carried on in workshops using walls full of Post-it notes, here the students will be offered for each step of the activity a virtual space to interact. Practically speaking, the students will be able to write multimedia (text, photos and videos) notes on a virtual board and exchange in chat. At any given point, they will be able to ask for the help of their teacher or the contribution of their other classmates. If they feel satisfied with how they treated a certain step they can also ask their teacher to validate their work before they move on to the next step. Teachers will be able to prepare each and every step of the activity by placing special non-editable notes to explain to the students the specifics of the issue at hand.

Activities can be created by the teachers to be private, and hence only seen by themselves, or public, visible to any teacher using the DT4S platform. In order to facilitate browsing through all the public activities, an in-depth search engine will be deployed, offering to search by activity language, name, or associated meta-tags. It will be possible for a teacher to duplicate any and all public activities into one of their own private activity in order to use it later on. Once duplicated, a public activity becomes essentially identical to a private one and can be edited and modified at will by the teacher.

In order to deploy a certain activity into the classroom, the teachers will be able to create courses. A course is essentially a group of activities which have been slotted into a common space to be usable by groups of students. Students are divided in teams with the amount of students in a team is a decision left to the teacher. Each team will tackle one activity only and students can only be part of one team at a time. Each course will be associated with a unique code, provided by the teacher when the course is first created. The code is then given to the students and each of them will register themselves into the course by using the code on their student interface. This will avoid any course management overhead on the teacher side, such as having to manually authorize all the students one by one in their course. Naturally the teachers will be able to filter the students enrolled and remove them if needed.

The general interface of the DT4S platform will also provide quality of life tools for teachers and students both such as messages about the ongoing courses, a calendar and detailed analytics data concerning their courses and activities.

Integration of DT4S learning framework in schools

DT4S active learning framework and activities can be integrated in the school context in different ways. The following are examples but are not exclusive:

- Support innovative teaching/learning practices in sustainability education showcasing the use of active learning, game-based learning and design thinking approaches





- Creation and deployment of georeferenced content to support educational adventure games integrating the subjects of natural sciences and other environmentally guides disciplines in formal and non-formal education
- Support activities that relate schools with external entities related to science and nature
- Support activities that reinforce experiential and virtual lab activities in the sustainability and environment domain
- Use as a reference database of best practice and examples on sustainability education learning activities and tools
- Self-assessment platform for green activities in educational institutions
- Adoption of sustainability in the learning/educational environment through integrated activities
- Ensure the commitment to sustainability education among senior staff and managers
- Improve environmental outcomes in the school as a result of a combination of DT4S activities creating eco-schools

The integration of the DT4S active learning framework might imply changes in the pedagogical approach of schools as the traditional teacher-centered, classroom-based teaching might not be the best to support this learning framework. Teachers suggest using the following:

- Thinking-Based Learning
- Competency-Based Learning
- Project/Problem-Based Learning
- Cooperative Learning
- Design Thinking
- Gamification
- Peer learning
- Learning by doing
- Learning by error
- Learning by living

In relation to teachers, DT4S must also consider the development of the following competences, namely in terms of instructor-support content:

- Digital skills
- Empathy with students
- Creativity
- Innovation
- Didactic design skills
- Creating adequate evaluation methods and techniques





- Communication skills

Skill development needs for educators

In the scope of the needs analysis process, a set of needs was identified following literature review and teacher survey.

Promotion of problem-solving skills

Instructors are in need to build their capacity to introduce problem-based learning design in their classrooms for developing tomorrow's innovative thinkers. Building problem-solving skills is important for children as it helps them gain confidence in their ability to make good decisions for themselves. Using effective problem-solving techniques can also strengthen children beginning to develop empathy skills. Furthermore, it can help children learn more positive attributions about other persons' intentions. Problem solving is essential for school readiness and academic success.

DT4S promotes problem-based approaches among instructors by developing understanding of theoretical concepts as well as practical skills for applying problem-based learning processes in the classroom. These skills will ultimately benefit students empowering them to build knowledge by synthesizing solutions to real world problems.

Ability to integrate the concepts of design thinking and sustainability into educational practices

Educators are in need of building their capacity to apply emerging methodologies, such as design thinking, in order to better prepare students to enter the world of work and to become active citizens in a global environment in which prioritizing sustainability objectives is important for inclusive, environmentally responsible growth. Teaching young students design thinking helps them develop a growth mindset as well as important problem-solving, analytical, and spatial thinking skills. Instructors are in need of good practice guidelines on how to best integrate design thinking methodologies. Moreover, sustainability education can be fun, engaging and empowering for students. It allows them to take responsibility for their actions and to contribute their vision for a sustainable future. It enables them to develop knowledge, skills, values, and motivation for action allowing them to maintain their own wellbeing in an increasingly interconnected world.

DT4S equips educators with the tools, knowledge, and support they need to embrace creativity and making in education for improved student performance, engagement, and learning. DT4S addresses this need by providing instructional support content.





