Islands Diversity for Science Education RoadMap

ISLANDS DIVERSITY FOR SCIENCE EDUCATION

2017-1-PT01-KA201-035919

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

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Chapter I – Introduction

1. Science and Technology Education for Sustainable Development

According to the Global Education 2030 Agenda UNESCO, **education for sustainability** presupposes knowledge, skills, attitudes and competencies like **critical thinking**, imagining future scenarios and making decisions in a **collaborative way**. It entails "the ability to go from local to global considerations, from short-term to long-term, and to realize that the world has been, is and will be changing over time, which changes the conditions for people and different generations" (Svanstrom, 2008: 343).

Education for sustainability intends to create a willingness to transform and become transformed and a **willingness to intervene**. This requires reasoning, informed decision making and conscious consideration and evaluation of different hypotheses for action and its consequences, and also a change in attitudes and behaviors. It also requires that individuals recognize themselves as **effective change agents**, as an agent who feels able to do something and who knows what can be made and how.

In order to counteract the lack of interest and disengagement of students from school and sensitize students for sustainable development, as well as to facilitate the construction of adequate knowledge and competencies, one has to **rethink education** and particularly **science education**, its purposes and processes.

Thus, teachers have to play a major guiding role based on **interdisciplinary** work and innovative teaching methods like the **'Big Ideas of Science'**, while students follows their own path of discovery. Only in this way, students improve their skills (especially in the sense of participatory learning), learn how to be critical and solve problems (through **Inquiry Based Science Education and Personal Geography**), and explore their creativity and group work ability. "Teaching for sustainability requires transformation to new ways of approaching education and life" (Sipos, 2008: 71) and thus it requires a reconstruction of the teaching and learning process, with the emphasis on the use of **educational learning tools**.

Credit: Sébastien Thibault

Rethinking science education implies reinforced scientific-technological education at all levels, providing better communication skills between students and their **community**, throughout the **design thinking methodology** (feel, imagine, create and share). It requires engaging in socio-scientific decision making **innovative activities** (like **science trails**), in close relationship with the community.

1.1. Welcome to IdiverSE

IDiverSE (Islands Diversity for Science Education) is an educational project, co-funded by the Erasmus+ Agency of the European Union and uses the Open Schooling model in partnership with the European Horizon 2020 project OSOS - Opens Schools for Open Societies.

IDiverSE builds on the awareness of the uniqueness and value of the European islands. It settles on the fact that with the use of real scientific research students can discover the value of their natural and local culture, while with the use of ICT they can share their discoveries with the outside world thus promoting the richness of their homelands.

This project intends to bring innovation to the school environment and open the school to the community, namely based on outdoors pathways where people experience science, through hands-on activities and observing natural phenomena around us.

IDiverSE also stands for "IdiverSE" and as such it aims to include an even deeper view of Diversity, integrating each student's internal world as unique and precious, promoting awareness for civic and ethical issues for the respect of difference. The whole process will be transparent and inclusive, raising community understanding of the importance of development and innovation in education.

IDiverSE aggregates 9 partners from 4 different countries (Portugal, including Madeira and Azores, Spain, England and Greece).

Focusing mainly on science education, it aims at promoting the use of Information and Communication Technology (ICT) and interdisciplinary work among teachers of the same school unit, while providing collaborative Inquiry-Based activities among students from different islands of the world, using the Inquiry Under the Microscope toolkit.

By promoting real scientific research and Inquiry Based Activities, it challenges students to become more independent and proactive, developing their critical thinking and the capacity to find problem solving solutions. For the international cooperation component, it promotes the development of social and communication skills, as well as tolerance and global citizenship.

1.2. About this publication

This publication concludes and summarizes a long period of study and research on collaborative inquiry, design thinking and science trails that covers from 2017 to 2020.

The Roadmap aims to contribute to the development of active learning inspired by teaching practices already applied within the scope of the Eco-Schools Program, which aims, among other objectives, to promote awareness and (in)formation for environmental education for sustainability; stimulate the implementation of actions that contribute to an effective improvement of resource management; and guide action (attitude and behavior change, commitment, participation and involvement, citizenship and governance).

This Roadmap aims to provide practical support, guidance and inspiration for teachers, who will have at their disposal several tools and complementary teaching methodologies in order to implement existing IDiverSE activities or design their own.

It contains the main achievements of the IDiverSE project with regard to interdisciplinary and inquiry-based activities from Portugal, Greece and Spain.

Chapter II – Framework

2. Idiverse Project: Framework

2.1. Sustainable Development Goals

IDiverSE builds on the awareness of the uniqueness and value of the European islands, bringing innovation to the school environment and, at the same time, **opening the school to the community** throw formal and non-formal education.

By proposing actions aimed at responsible learning, through the promotion of multidisciplinary skills and the integration of theory with practice on different themes, IDiverSE follows the RRI principles – Responsible Research and Innovation: **Science Education, Governance, Ethics, Open Access and Gender Equality,** and is aligned with the SDGs of 2030 Agenda[1], more directly with **15 main SDG** (see figure).

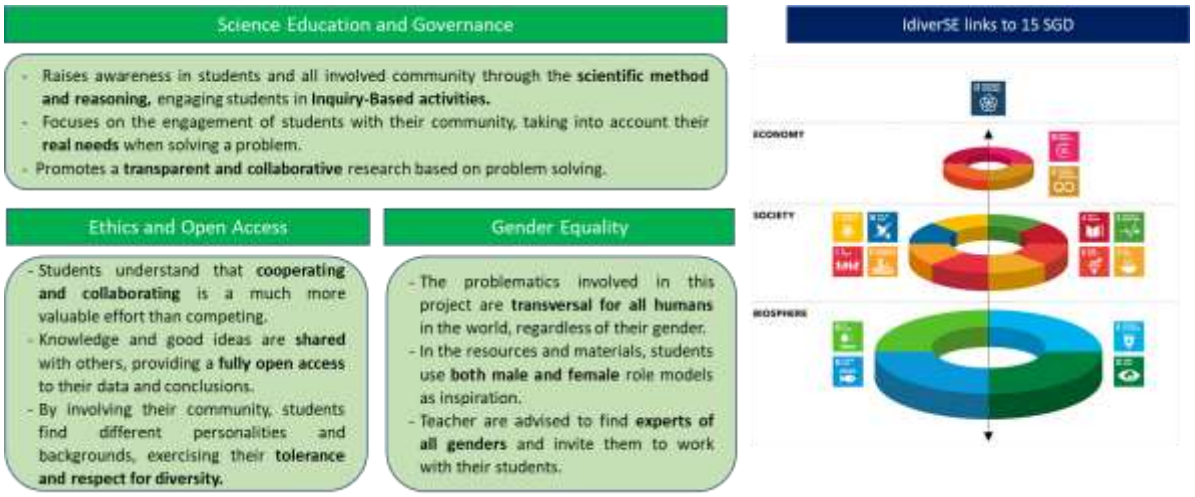


Figure 1: IDiverSE link with RRI principles and SDG

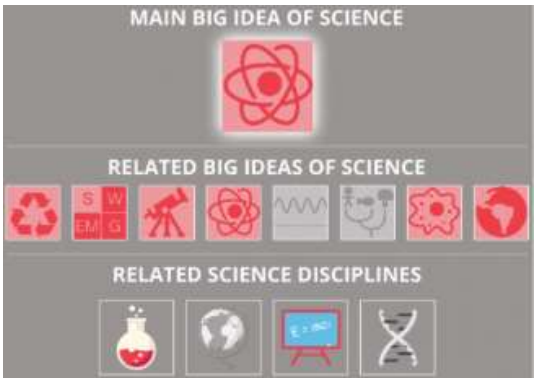
By ensuring that students in different islands acquire the knowledge and skills necessary to promote sustainable development, IDiverSE goals link directly to socio-ecological systems - biosphere, society and economy SDGs – with emphasis in the SDG represented in the figure.

As you are going to see further in the document, iDiverSE adopts a human-centered approach, base on Science Education and Governance, which is closely related to biosphere, society and economy SDGs.

[1] The 2030 Agenda for Sustainable Development (UN 2015) provides for all countries to develop policies, measures and actions in order to meet 169 targets, distributed across the 17 Sustainable Development Goals (SDGs). The SDGs can be grouped into three major groups: objectives that drive positive change (catalytic); objectives that accelerate the achievement of national targets (accelerator); and final objectives, which contribute to a global purpose (end).

2.2. Big Ideas of Science

Several researches point to the benefit of including new methodologies like Interdisciplinarity and Inquiry-Based Learning in the teaching practice as a way of shifting to a student-centred approach that meets the requirements of this fast-developing world we are living in. When talking about interdisciplinary learning, first we must keep in mind that there are several levels of interweaving different subject domains.



A first level would be to make connections between concepts coming from the same domain (for example physics). A second level would be to connect concepts coming from different subject domains (for example physics and chemistry). A third level would be to connect concepts coming from different disciplines (for example natural sciences and social sciences). Thus, as one can imagine, the topic of interdisciplinary learning is quite vast, multifaceted and complicated. It cannot be achieved in a short period of time and not all at once.

To promote interdisciplinary learning teachers will have at their disposal the Interdisciplinary Map of Science Ideas, which relates the content taught in school in different science domains through a set of **8 Big Ideas of Science** (BIS)[2]:

- **Energy**
- **Forces**
- **Universe**
- **Particles**
- **Quantum**
- **Evolution**
- **Cells**
- **Earth**

The BIS are a set of core, crosscutting ideas that to their total describe the world around us. The concept of using a set of core science ideas to promote interdisciplinary learning has been around for a few years but it is relatively new and has not yet found its way to schools across Europe.

The "Big Ideas of Science" aggregate all the fundamental concepts of Science Education. Each idea is comprised of a core sentence which contains the essence of the idea and an additional explanatory part:

[2] The Big Ideas of Science set used in PLATON and referenced to in IDiverSE were originally designed by Ellinogermaniki Agogi and Núcleo Interactivo de Astronomia under the Go-Lab project and are currently also used in the Go-Lab platform.

1. Energy can neither be created nor destroyed. It can only be transformed from one form to another. The transformation of energy can lead to a change in state or motion. Energy can also be converted to mass and vice versa.

2. There are four fundamental interactions/ forces in nature. Gravitation, electromagnetism, strong-nuclear and weak nuclear forces. All phenomena are due to the presence of one or more of these interactions. Forces act on objects and can act at a distance through respective physical field, causing a change in motion or in the state of matter.

3. Earth is a very small part of the universe. The Universe is comprised of billions of galaxies, each of which contains billions of stars (suns) and other celestial objects. The earth is a small part of the solar system with the Sun in its center, which in turn is a very small part of the Universe.

4. All matter in the Universe is made of very small particles. They are in constant motion and the bonds between them are formed by interactions between them. Elementary particles as we know, form atoms and atoms form molecules. There is a finite number of types of atoms in the universe which are the elements in the periodic table.

5. In very small scales, our world is subjected to the laws of quantum mechanics. All matter and radiation exhibit both wave and particle properties. We cannot simultaneously know the position and the momentum of a particle.

6. Evolution is the basis for both the unity of life and the biodiversity of organisms (living and extinct). Organisms pass on genetic information from one generation to another.

7. Cells are the fundamental unit of life. They require a supply of energy and materials. All life forms on our planet are based on this common key component.

8. Earth is a system of systems which influences and is influenced by life on the planet. The processes occurring within this system influence the evolution of our planet, shapes its climate and surface. The solar system also influences Earth and life on the planet.

Using this map, teachers from different subjects can discover how the topics they teach are connected with each other, bring this knowledge into the class and even coordinate their classes in order to teach related topics at the same time. Teachers can even go a step further and prepare interdisciplinary classes where the connected topics are taught under the same activity. The IDiverSE activities might not all be interdisciplinary on their own, however, they will include information about to which Big Ideas of Science they are related and how, as well as information about the subject domains on which it can be included. Using this information, teachers from different subjects can perform connected activities with the same students or work together in the same activity from different points of view.

2.3. Handprint

Environmental education has to be forward-looking, focused on supporting students in view of the challenges facing the planet now and in the future. The importance to students of a positive attitude lies in the fact that thinking has to be built on the basis of positive spirit ("Hand-print"[3]), where there is only hope for the best and no despair for the worst.

In one hand, the development of positive thinking is very important to empower young people to be leaders in climate policies. On the other hand, the identification of positive action seeks to find a solution using available resources, rather than focusing on things that are not working well. Consistent exploration of new possibilities creates a confident attitude to face challenges. This is consistent with a growing body of research into the constructive effects of positive thinking. Positive emotions, like all emotions, arise from the way we interpret events and ideas as they develop. Another practical consequence of positive thinking is an increase in creativity and innovations.

Positive message versus negative message

- Like any stimulus, individuals are likely to be desensitized by the message. The public has a limited load capacity and a finite set of concerns, especially when faced with extreme and immediate economic threats and risks.
- Dramatising climate change, stating the most extreme impacts and using exaggerated images, undermines confidence in environmentalists, scientists, political leaders and/or the media.
- When individuals are confronted with messages that present risks beyond their control — and receive little information about what can be done — they deal psychologically with that risk by engaging in self-denial (e.g., "Other people will get cancer, but I won't" or "climate change isn't real" or "the impacts of climate change will not affect me"), or deal with the risk by becoming fatalistic and apathetic, believing there is nothing that can be done about environmental and social problems.

Handprint Competencies - Suggested Approaches to Promoting Positive Action

The key approach to developing positive actions is to involve students in active learning. Active learning involves students in discussions and, most importantly, in actions that help solve problems. The key to active learning to develop action skills lies in a variety of student-centred teaching and learning strategies/approaches/pedagogies.

[3] Launched in 2007 by the Center for Environmental Education (CEE) at the 4th UNESCO International Conference - Conference on Environmental Education held in Ahmedabad, India, the Handprint concept promotes positive individual and collective actions. Handprint is used as opposed to "Footprint" to symbolise positive human actions on the environment.

According to Barnes (1989), there are several student-centred strategies:

- **Encourage project-based learning** motivated by research. Projects can be built around research, action or action research, but should be about real issues. This helps link the classroom curriculum to the student's real world and their own interests at the individual, family and/or community levels.
- **Organise activities such as visits and fieldwork** to sites of interest to motivate hypothesis research, interviews etc.
- **Gain experience and skills through practical learning** - internship and volunteering.
- **Use approaches with simulation in context** - dramatisations, games, experiments, case studies. They encourage empathy and help bring different perspectives into the classroom.
- **Write critical essays and opinion articles.** Reflecting on an authentic learning experience helps students build knowledge that allows them to take focused action.
- **Present the narrative of people/experts working with a problem** by viewing videos, using other multimedia resources created for specific topics and inviting experts, such experiences create a vision and motivation to perform actions.
- **Production of mind maps**, construction of scenarios, life cycle analysis. These are tools that help make abstract concepts tangible and identify opportunities for action.
- **Organisation of awareness-raising campaigns** - blogs, websites and social networks, videos, festivals, exhibitions, flash mobs, etc. that promote the realization of positive environmental and social actions.
- **Collaborate and co-learn through** twinning schools that have joint research and partnerships with various stakeholders to promote the exchange of different perspectives. The key is to encourage dialogue between schools located in different and diverse socio-economic, geographical, and cultural contexts, to name a few.

Chapter III – Citizenship Education

3. Citizenship Education

"Educating for sustainability" presupposes "educating for citizenship", i.e. providing civic, interventional and creative student participation in class and school life; developing true ecological and environmental awareness; educating for the values of coexistence, dialogue, solidarity, responsibility and autonomy.

The IDiverSE Project is based on the assumption that the place of Citizenship and Development in the education of children and young people must extend beyond the classroom and occupy a central place in school and community life.

Thus, the **Whole School Approach** is preferred. It has been progressively advocated, in particular by the Council of Europe, as the "3C's or Education for Democratic Citizenship and Human Rights": Curriculum; Culture; Community.

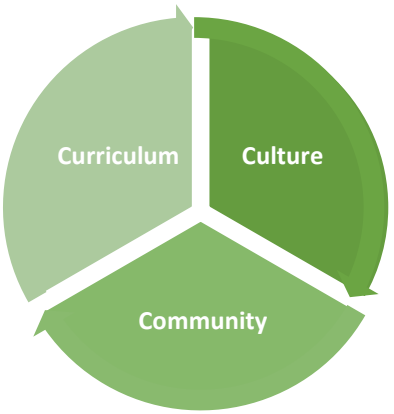


Figure 2. The 3C's of Education for Democratic Citizenship and Human Rights

Eco-Schools and IdiverSE encourage young people to take actions to protect their environment and to be the change for sustainability. It starts in the classroom, expands to the school and fosters change in the community.

3.1. Eco-Schools Methodology: 7 steps

IDiverSE's inquiry cycle is based on participation and co-responsibility, through the establishment of networks between the policies and practices of school organisational culture. By promoting reflection and discussion and active interdisciplinary and Inquiry-based activities, reinforcing the active role of citizenship and at the same time integrating and implementing the Student Profile, IDiverSE is inspired on **Eco-Schools Program**[4] **methodology**.

Following the methodology of Agenda 21 and revealing itself as a practice consistent with Sustainability Education, IDiverSE's inquiry cycle aims to:

- **Increase knowledge** (dissemination, awareness, training and information) in Environmental Education for sustainability;
- **Make Environmental Education/SDE** a part of formal, non-formal and informal education;

[4] Eco-Schools is an international programme of the Foundation for Environmental Education, recognised by UNESCO as the world's largest sustainability education network currently adopted in 67 countries. At 25 years on the international stage in 2019, it is a "tool" for the implementation of the Sustainable Development Goals (Agenda 2030), emphasising its vocation for education for responsible citizenship. The Programme promotes good environmental practices and recognises the high quality work done by schools within the framework of Environmental Education for Sustainability. It is coordinated at international, national, regional and school levels.

- **Work on the environmental management** of the school space, by implementing actions that lead to real improvements in resource management;
- **Inform and involve participants** and the entire school community, with an emphasis on students by applying the methodology inherent to Agenda 21;
- **Guide to Action** (change of attitude and behaviour, commitment, participation and involvement, citizenship and governance);
- **Approach good sustainability practices** in a positive way (constructive teaching by example), recognising and rewarding progress;
- **Contribute to progress** on the environmental literacy scale through the use of participatory methods to exercise citizenship.

IDiverSE, based on Eco-Schools Program, adopts a seven-step methodology leading to active learning that contributes to education for sustainable development in that it entails: educational experiences that lead to the acquisition of meaningful learning; the involvement and active participation of the various components of the school community around a common goal; and the transverse and interdisciplinary nature of the actions and themes developed within the program.

The link between environmental education and citizenship education is therefore unequivocal.

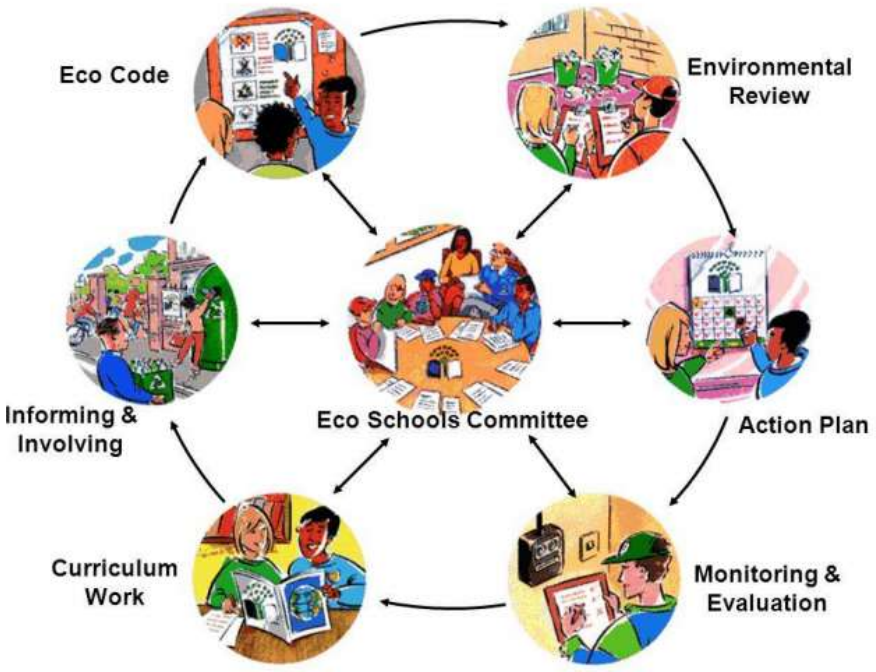


Figure 3. Seven-Step Methodology

3.2. IDiverSE Methodology: inquiry

The methodological approach of IDiverSE seeks a global development of the student through the rigorous application of the scientific method, the resolution of real problems which leads to the development of fundamental skills and active collaboration with colleagues, students from other islands and social stakeholders in their environment.

IDiverSE assessment focuses on assessing student learning in three fundamental areas: **The Design thinking method, the development of 21st century skills and the Inquiry learning process**.