Awareness on the benefits of integrating ICT technologies in education

Educators can significantly benefit from the deployment of ICT, and more specifically serious games, in the context of the educational offerings. Furthermore, it is important for educators to understand that these methodologies allow students to learn in a more active way that allows the transferability of knowledge from the school environment to real life. In addition, it promotes among students the ability of lifelong learning and knowledge development throughout their career. And it empowers students to think innovatively. The use of ICT in education adds value to teaching and learning by enhancing the effectiveness of education through experimentation, feedback loops, and motivational aspects that promote engagement. Moreover, it adds a dimension to learning that was not previously available through complementary to traditional instruction digital learning tools. ICT leads to positive attitudes to education as students find technology-enhanced environments more stimulation and engaging than traditional classrooms. Instructors have the capacity to inspire students to be open-minded in ICT technologies as learning tools. ICT provides interactive learning experiences that foster student motivation, especially when educators empower students to experiment with virtual environments that simulate the workplace, contributing to their preparation to engage in their future careers and promoting their adaptability to change.

Enriching course content and activities

Relevance of educational activities is a key aspect that motivates student learning. Establishing both personal and real-world relevance provides students with an important opportunity to relate the course subject matter to the world around them, and to assimilate it in accordance with their previously held assumptions and beliefs. Relevance is a key factor in providing a learning context in which students construct their own understanding of the course material.

Involving students in activities that are inspired by real-life helps address the issue of content relevance, or significance in an educator's classroom. Educators can demonstrate to students that what they are learning can be applied. They can further demonstrate that, as they find ways to use knowledge to create new ideas, plans, operations, or designs, they build high level skills that are demanded by industry. Content becomes relevant not only because there is a link to real world situations but because it can be the key to effective, enhanced performance not only in the classroom but also in the workplace. If students understand that they can use the knowledge and skills they have gained to better themselves and the lives of those around them they will feel a sense of empowerment and will be motivated to learn.

Educators can benefit from educational approaches, such as active learning and design thinking that help link course content to real world contexts enriching the learning





experiences of their students and building skill sets that are demanded by industry and society.

Serious games and simulations, such as the DT4S services for sustainability education, offer students the opportunity to be actively involved in solving real-life, open-ended problems that have potential for provoking extensive research, discussion among and between classmates and teacher, contributions from career and life experiences, and critical thinking.

Preparing students to actively engage in sustainable development practices

Education for sustainable development promotes the development of knowledge, skills, understanding, values, and actions required to create a sustainable world, which ensures environmental protection and conservation, promotes social equity, and encourages economic sustainability.

Sustainability education provides an alternative approach to building environmental awareness and skills aiming to educate students as global active citizens that possess the knowledge and positive attitudes to contribute to growth while preserving the environment. Students need new perspectives to be able to understand the rapidly changing world they live in. In addition, they need to participate in this world. Many of them also want to help reduce poverty, protect the environment and create inclusive societies. To realize this ambition, a new approach to education is needed.

Educators are in need to becoming familiar with and able to apply in practice sustainability education activities that foster innovative thinking through emerging pedagogical design, such as design thinking and active learning.

DT4S introduces a learning framework through which educators can cultivate the entrepreneurial capacity of students to introduce solutions to complex, real-world sustainability challenges. The proposed design thinking framework can further be deployed by educators not only in sustainability educational contexts but in wider learning scenarios where thinking out of the box and synthesizing human centered solutions is applicable.

Skill building for career development and satisfaction as a result of new pathways for personal and professional growth

Career satisfaction is important as it is a motivating factor for educators to stay active in their profession and to strive to enrich their skill sets and teaching. Building professional knowledge throughout their careers is key to career satisfaction for educators, as is of course for other professionals. Educators should understand that self-development provides them with a variety of advantages in relation to personal and professional growth. Through DT4S, they will understand the need for their continuous development. They will broaden their horizons, and their students' as well, since educators' success is reflected on student success. By deploying emerging active learning design combined with gamified



learning approaches, educators will develop of sense of career development and satisfaction as a result of delivering high quality education to their students.

Promoting career development through lifelong learning skill building

If the educators decide to apply the design thinking methodologies in their courses, they will modernize their instructional practice. Furthermore, they will make their course more appealing and effective for their students. Education for sustainable development empowers learners to take informed decisions and responsible actions for environmental integrity, economic viability and a just society, for present and future generations, while respecting cultural diversity. It is about lifelong learning, and is an integral part of quality education. ESD is holistic and transformational education which addresses learning content and outcomes, pedagogy and the learning environment. It achieves its purpose by transforming society.

DT4S aims to build instructor skills on emerging pedagogical design through good practice guidelines and training content that they can use directly in their classrooms or refer to for inspiration when designing additional learning activities for their students. The instructor training content in DT4S will focus both on sustainability educational activities and on the deployment of design thinking in secondary education more broadly. Instructor training will further focus on the DT4S gamified learning environment through which instructors will be able to structure sustainability activities and students will be able to access educational content and to collaborate in groups on sustainability challenges. DT4S will also empower educators and students to be 'global citizens' who engage and assume active roles, both locally and globally, to face and to resolve emerging societal and industry challenges and ultimately to become proactive contributors to creating a more just, peaceful, tolerant, inclusive, secure and sustainable world.