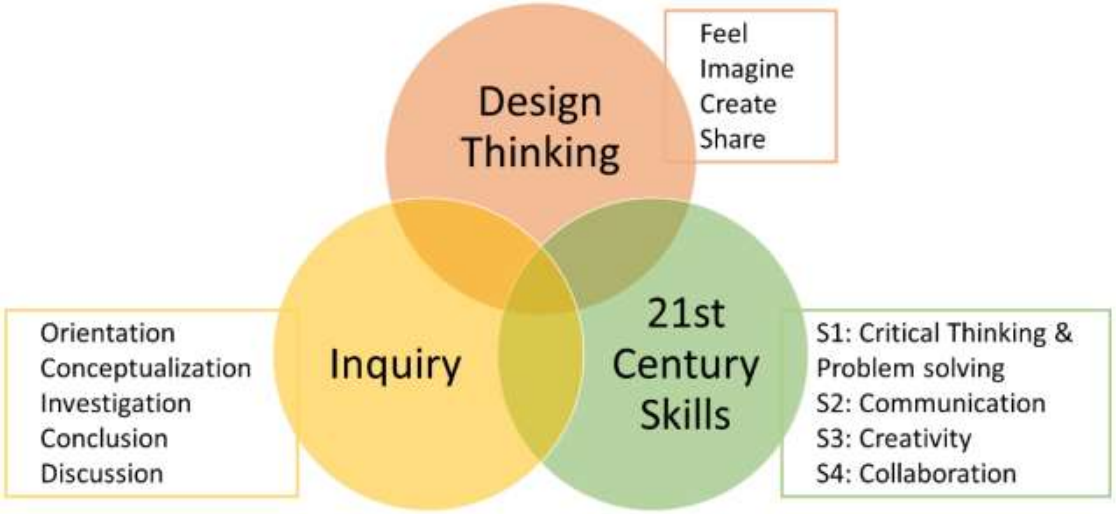


Figure 4. Global Assessment of IDiverSE

The aim of the IDiverSE assessment is not only to measure a certain level of development or mastery in these areas, but also to guide students on how to improve their learning, providing them with the necessary tools and regular indications so that they can advance in their learning process. This formative assessment approach of IDiverSE seeks to give a constant feedback to students so that they are aware of their learning, to help them to be strategic and to direct their motivation towards the learning objectives.

Within this competence-based assessment approach, it must be borne in mind that skills are not observable by themselves; therefore, they must be inferred through specific student actions.

In this sense, IDiverSE provides the teacher with **assessment criteria and tools** to collect observable evidence from students throughout the process and integrate it into the overall assessment approach. In addition, it provides analytical and technological tools that automatically collect evidence of student performance.

Thanks to this kind of analytical tools, students can review their progress and teachers can adapt their methodologies according to students' needs.

3.2.1. Design Thinking

Design Thinking has been widely used in the business sector and has now started to be integrated in the education world. It allows students to deeply and meaningfully communicate with their community, look at the world through the perspective of their community and discover main relevant issues that should be worked on. The goal is for students to work on topics that are relevant for their community, discover how their community is behaving toward the topic and create a final output that will be practical and directly applicable, promoting awareness and community development.

Design Thinking is a design methodology that provides a solution-based approach to solving problems, in a sequence of four steps: **Feel, Imagine, Create/Do and Share**.

Through these steps, students will learn deeply about the concepts and will contact with their community in order to discover how the community relates to the question/problem at hands, bringing up solutions to problems and highlighting good examples.

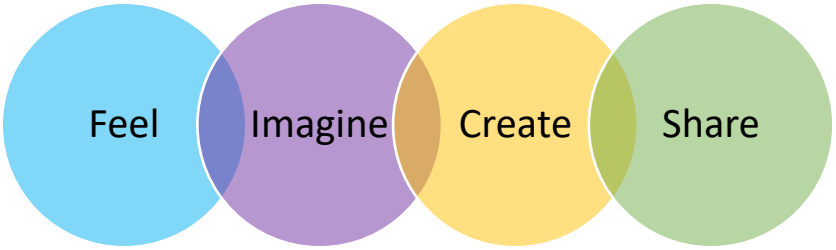


Figure 5. Design Thinking Steps

Students are thus invited to reflect in a collaborative way about which are the actions and the steps they are carrying out throughout the four phases:

- **Feel**

  This step starts with asking you to slow down and 'understand' the situation before jumping to 'solve' it. It develops EMPATHY. When you want to design a better solution, you need to move from 'assumptions' to 'insights' - this happens when you engage with the user and design solutions “with”', instead of “for” them. You can learn more here.

- **Imagine**

  This step asks you to brainstorm solutions to improve, enrich, change the user experience. It develops ETHICS. When you choose to offer a solution to change the current situation, it asks you to take the 'responsibility' for the 4 Islands Diversity for Science Education 2017-1-PT01-KA201-035919 same. This mindset helps you believe that you are not helpless, change is possible, and you can drive it! You can learn more here.

- **Create/Do**

  This step is about creative agency and the ability to take timely action. It develops EXCELLENCE. 'Action' that follows 'intention' results in desired 'impact'. Furthermore, the focus on details allows the action to improve the 'quality' of the experience, building a habit for excellence. You can learn more here.

- **Share**

The final step is 'Share' - cultivating the abundance mentality. It develops ELEVATION. Elevation is the shift from 'competing' with others to 'completing' others. Inherent in this step is the belief that the “I can” spirit offers hope and inspiration for further change. Go ahead, be a storyteller and shamelessly inspire others to 'Be the Change'!.

3.2.2. 21st Century Skills

One of the major problems that education is facing today is the lack of interest and disengagement of students from school. While the world is evolving at such a fast pace that almost all the knowledge can be obtained by making a quick search on a smartphone, many schools seem to maintain the same methods as 100 years ago.

It is ever clearer that in this 21st century it becomes pointless to ask students to remain sited for hours, with no technology at hand, listening to a teacher talking. While many students are still able to memorize the knowledge and pass the exams, after a short period of time, most forget what they have learned or are incapable of transferring it to other situations. Considering this, the active methodologies described above provide students with opportunities to grasp complex ideas, acquire skills in real contexts, combining them and applying them later in varied situations.

With regard to teaching and learning, **active, student-centred strategies** are preferred. The intention is that the student learns for him or herself, developing a set of skills, in a context of integrated, integrating, multi, inter and trans-disciplinary teaching, where students learn to learn and prepare to solve existing and future problems.

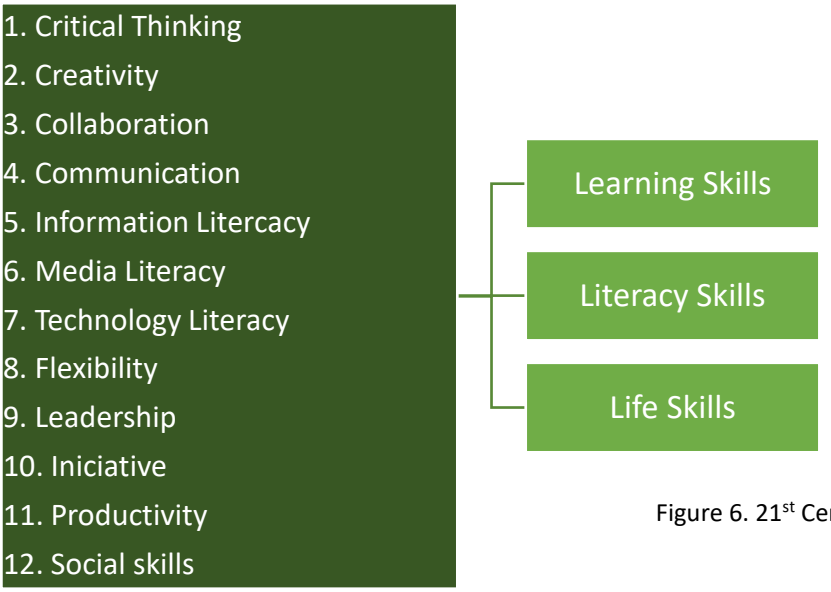


Figure 6. 21st Century Skills

Among the skills commonly referred to as 21st Century Skills (grouped in the fields of communication, literacy, and social), project-based learning, despite contributing to the development of all these competencies, particularly stimulates the so-called 4C's (Critical thinking, Creativity, Collaboration, Communication) and the sense of Responsibility, Belonging, Initiative and Leadership.

3.2.3. Project-Based Learning

In **Project-Based Learning**, students grapple with difficult issues and questions, allowing them to manage their own content and build their own knowledge, so it is easy to transfer and retain information. These activities instil in students the responsibility to identify problems, look for solutions, conduct research, analyse data, select information, integrate information and relate new information to previously acquired knowledge; in other words: "knowledge is the result of the activity that solves problematic situations" (Dewey, 1929).

Generally integrated in the previous one, **Problem-Based Learning** establishes a teaching strategy focused on the student, where the aim is that the student learns for him or herself. This strategy can be summarised as follows: teachers present students with a case study. Then, students, organised into working groups and with the support of teachers, identify the problem, investigate, debate, interpret and produce possible justifications and solutions or resolutions, or recommendations. In the end, there will always be a discussion/reflection on the conclusions of the investigation, and the process culminates in an oral and/or written presentation. Problem-Based Learning is based on the principles of the active school and the scientific method.

IDiverSE aims to become an opportunity to develop active learning using methods that allow students to develop skills that allow them to question established knowledge, integrate emerging knowledge, communicate efficiently and solve complex problems. It focuses on **Project Based Learning** (***PBL***), a method that develops outside conventional teaching-learning models, supported by a "constructivist approach", which has proven to be effective in schools. The approach can be used at all ages, and at widely differing levels of the educational system, in or outside a school context, for educational situations or solving social problems.

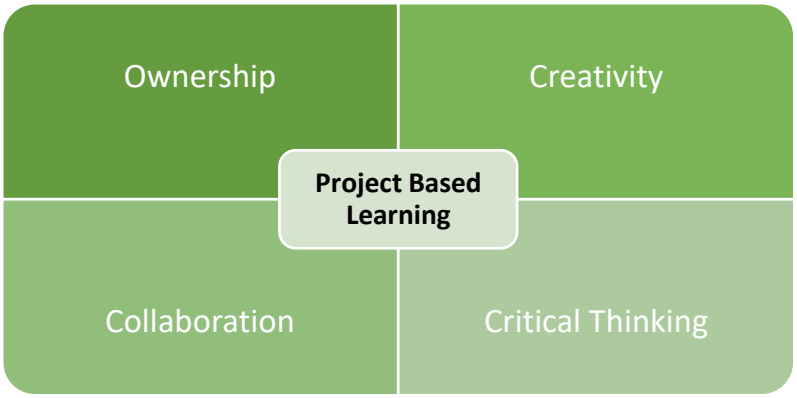


Figure 7. Project Based Learning Method

Project Based Learning retains some essential characteristics that define its specificity: it is, first and foremost, a method for **problem-solving**, which means that the starting point is real questions and/or problems that must be pertinent and relevant to the students and experienced as real problems for those who will deal with them (i.e. situations for which, at the outset, there is no all-encompassing answer). The project encourages an open, critical and reflective dialogue on environmental problems, motivating participation in their prevention and resolution, while providing training for informed decision-making, development of collaborative work and problem solving with the involvement and effective participation of the community wherever possible.

3.3.4. Collaborative Inquiry e Interdisciplinary

As the future becomes so complex and students have the possibility of being whatever they want, it is nearly impossible to predict what career they will follow.

Many students won't even follow one career but will work in many jobs and maybe even invent new ones. This means that, more than a list of pieces of knowledge to be memorized, students need to be stimulated to develop certain key skills that will make them resilient, creative and successful in whatever future they pursue. Inquiry is just that! It teaches students how to learn, how to be critical and solve problems and allows them to explore their creativity and group work ability.

Inquiry-Based Learning is a methodology through which students become active in their own learning by following the steps of science research. Instead of going into class and transmitting to students a certain amount of knowledge that they have to memorize, through Inquiry, the teacher creates a scenario where the student will go through a project, beginning with a question, making hypotheses and experiments to test the hypotheses and reach conclusions on their own. The teacher plays a major guiding role, while students follows their own path of discovery.

Considering this, collaborative Inquiry will be integrated in all the activities, promoting **communication and collaboration** between students from the different islands, who will exchange ideas and best-practices form their communities. This will also allow for a global view of the challenges but also the privileges of the life on islands. Additionally, interdisciplinary is promoted throughout the way by supporting collaboration between teachers from different disciplines as well as through the Interdisciplinary **Map of Science Ideas** which allows teachers to find relevant connections between the topics they teach and bring an interdisciplinary approach into their practice (see 2.2).

All the activities are created following the IDiverSE 7-phase inquiry cycle (see 3.1), preferably aiming at involving several teachers from different subject domains and with the **collaboration** between students of different islands.

All the IDiverSE activities accommodate a collaborative component, where students from the different islands of the world follow the same protocol to collect data in order to compare the results and make a global analysis in a collaborative way.

The inquiry components (IC) are presented below:

- **IC1: Setting the scene**
- **IC2: Refreshing prior knowledge**
- **IC3: Wondering about how something works**
- **IC4: Thinking about how to test hypotheses**
- **IC5: Doing research and collecting data**
- **IC6: Interpreting data and drawing conclusions**
- **IC7: Comparing conclusions to hypothesis and existing theory**
- **IC8: Reviewing and reflecting on what has been done**
- **IC9: Discussing and connecting with everyday life**

The inquiry components can be deployed when implementing any inquiry activity, regardless of the project.

Although IDiverSE activities follow a 4-step design thinking structure, as explained above, these are fully in line with the inquiry-based learning approach. Even though inquiry-based learning might be presented with no connection to design thinking, the design thinking methodology is, itself, a type of inquiry divided in 4 phases.

Thus, IDiverSE activities, although they follow the four-steps of design thinking they are completely inquiry based. In some cases, parts of IDiverSE activities are even intergraded in an online platform where students will need to visit and go through an inquiry scenario to do further research on a specific topic.

In addition and as mentioned in 3.2, Eco-Schools use a similar inquiry approach comprised of 7 steps for their activities.

In order to make the connection between the four steps of design thinking, the Inquiry components presented above and the 7-steps inquiry of eco-schools more evident we present these approaches and their correlation in the table below.

Looking at this table we can clearly see that, although the different methodologies follow different steps, they all focus on the same principles and work process.

Table 1. Connection between Design Thinking, Inquiry Components and the seven steps towards becoming an Eco-school

Design Thinking Step	Most relevant Inquiry Components	Eco-Schools 7 Steps
Feel The student dives deep in the problem	**IC1:** Setting the scene **IC3:** Wondering about how something works **IC5:** Doing research and collecting data **IC6:** Interpreting data and drawing conclusions **IC7:** Comparing conclusions to hypothesis and existing theory **IC9:** Discussing and connecting with everyday life	**1. Eco Schools Committee** The Eco-Schools Committee is formed by the students and is the driving force behind the Eco-Schools process and will represent the ideas of the whole school **2. Environmental Review** Carrying out an environmental review helps the school to identify its current environmental impact and highlights the good, the bad and the ugly **Curriculum work / interdisciplinarity** Besides increasing the status of the programme, linking Eco-Schools activities to the curriculum ensures that Eco-Schools is truly integrated within the school community
Imagine Students start imagining solutions for the problem	**IC2:** Refreshing prior knowledge **IC3:** Wondering about how something works **IC4:** Thinking about how to test hypotheses	**3. Action Plan** The Action Plan is the core of the Eco-Schools work and should be developed using the results of the Environmental Review. **Curriculum work / interdisciplinarity**

	IC8: Reviewing and reflecting on what has been done	
Create Students work to finding real solutions for the problem	**IC2:** Refreshing prior knowledge **IC5:** Doing research and collecting data **IC6:** Interpreting data and drawing conclusions **IC7:** Comparing conclusions to hypothesis and existing theory **IC8:** Reviewing and reflecting on what has been done	**Action** Put the plan into action **4. Monitoring & Evaluation** To find out whether or not the targets set out in the plan of action are being successfully achieved, you must monitor and measure your progress.
Share Students share their work and solutions with their class and community	**IC1:** Setting the scene **IC2:** Refreshing prior knowledge **IC8:** Reviewing and reflecting on what has been done **IC9:** Discussing and connecting with everyday life	**6. Informing & Involving** Getting everyone on board! Actions should not just be confined to the school: for example, pupils should take home ideas to put into practice. **7. Eco-code** A statement that represents the school's commitment to the environment

These components form the "**Inquiry Under the Microscope" toolkit**, an alternative training method for teachers. This toolkit focuses not only on introducing inquiry as a whole but, most importantly, on breaking down inquiry into its components and introducing them to teachers progressively as a series of small adaptations.

This methodology will allow teachers to start by rethinking their way of teaching and the way they collaborate with other teachers, and then, continue with making alterations by adding inquiry components gradually, one after the other, into their everyday teaching.

Moreover, this will enable teachers to progressively shift from a teacher-centred approach to an inquiry learning approach, more smoothly, namely through a series of meaningful and small adaptations that, overall, constitute the foundations needed for implementing inquiry into everyday classroom settings.

Chapter IV – Interdisciplinary and Inquiry-based Activities

4. IDiverSE Tools

in the sections below we present the tools that will comprise the IDiverSE methodology for designing and implementing activities.

Personal Geography

Open and critical thinking can be achieved through personal geography, which aims at artistically representing different experiences and perspectives from students progressively as they go through the activities.

Personal geography helps students to discover the value of their cultural heritage through an artistic expression (mental maps), while it also helps them self-reflect and gain a better understanding of the added values of every learning experience. It allows students to think about themselves for a moment and reflect about who they are and where they want to go.

In IDiverSE, Personal Geography represent the first moment of the students involvement. It will be their first representation of their place in their community and how they feel in it. As such, the project begins with them reflecting, mind-mapping and drawing a reflection of the following sentence: "me in my island, my island in me". This sentence can be adjusted to any situation like "me in my school, my school in me", "me in my community, my community in me", etc.

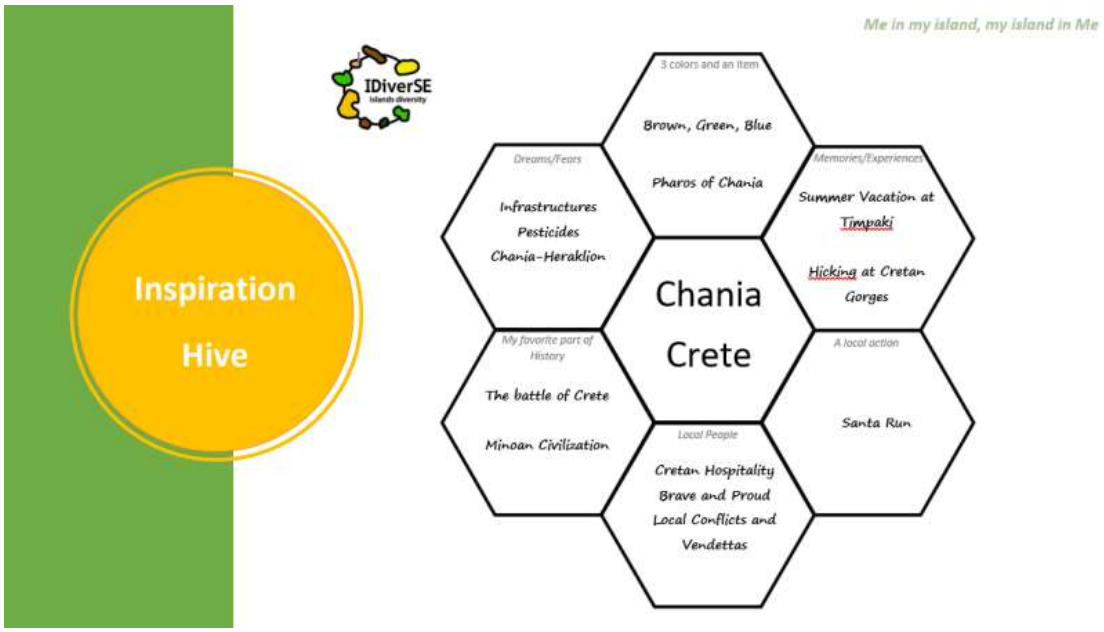


Figure 8. Geography personal statement example

Personal Geography is an innovative methodology that has not been fully explored in the world of education, and especially in the world of science education. By using it, we aim at allowing students to self-reflect and discover the impact of any given learning experience through an artistic expression. This can also be used as an assessment tool for teachers since students will regularly add components to their drawings throughout the project, related to what they learn and how they feel about the experience.

Using personal geography, students are stimulated to create connections between new and older knowledge as well as between new knowledge and themselves through memories and experiences. How does this concept apply in practice? It is very simple, actually:
- students make their personal geography mapping as the first step of their involvement in the project;
- throughout the implementation of the activities, students regularly add components to their drawing, reflecting their new knowledge and their feelings about the experience;
- students take pictures of their drawing regularly;
- at the end, students make a compilation with the first, last and two in the middle pictures of their personal geography drawing and, if they want, add it to their portfolios.

GlobalLab Platform

This unique, web-based, educational platform that enables students, teachers, and learners of all ages to pose questions and together find answers helps teachers to finally have in one place all the resources, tools, partners, and support to bring authentic investigations to classrooms and homes.

With this tool, everyone is both a learner and a knowledge creator where students can collect data and collaborate with other students from all over the world.

OSOS – Open Schools for Open Societies

Open Schooling is a model that provides school teachers and headmasters with a framework to develop and transform the school into an open school.

By transforming into an open school, the school becomes a reference knowledge centre of the community, a science hub where citizens can seek for knowledge and the place where the students' work has an important impact for the surrounding community and with the involvement of the community. IDiverSE follows the Open Schooling Model principles and integrates the activities in the OSOS Portal.

IDiverSE assessment toolkit

Innovative learning methodologies require innovative assessment methods. The IDiverSE assessment toolkit is a set of tools and tips that give you the chance of assessing your students learning and development of key 21st century skills, while at the same time providing them constant feedback to raise their awareness and allow them to control their progress.

IDiverSE assessment focuses on providing students with the tools, awareness and regular feedback from the teacher, so as to be able to control their own learning and development of fundamental key skills for the 21st century.