ANNEX: TEMPLATE FOR THE PRESENTATION OF A BEST PRACTICE (T1.3)

TITLE	
<i>[Name that describe this best practice]</i>	
SUMMARY	
<i>[Provide a short description of the best practice being addressed explaining why it was considered a best practice. Max. 10 lines]</i>	
EDUCATIONAL ORGANIZATION	
<i>[Where did it take place?]</i>	
DESCRIPTION	
<i>[What was the initial problem or challenge? Who were the stakeholders involved – people, institutions? When was it implemented? What was the methodological solution/process adopted? Were there any constraints in implementing the best practice? How was the best practice validated? What was the impact – quantitative and qualitative - of the best practice? What were the success factors? How can the best practice be replicated or extended? Are there any resources that can be reused?]</i>	
MORE INFORMATION	
<i>[Is there a contact to get more information for this best practice? Articles, website, link?]</i>	
DATE	<i>[Date of this report]</i>
AUTHORS	<i>[Authors of this report]</i>





ANNEX B: TEMPLATE FOR THE INSTRUCTORS SURVEY (Task 1.4)

This questionnaire is meant to assess instructors' perceptions, attitudes, needs, and expectations in relation to the proposed learning intervention.

Country: _____

Age: _____

Gender: Male / Female

Indicate the importance of the following sustainability skills for the future professional and personal life of your students after they finish their education: (from 1-not important at all to 5-very important)

	1	2	3	4	5
Digital literacy					
Information and media literacy					
Willingness to learn					
Independent and autonomous learning					
Integrating information from diverse areas					
High level thinking					
Innovative thinking					
Critical thinking					
Emotional Intelligence					
Creativity					
Open mindedness					
Openness to criticism/feedback					
Openness to others' ideas and thoughts					
Flexibility and adaptation to change					
Initiative					
Being positive					
Ability to prioritize					
Sense of quality of work					
Good communication skills					
Empathy					
Being a listener					
Negotiation					
Storytelling skills so that students become influencers					
Collaboration in multidisciplinary teams					
Leadership					
Good presentation skills					





Transferring knowledge to the real world					
Problem solving					
Following systemic design processes					
Ability to effectively research and inquire					
Ability to view a problem from a high level point of view					
Provide clarity to problems					
Ability to evaluate potential solutions					
Analysis of the factors that contribute to an unwanted situation					
Working with limited resources					
Implementing and assessing the effectiveness of a solution					
Validating solutions from the perspective of the end users					
Project planning					
Project management					
Positive attitudes that lead to responsible behavior					
Global mindset					
Ethics					
Commitment to sustainable solutions					
Ability to inspire others to invest in a sustainable vision					
Responsible consumption					
Responsible production					

Would you add any other skill to this list? Yes / No

If yes, which? _____

Do you think that the current educational system allows you to develop the skills that you consider more important? Yes / No

If not, which of the following pedagogical methodologies would be more suited (from 1- not suited at all to 5-totally suited)

	1	2	3	4	5
Flipped Classroom: pedagogical approach in which the traditional elements of the lesson taught by the teacher are reversed – the primary educational materials are studied by the students at home and, then, worked on in the classroom.					
Project/Problem-Based Learning: PBL allows students to acquire key knowledge and skills through the development of projects/solutions that respond to real-life problems.					





Cooperative Learning: The main characteristic is that it is structured based on the formation of groups of 3-6 people, where each member has a specific role and to reach the objectives it is necessary to interact and work in a coordinated manner.					
Gamification: The integration of game mechanics and dynamics (points, badges, etc.) in non-ludic environments such as education.					
Design Thinking: Design Thinking (DT) applied stems from industrial designers and their method to solve problems and satisfy the needs of their clients. Applied to education, this model makes possible to identify with greater accuracy the individual problems of each student.					
Thinking-Based Learning: This pedagogical approach is meant to show students how to work with the information they receive and to teach them to contextualize, analyze, relate, argue...					
Competency-Based Learning: Instead of focusing only in the acquisition of information, teachers can go through the academic curriculum without significant deviations but focusing it in a different way, putting into practice real examples and, thus, transmitting to their students a more tangible dimension of the lessons.					
Other: _____					

Are there any other relevant learning needs for students in terms of sustainability education that you would like to indicate?

What skills do instructors require to be able to integrate ICT-enabled solutions for enriching the sustainability skills of their students into their teaching practices?

What resources do instructors require to be able to integrate ICT-enabled solutions for enriching the sustainability skills of their students into their teaching practices?

Are you familiar with any relevant practices, initiatives, policies, and strategies on sustainability education that could be used as an example? If so, can you provide a link or a reference to that practice?





Note: the following are examples of aspects that can be represented in a good practice but are not exclusive:

- *Innovative teaching/learning practices in sustainability education*
- *Commitment to sustainability education among senior staff and managers*
- *Adoption of sustainability in the learning/educational environment*
- *Achieving positive social, economic and environmental outcomes (eventually outside of the school) as a result of the initiative*
- *Considering the school environment as a tool to learn about sustainability issues*

Are you familiar with any relevant ICT-based solutions in sustainability education? If so, can you provide a link or a reference to that practice?