GRASP Platform – A Space for everything

In this platform students and teachers can create interactive learning spaces building learning experiences with content from across the web. They also can access hundreds of resources covering a wide variety of subjects.

Schools can create, manage and share content with colleagues and prepare interactive presentations for meetings or seminars. They can discuss and connect with established communities of practice and personal interest groups.

4.1. IDiverSE Activities

Following citizenship education principles and IDiverSE's methodology (see 3.2) a set of activities were designed and created, putting into practice collaborative and Interdisciplinary work, as well as innovative teaching methods. In the following table you can see a summary of the IDiverSE Activities.

Table 2. IDiverSE Activities

Activity name	Age Group	Interdisciplinary collaboration	Activity Summary
Bees for the future – Biodiversity	9 to 25	Biology, Mathematics, Environmental Sciences, Health, Psychology, Economy, English and Environmental Education.	Students will discover what is the importance of bees for human life as well as for the whole ecosystem.
Restless Earth – Natural Disastors	9 to 18	Biology, Physics, Chemistry, Geology, Mathematics, Geography, History and English	Students will learn about the natural mechanisms behind volcanoes, earthquakes and tsunamis.
Students Study Volcanoes - Volcanoes	9 to 25	Biology, Physics, Chemistry, Geology, Mathematics, Geography, History, English.	Students will learn pedagogical practices based on inquiry-based methods that are more effective in science education.
UV radiation: friend or foe?- Health	under 6; 6 to 15	Biology, Environmental Sciences, Health, Psychology, Physics and Astronomy, Arts and English.	Students will understand that UV rays are very important for human health but can also pose a threat.
Marine Litter …. The usual suspects at my beach – Litter	all ages	Biology, Environmental Sciences, Health, Geology, Psychology, Arts and English	Students will learn more about the impacts and consequences on marine ecosystems contamination.
Design Thinking with the Moon – The Moon	all ages	Astronomy, Earth Sciences, Geography, Mathematics, English	Students will be invited into connecting to the Moon cycle by observing the Moon appearance and position in the sky during one month.

IDiverSE activities can be implemented as stand-alone lessons or in the framework of project-based learning that will engage students in the process of Design Thinking. Through Design Thinking steps (see 3.2.1), students will learn deeply about the concepts and will contact with their community, in order to discover how the community relates to the question/problem at hands, bringing up solutions to problems and highlighting good examples.

All the activities include collaboration between students of different islands and the creation of relevant work that can be directly applicable in the community and with the contribution of the community, promoting awareness and community development. (see activity template – Annex 2). You can learn more about how the activities were created and the meaning behind each of the steps here.

ACTIVITY 1 | Bees for the future – Biodiversity

Keywords: Bees, Biodiversity, Ecosystem, Pollination, Extinction

Interdisciplinary collaboration ideas:

Biology, Mathematics, Environmental Sciences, Health, Psychology, Economy, English and Environmental Education.

Age Group: from 9 to 25 years old

Learning objectives:

Students will contact the scientific method in an Inquiry-Based activity that will lead them to learn important concepts such as sustainability, ecosystems, Biodiversity and protection of the web-of-life.

Problem: Do you like bees? Do you think they are important? What would happen if bees disappeared?

Well, fellow explorer, today you are going to become a scientist researching on one of the most important contemporary science research problems. Although we are used to seeing people run away from bees or associate them with the sweet tasting wonderful food we call honey, bees are so much more than that. Do you know why? Embark on this journey, play a fun game, enrol in an interactive research platform, collaborate with your community and with colleagues from different countries and you will become an expert and a very important change maker in the world. Bees will thank you … and humanity as well!

Activity Summary:

Students will discover what is the importance of bees for human life as well as for the whole ecosystem and will investigate how their communities and the communities that live in other islands are behaving towards bees. Bees are a major contemporary science concern, as they are necessary for the pollination and consequent reproduction of most of the plants that we eat (and that the animals that we eat use to feed as well) and their numbers have been decreasing at a fast rate.

Opportunities to collaborate with stakeholders:

Students will be challenged to interview, discuss and collaborate with different experts on the field such as beekeepers, farmers, scientists, environmental experts, etc.

Teachers should allow students to invite experts to their school, to collaborate in their creations as well as family members and any other important stakeholders.

DESIGN THINKING - PHASES

FEEL — Students will use a collaborative platform to collect data from their community and compare it with data from other communities.

IMAGINE — Students will be advised into bringing the problem to their families and have discussions about the problem at hands.

DO — Students will be encouraged to collaborate with their families, community and important stakeholders in their creations.

SHARE — Students will reach out to the whole community to share their work, including stakeholders who can reinforce the change-making progress.

More information about this activity here

Author of the activity:

David Sousa; Priscila Doran (Portugal)

ACTIVITY 2 | Restless Earth – Natural Disastors

Keywords:
Volcano, Earthquake, Tsunami, Natural Hazards, Citizen Protection.

Interdisciplinary collaboration ideas:
Biology, Physics, Chemistry, Geology, Mathematics, Geography, History and English.

Age Group: from 9 to 18 years old

Learning objectives:

Students engage in an inquiry-based activity which will allow them to explore natural phenomena. They study the nature of these phenomena and understand the mechanisms that cause them. The activity is designed so that students will develop fundamental skills such as problem solving, critical thinking, communication, creativity and collaboration.

Problem: How important is the impact of volcanic eruptions, earthquakes and tsunamis?

Our beautiful planet is constantly under transformation. Sometimes, changes occur over a very long period of time and we barely note them. Some other times however, transformations are the result of massive and devastating events. In this activity we explore some of Earth's most intense and overwhelming events; volcanic eruptions, earthquakes and tsunamis.

Activity Summary:
Students will learn about the natural mechanisms behind volcanoes, earthquakes and tsunamis. Additionally, they look back in history to understand the impact of such phenomena in older civilizations. You will also be challenged to design a citizens' alert programme in order to raise awareness in the local community and help your municipality in preparing citizens for such events.

Opportunities to collaborate with stakeholders:
Students will be challenged to interview, discuss and collaborate with different experts on the field such as beekeepers, farmers, scientists, environmental experts, etc. Teachers should allow students to invite experts to their school, to collaborate in their creations as well as family members and any other important stakeholders.

DESIGN THINKING - PHASES

FEEL

Students do a search on past catastrophic events and find out the impact they had on their society. They can talk to people in their community that might have lived through these events

IMAGINE

Students investigate a historic event related to a natural diaster, do some research, talk to historians and other experts. Teachers can organize a trip and contact with experts.

DO

Students are encouraged to collaborate with local authorities and stakeholders to design their own citizen's alert programme.

SHARE

Students will reach out to the whole community through their science trail, share their work, including stakeholders who can reinforce the change-making progress.

More information about this activity here

Author of the activity:
Eleftheria Tsourlidaki (Greece)

ACTIVITY 3 | Students Study Volcanoes - Volcanoes

Keywords:
Volcano, Volcanic Eruption, Remote Labs, Citizen Protection.

Interdisciplinary collaboration ideas:

Biology, Physics, Chemistry, Geology, Mathematics, Geography, History and English.

Age Group: from 9 to 25 years old

Learning objectives:

Students will learn the science behind volcano eruptions, the methodologies scientists use in order to monitor volcanoes and forecast volcano eruption probabilities, the connection between earthquakes and volcanoes.

Problem: How science is made and how it affects everyday life?

the "Students Study Volcanoes" accelerator focuses on the study of a physical phenomenon with great societal impact and proposes pedagogical practices based on inquiry-based methods that are more effective in science education. The objective of this combination is on one hand to increase children's and student's interest in science, on how science is made and how it affects everyday life, and on the other to stimulate teacher motivation on up-taking innovative teaching methods, subjects and practices to enrich the science curriculum.

Activity Summary:
This activity focuses on the study of a physical phenomenon with great societal impact and proposes pedagogical practices based on inquiry-based methods that are more effective in science education. This activity aims to shed light in the mechanisms of volcano eruption, provide students and schools with educational scenarios employing state of the art simulations and remote labs.

Opportunities to collaborate with stakeholders:
Students will analyze data from earlier volcanic eruptions and identify empirically the probability of a volcanic eruption based on evidence. Using these empirical data, they will run volcanic crisis management simulations utilizing available monitoring virtual tools to understand the decision making process taking place in order to preserve human life.

DESIGN THINKING - PHASES

FEEL

Students get the background information on volcanoes and on the existing methodologies regarding the monitoring and forecasting of the probability of a volcanic eruption.

IMAGINE

Students will be able to interact with experts on the fields of geology and volcanology in dedicated invited sessions in their schools or visits, virtual or physical.

DO

Students will keep an interactive logbook with which they collect material, notes, multimedia resources and also keep the minutes of their virtual meetings with other schools.

SHARE

Students will organize an infoday in their school to present their work regarding volcanic hazards and the role of the school in helping their community.

More information about this activity here

Author of the activity:
Emmanuel Chaniotakis (Greece)

ACTIVITY 4 | UV radiation: friend or foe? - Health

Keywords:
UV radiation, Sun, Health.

Interdisciplinary collaboration ideas:

Biology, Environmental Sciences, Health, Psychology, Physics and Astronomy, Arts and English.

Age Group: from 6 to 15 years old

Learning objectives:

Students will contact the scientific method in an Inquiry-Based activity that will lead them to learn important concepts such as the Sun and other stars, the solar system, scales in the universe, light spectrum and radiation, UV light and health. Students will also evaluate the level of awareness of their families and communities, creating then an adjusted awareness raising plan.

Problem: Are you ready to put science into action and learn all about light, radiation and its relationship with our body?

Explore the fun exercises suggested in this activity and discover if UV radiation is in fact a foe, a friend, or maybe both? Then, discover what your community thinks about it, how the people in your family behave regarding it and help your community to act in an informed way towards the sun.

Activity Summary:

Students will learn about light and UV radiation. They will understand that UV rays are very important for human health but can also pose a threat. Upon learning this, students will discover the level of awareness of their community and create strategies to raise their awareness for the benefits and dangers of UV radiation and how to behave towards it. During the process, students will learn important concepts such as the Sun, the scales in the solar system, light spectrum, how different animals see the world in different ways, etc.

Opportunities to collaborate with stakeholders:

Students will be challenged to interview, discuss and collaborate with their families and other community members as well as to collaborate with different experts on the field such as researchers, doctors, medical institutions, sunscreen brand, etc.

DESIGN THINKING - PHASES

FEEL

Students will use a collaborative platform to collect data from their community and compare it with data from other communities.

IMAGINE

Students will be encouraged to collaborate with their families, community members and important stakeholders in their creations.

DO

Students will be advised into bringing the problem to their families and have discussions about the causes and solutions to the problem at hands.

SHARE

Students will reach out to the whole community to share their work, including important stakeholder entities who can reinforce the change-making progress.

More information about this activity here

Author of the activity:

Priscila Doran the contribution of Maria Celestina Henriques (Portugal)

ACTIVITY 5 | Marine Litter …. The usual suspects at my beach – Litter

Keywords:
Marine ecosystems; Marine litter; Environmental Education; Monitoring; Sustainable Consumption.

Interdisciplinary collaboration ideas:
Biology, Environmental Sciences, Health, Geology, Psychology, Arts and English.

Age Group: all ages

Learning objectives:

Through the framework of the marine litter problem, students will work on questions related to its causes and consequences on marine ecosystems contamination, learning about sustainable consumption and waste management.
Considering this, students will research their local beach, collect marine waste, analyse their consumption of microbeads and figure out solutions to improve community awareness.

Problem: Do you know that microplastics are serious threats to the marine environment?

Students will become detectives researching the "usual suspects" polluting their beach. These can be plastics, microplastics, cigarret buds, glass bottles, etc.Through a series of proposed exercises, students will learn about plastic pollution and pollution in general, sustainable consumption and will fight to raise awareness in their community in order to protect their local marine fauna and flora as well as their own health and life.

Activity Summary:
Through the framework of marine litter problem, students will work on questions related to sustainable consumption and waste management, as well as impacts and consequences on marine ecosystems contamination. Considering this, students from the different islands will collaboratively figure out solutions to improve community awareness and the implementation of measures/solutions concerning the marine litter problem.

Opportunities to collaborate with stakeholders:
Students will contact with the community when researching their local beach and collecting evidence related to the level of awareness and lifestyle habits of their families, neighbours and community members. Students can also contact with their municipalities in order to discuss, create and share their ideas about how to solve the problem.

DESIGN THINKING - PHASES

FEEL Students will investigate a predetermined area of their local beach and collect all the litter they can find within the area.	IMAGINE After the sampling of the local beach, students are aware of the main sources of marine waste and beach pollution.
DO After coming up with their most creative solutions for their community, students should propose a set of activities.	SHARE The sharing can be done in the form of a fair, an exhibition or a science trail. In a science trail, each group of students can decide to present their work in a different way.
More information about this activity here	**Author of the activity:** Margarida Gomes; Tânia Vicente; Renata Gonçalves, Patricia Romeiro (ABAE), Priscila Doran (NUCLIO)

ACTIVITY 6 | Design Thinking with the Moon – The Moon

Keywords:
Astronomy, Earth-Moon System.

Interdisciplinary collaboration ideas:
Astronomy, Earth Sciences, Geography, Mathematics, English.

Age Group: all ages

Learning objectives:

Students will contact the scientific method in an Inquiry-Based activity that will lead them to learn important concepts about the Earth-Moon-Sun system.
While going through this project, students will develop fundamental skills such as problem solving, critical thinking, communication, creativity and collaboration.

Problem: Have you ever looked to the Moon?

This activity will guide you to an observational project where you'll record daily observations of our nearest neighbour in space. While you complete your observation log, interact with your community to share knowledge about the moon phases.

Activity Summary:
Students will be invited into connecting to the Moon cycle by observing the Moon appearance and position in the sky during one month. Students will be creative and artistic, creating a Moon journal with drawing made from the moon every single day (with exception of cloudy days) and will compare their results with those of other students from different regions of the world. Throughout the process students will raise questions about the configuration of the Earth-Moon-Sun system, think about eclipses and take some conclusions about the shape of our planet.

Opportunities to collaborate with stakeholders:
Students will be challenged to interview, discuss and collaborate with their families and other community members as well as to collaborate with participants from different regions of the world. Teachers should encourage students to share their findings in a collaborative platform as well as with family members and any other important stakeholders.

DESIGN THINKING - PHASES

FEEL — Students will use a collaborative platform to collect data and compare it with data from other communities.

IMAGINE — Students will be advised into bringing the problem to their families and have important discussions about the causes and solutions to the problem at hands.

DO — Students will be encouraged to design a realistic model of the Earth-Moon-Sun system that explains lunar phases and eclipses.

SHARE — Students will reach out to the whole community to share their work.

More information about this activity here

Author of the activity:
Gustavo Rojas, Rosa Doran, Priscila Doran (NUCLIO)

4.2. Science trails

Science Trails is a project in which science, nature and local culture merge in a process of awareness for especially relevant subjects related to science and local culture. Science Trails combines outdoor experiences to discover and understand science concepts.

IDiverSE activities (among others) can be used to create a science trail around your school, with the collaboration of all the community. The IDiverSE science trail methodology is integrated as an accelerator in the **OSOS platform**, which brings an innovative open schooling model which is fully in line with the IDiverSE principles.

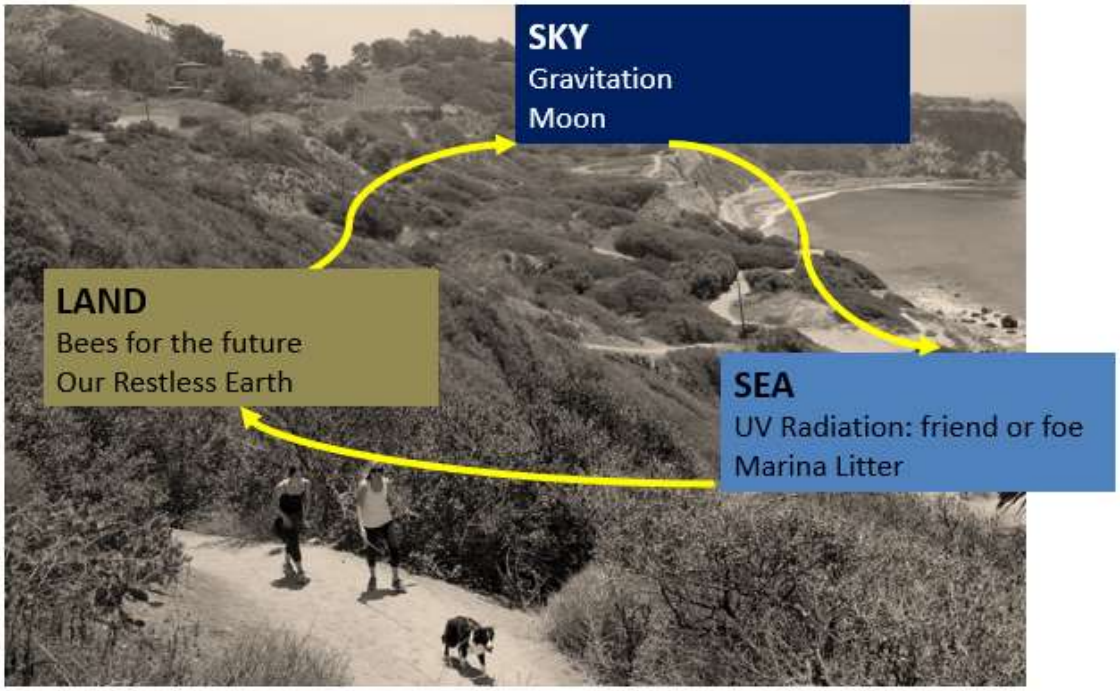


Figure 9. Example of a land-sky-sea science trail

Choosing the topics

The first step of the creation of a Science Trail is the reflection about where we are and the community around us. For this reason, the first step of the process will be to promote the reflection about the place of each students in his/her community and what are the main aspects that should be focused on when creating a science trail for and with the community.

In order to begin this reflection, we propose an artistic exercise that will help students look deep into their life and discover what is relevant for them (mental maps). Through the Personal Geography mapping, in this context, it is important to guide students into highlighting not only the main problems that should be addressed in their community but also the strong points about their culture, history and local society. In a science trail, these should also be represented.

After creating their drawings, each student should identify the most important features of their islands, from their perspective.

Teachers can use a Padlet, Mentimeter, or any other tool like post-it notes, for example, that students glue to a wall or board.

After each student has identified his/her most important topics, the whole class should discuss about what are the most common ideas among them and if they feel the same or not. Each student should have room to argue why he/she thinks that the chosen topics are important.

After this, the class should be divided into groups (as many groups as pretended stations of the science trail) and each group should choose one (or more) topics to work in to create one (or more) station for the science trail.

Defining the physical trail and the target community

After each group has decided on what topic they are going to focus, the number of stations of the science trail should be defined. In principle the number of stations will be equivalent to the number of working groups. However, this is flexible and each school should decide on what is best.

A station of a science trail is a physical stop where the visitor goes through an interactive activity/game that will serve the following purposes:

- Introduce the topic (usually through a game, quiz, fun experiment, etc.);
- Raise awareness to the problem (a video, another game, etc.);
- Present the solutions and how they can be applied.

It is important to establish from the beginning what type of stations the science trail will contain:

- Self-sustainable station where the accesses a **link or a QR code** that leads to an online platform where the whole activity can be performed;
- Self-sustainable station created in the form of an exhibition with **physical materials** that are kept in place;
- Stations that require the presence of at **least one student** to lead the visitors through the activity (this is the recommended for at least the release of the science trail to the public).

Having decided on what types of stations the science trail will have, the target community should be defined and the place where the science trail will be built should be chosen. This can either be inside the school, in a public garden, on a shopping mall, etc. There is no limit to the possibilities and this should be defined among the school, and if necessary the city hall.

After being defined, students should actually map the trail where the stations will be exposed in a Map, marking the trail, the stations and with a proper scale.

Research about the topic and the community

After having decided in what topic they will focus, students should carry out a research activity related to the topic at hands and discover how the community relates to the topic.

Time for action

After being acquainted with Inquiry and Design Thinking, students should take leadership of their progress and begin their own explorations about the topic on focus.

Students should first plan how they are going to research their topic. They should follow the steps of a proper scientific research:

1. Begin with one or more question
2. Make hypothesis
3. Plan how they are going to test their hypothesis
4. Put their plans into action and collect their data
5. Organize and analyse their data
6. Draw conclusions

The main dimensions that students should cover when doing their research are:

- What do I know about the topic and how can I learn more?
- How does this topic relate to my community?
- How does my community relate to the topic?
- What stakeholders should I involve in my process?

For this, students should include in their plans the involvement of the community and visits to the field. They should talk to experts, to their families, maybe interview their community, etc. whatever necessary to extract the information they need about the topic to then proceed with developing solutions to improve it (in case it is a problem) or to highlight it (in case it is a strong point about the community).

Collaborating

One of the most important aspects of IDiverSE is the collaboration overseas. Students should know that they live in a place that is unique and special but that they are also connected to other students all over the world. In today's world, isolation becomes less relevant as we are one click away from many other people that feel the same things that we do. So, students should consider a way of collaborating with students from other places of the world in order to collect the same kind of data and in the same way.

Students can explore the **Globallab platform** to see if there is any relevant project already created about their topic, or they can register and create their own project. If this is the case, teachers should communicate with each other (through the IDiverSE website or any other means desired) and exchange their students' projects so that they can collaborate. Alternatively, teachers should begin collaborating with each other even before their students start their projects and prepare communication channels for their students.

The goal of this collaboration is to learn about:

1. How does the topic relate to other communities around the world?
2. How do other communities around the world relate to the topic?
3. What good examples can I bring to my community from other community(ies) around the world?
4. What good examples can my community give to others around the world? Students can also communicate to exchange thoughts and ideas and bring some cultural diversity into their projects.

Sharing and Reporting

After creating and implementing the science trail, teachers and students should register every detail of the journey with pictures and videos so that by the end they have a complete report to share with the community. The project can be shared using Globallab (see 4.2).

We advise you to also use **wikiloc site or wikiloc app.**

If you use it, you have first to create the science trail with it. Please see Annex 3 –"Activity Sheet | Create your own trail on Wikiloc".

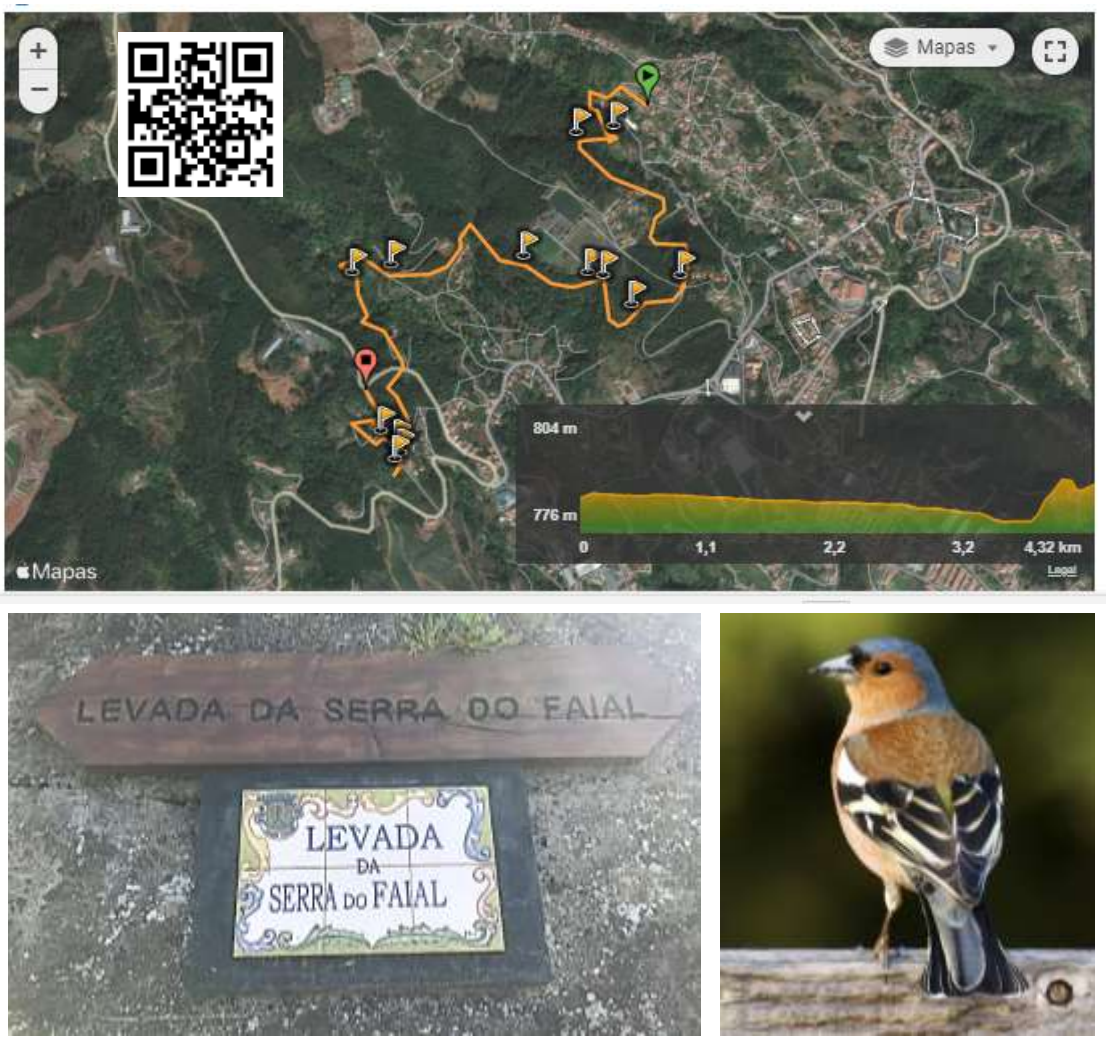


Figure 10. Science Trail in Madeira (Faial island)

Finally is crucial to understand the threats and weaknesses of the trails, understand what can be improved and so you can register your school science trail impact, fulfilling a report available here.

Chapter V – Idiverse Assessment Toolkit

5. Idiverse Assessment Toolkit

The methodological approach of IDiverSE seeks a global development of the student through the rigorous application of the scientific method, the resolution of real problems and active collaboration with social stakeholders in their environment.

As such, the main aim of the IDiverSE assessment approach is not only to measure a certain level of development or mastery in these areas, but also to guide students on how to improve their learning, providing them with the necessary tools and indications so that they can advance in their learning process.

IDiverSE assessment focuses on student learning in three fundamental areas: the development of 21st century skills, the development of inquiry skills, and the development of design thinking skills.

Within this competency-based assessment approach, it must be borne in mind that skills are not observable by themselves; therefore, they must be inferred through specific student actions. In this sense, IDiverSE provides the teacher with assessment criteria and tools to collect observed evidence from students throughout the process and integrate it into the overall assessment. In addition, it provides teacher with analytical and technological tools that automatically collect evidence of student performance. Using this kind of analytical tools, students can review their progress and teachers can adapt their methodologies according to students' needs.

In the IDiverSE Assessment there are three different steps:

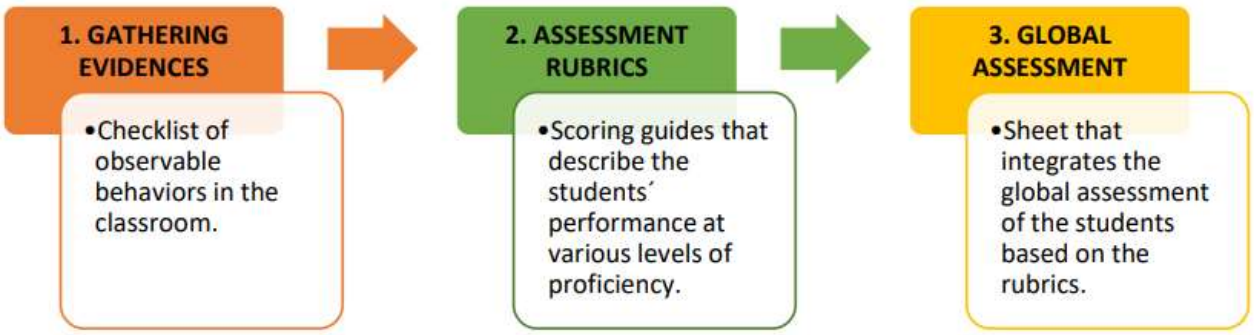


Figure 11. IDiverSE Assessment Steps

Chapter VI – Implementation

6. IDiverSE Schools

IDiverSE was implemented by 23 schools from three different countries: Portugal, Greece and Spain. In Portugal, 9 schools have participated: 6 schools from de Azores' archipelago and 3 schools from Madeira Island. In Greece, 3 schools from Crete Island, 1 school from Chios Island and 1 school from Rhodes Island implemented the project, in a total of 5 schools. In Spain 9 schools have participated in the implementation of iDiverSE. 5 schools are from the Canary Islands, 2 from the Balearic Islands and 2 from the Basque Country.

A different number of teachers have participated in each school. In some cases, only one teacher has participated, and in other cases up to 3 teachers have participated. In addition, in some schools activities have been carried out at different educational stages. In total 17 teachers from Spain, 35 teachers from Greece and 26 teachers from Portugal have participated in the iDiverSE implementation.

There have also been mote than 500 students from different educational stages, from 5th grade of primary education, to 4th grade of secondary education. In the following table, the number of teachers and students can be seen for each school, from each country.

Portugal

School	Teachers	Students
Escola Básica e Secundária Armando Côrtes-Rodrigues	3	51
Escola Secundária Jerónimo Emiliano de Andrade	1	20
Escola Secundária de Lagoa	1	9
Conservatório Regional de Ponta Delgada e EBS Armando Côrtes-Rodrigues	3	21
Escola Secundária Vitorino Nemésio	3	45
Escola Secundária da Ribeira Grande	3	49
Escola Secundária Jaime Moniz	5	39
Escola Básica dos 2/3 Ciclos Dr. Horácio Bento de Gouveia	6	32
International Sharing School - Madeira	1	20

Greece

School	Teachers	Students
2nd Primary School of Voutes	2	30
5th Primary School of Rhodes	1	18
High School of Vamos	2	30
Primary School of Nenita	2	15
Experimental High School of Heraklion	2	15

Spain

School	Teachers	Students
IES San Juan de la Rambla	1	18
IES La Orotava-Manuel González Pérez	3	78
IES Mencey Acaymo	1	40
IES Domingo Pérez Minik	2	-
IES El Rincón	2	15
IES Arxiduc Lluís Salvador de Palma	2	130
Sant Josep Obrer School	2	-
San Felix de Ortuella	3	150
Esclavas SC Fátma	1	50

Below is the list of projects carried out during the implementation of iDiverSE by each school, from each country. In total, **33** iDiverSE projects have been carried out. Some schools have carried out 2 our 3 projects and in other cases, only one project.

Portugal

School	Projects
Escola Básica e Secundária Armando Côrtes-Rodrigues	Marine litter in my beach How to implement reading habits in Vila Franca do Campo
Escola Secundária Jerónimo Emiliano de Andrade	UV Radiation: Friend or Foe?
Escola Secundária de Lagoa	Marine litter in my beach
Conservatório Regional de Ponta Delgada e EBS Armando Côrtes-Rodrigues	Organistic itineraries
Escola Secundária Vitorino Nemésio	Personal Geography Bees for the future
Escola Secundária da Ribeira Grande	Importance of the family budget Promotion of gender equality Community and Ecological Masks
Escola Secundária Jaime Moniz	UV Radiation: Friend or Foe? Bees for the future
Escola Básica dos 2/3 Ciclos Dr. Horácio Bento de Gouveia	Bees for the future
International Sharing School - Madeira	Personal Geography UV Radiation: Friend or Foe?

Greece

School	Projects
2nd Primary School of Voutes	The city of the sun
5th Primary School of Rhodes	Earthquake and Volcanos – I am not afraid of earthquakes, I am an Earthquake Specialist
High School of Vamos	Our Restless Earth
Primary School of Nenita	Our Restless Earth
Experimental High School of Heraklion	Volcanoes and Earthquakes in Greece Earth's Climate and Climate Change In the paths of science

Spain

School	Projects
IES San Juan de la Rambla	Technological Recycling
IES La Orotava-Manuel González Pérez	Students Study Volcanoes GOC Tenerife
IES Mencey Acaymo	Apadrina
IES Domingo Pérez Minik	Our Restless Earth
IES El Rincón	Our Restless Earth
IES Arxiduc Lluís Salvador de Palma	Energy Intelligence
Sant Josep Obrer School	Marine Litter in My Beach
San Felix de Ortuella	Bees for the future Our Restless Earth
Esclavas SC Fátma	Bees for the future

6.1. Best practices and examples to be shared

Escola Básica e Secundária Armando Côrtes-Rodrigues

Projects: MARINE LITTER IN MY BEACH
HOW TO IMPLEMENT READING HABITS IN VILA FRANCA DO CAMPO
3 teachers: Luís Veríssimo, Sónia Serpa, Graça Amaral
51 students

Country: **Portugal**

Location: São Miguel Island, Azores

Teacher testemonial:

"A motivation and an inspiration, it is a pity that the current education system does not allow such a inspiring teaching methodology in a mass way." – Luís Veríssimo

"This course allowed us to explore the multiple relationships that we can establish between different areas of knowledge, with the teacher being responsible for managing the different contents in order to involve students in the whole process, developing young people's critical and creative thinking, as well as their capacity to interact in order to build knowledge." – Sónia Serpa & Graça Amaral

Project links:
MARINE LITTER IN MY BEACH
Student Version
Teacher Version
HOW TO IMPLEMENT READING HABITS IN VILA FRANCA DO CAMPO
Teacher Version
Student Version

Student testemonial:
"It was the best class this year." – Silvana, 6ºC

"We enjoyed working on this project because a different methodology was used other than the ones our teachers use on a daily basis."





Escola Secundária Jerónimo Emiliano de Andrade

Projects: UV RADIATION: FRIEND OR FOE?

1 teacher: Joaquina Novo

Country: **Portugal**

Location: Terceira Island, Azores

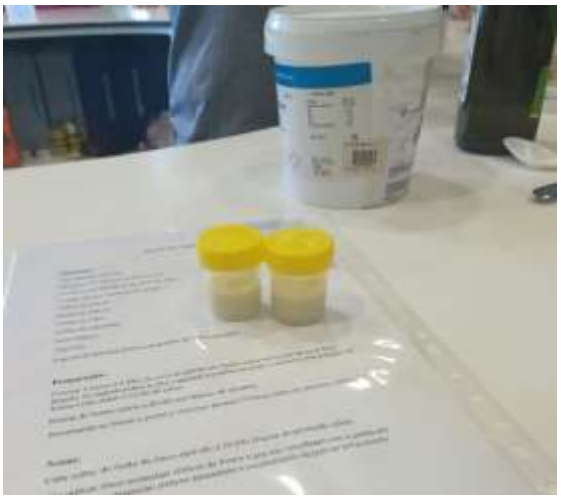
Teacher testemonial:

"Participating in this workshop contributed not only to my professional enrichment and personal experience, but also to the motivation to adopt new methodologies.

It allowed me to develop a collaborative work with several teachers from other disciplines, promoting interdisciplinarity and the sharing of knowledge and experiences."

Student testemonial:

"The students loved doing personal geography and were excited about the results achieved at the end of the project."



Escola Secundária de Lagoa

Projects: MARINE LITTER IN MY BEACH

1 teacher: Isabel Santos

9 students

Country: **Portugal**

Location: São Miguel Island, Azores

Teacher testemonial:

"Bearing in mind the topic treated and the way it was approached, it made almost all students more aware of the problem and, I think, their own commitment to nature, more specifically to the sea. Methodology to follow."

Project links:

MARINE LITTER IN MY BEACH
Student Version
Teacher Version

Student testemonial:

"I'll never throw trash on the floor again. Of course, I knew it shouldn't be done, but I didn't care. Now I realized that I shouldn't do it." – Gonçalo Augusto, 7º B

International Sharing School - Madeira

Projects: PERSONAL GEOGRAPHY
UV RADIATION: FRIEND OR FOE?

1 teacher: Isabel Chaves

Country: **Portugal**

Location: Madeira Island, Madeira

Teacher testemonial:

"Personal Geography is a tool to be explored with students that has immense potential. It allowed students from other countries to look for reasons to enjoy being where they are and for local students to discover "hidden" aspects of their identity"

Student testemonial:

"I really enjoyed doing the activity about Personal Geography. Drawing and reflecting on what I drew allowed me to discover things I did not know about myself." – Sara Florença, 8ºano

"The experimental activity on UV radiation was very cool. The color change of the beads convinced me that UV radiation is not always the same and can be dangerous to our health." – Pedro Cheng, 8ºano

Conservatório Regional de Ponta Delgada e EBS Armando Côrtes-Rodrigues

Projects: ORGANISTIC ITINERARIES

3 teachers: Cristiana Spadaro, Mónica Reis, Isabel Albergaria e Noélia Santos
21 students

Country: **Portugal**

Location: São Miguel Island, Azores

Project links:
ORGANISTIC ITINERARIES

Teacher testemonial:

"In over 15 years of teaching practice, my students have always shown a thirst for knowledge and curiosity in relation to their surroundings, asking pertinent questions in relation to scientific knowledge, hence this type of initiatives are always an asset for any educator, since they allow students to get in touch with experts in the field, which also allows them to be motivated to learn repetitive and boring content, such as memorizing the multiplication tables or improving written expression."

Student testemonial:
"The students, in general, responded positively to the entire process of development of the project, even getting emotional responses, especially in the context of History. Another noteworthy reaction was the enthusiasm for the activities carried out in the field of Physics."

Escola Secundária Vitorino Nemésio

Projects: PERSONAL GEOGRAPHY
BEES FOR THE FUTURE

3 teachers: António Antunes, Augusto Vilela, Maria Gabriela Martins

Country: **Portugal**

Location: Terceira Island, Azores

Teacher testemonial:

he world
vant and
sibility of
ing their
enhances
' – Maria

emotions
and the
actices of
ice made
it easier to prioritize the challenge at hand, also because my motivation was increased and I experienced a rewarding and stimulating relational environment." – Augusto Vilela

Student testemonial:
"The students' reaction was very positive. After all, living on an island is not living in an isolated space, but integrating a network of islands, an extended space of other islanders."

"The students considered that, after working on the project, they were better related to each other and viewed the relationships with the teachers more positively; they wanted to continue participating in similar projects, based on the same methodologies."

Escola Básica dos 2/3 Ciclos Dr. Horácio Bento de Gouveia

Projects: BEES FOR THE FUTURE

6 teachers: Ana Maria Velosa, Ana Lúcia Vasconcelos, Maria Cecília Pontes, Maria Claret Almeida, Orlanda Andrade, Sandra Proença

Country: **Portugal**

Location: Madeira Island, Madeira

Teacher testemonial:

"This project was an asset, as it made available and valued a great diversity of tools and active work methodologies, developing in students the ability to solve everyday problems and make decisions." – Ana Velosa

"This project brought innovation to the school environment and opened the school to the community, namely, in the distribution of the awareness "kit" for the importance of bees. Collaborative work with class council colleagues becomes an indispensable way of joining efforts and knowledge for the realization of a project, it is undoubtedly a reason for work." – Cecília Pontes

"These activities, around problems that affect several islands in common, make students more motivated for a more active intervention and participation in society." – Claret Almeida

"It was a learning process not only for the students but also for me. It was gratifying to see them go on their discovery, to test hypotheses to seek and discuss information until they reached conclusions." – Orlanda Andrade

Student testemonial:

"Being part of this project instilled in the students a sense of responsibility towards the world in which they live. They felt that they could be more proactive and that their attitude was also relevant." – Ana Lúcia Vasconcelos

"If, in a first phase, the students may have shown some reticence with the project and with the methodology, they quickly became actively involved in the activities and in the development of the proposed tasks. The students were building their path throughout the project collaborating with each other in an environment of support and mutual support." – Sandra Proença

Escola Secundária Jaime Moniz

Projects: UV RADIATION: FRIEND OR FOE?
BEES FOR THE FUTURE

5 teachers: Cecília Ferreira, Elisabete Chaves, Fernanda Freitas, Marco Ribeiro, Teresa Nóbrega

Country: **Portugal**

Location: Madeira Island, Madeira

Teacher testemonial:

"It is in the combination of knowledge and in the valorization of each one's abilities, that teaching-learning has to happen, in order to have a more just society and more aware of its humanity." – Elisabete Chaves

"As a teacher, these are projects and activities that motivate me to continue in the profession. It was with great satisfaction and pride that I observed the "growth" of the students throughout the year, the increase in their self-confidence and autonomy." – Fernanda Freitas

"As a teacher it was enriching to see the pride of the students in carrying out the tasks, as they are doing a collaborative work in the collection of data with other colleagues from the school in the country and abroad." – Marco Ribeiro

Student testemonial:

"There was a blossoming of creativity. The students were very enthusiastic about Personal Geography." – Teresa Nóbrega

"Phrases of some students, during mind mapping: "Fun, not boring"; "Be different"; "Spread awareness"; "Be active"; "Be present"; "Learning sciences in a fun way"." – Cecília Ferreira


TENS O MUNDO
AS COSTAS

Escola Secundária da Ribeira Grande

Projects: IMPORTANCE OF THE FAMILY BUDGET
PROMOTION OF GENDER EQUALITY
COMMUNITY AND ECOLOGICAL MASKS
3 teachers: José Alves, Maria da Conceição Ferreira, Pedro Sousa
49 students

Country: **Portugal**

Location: São Miguel Island, Azores

Project link:
COMMUNITY AND ECOLOGICAL MASKS, ANTI COVID 19

Teacher testemonial:

"The application of the IDverse methodology to teaching proved to be very important for my performance and reinforced my teaching skills in teaching." – José Alves

"The work done on this project was very meritorious and rewarding. The dynamics and predisposition of the students was evident, which in these projects, catalyzes and motivates even more, everyone, including me. These are projects that must be part of one of the usual and recurrent tools of the national education system." – Pedro Sousa

Student testemonial:

"We like to work in this mode of teaching, it allows us to think"

"The students were surprised, due to the fact that they had to address topics of great relevance to society in general."

"With our project, our group concluded that this action is gratifying, not only in terms of contributing to the environment, but also with the fact that it is a good experience for us because it contributes to the growth of our skills and competences."

2nd Primary School of Voutes

Project: THE CITY OF THE SUN

Country: **Greece**

Location: Crete Island

In the 2nd Primary School of Voutes we implemented a design thinking approach to discuss problems of our island (Crete) and find solutions. Our project was called "The city of the Sun" and was created by pupils of the sixth grade in the courses of Informatics, Physics and Arts.

The pupils were inspired by their place and created a city that exploits the main source of life on our island, the Sun.

The city was designed in Tinkercad, a3D Online Tool. The pupils designed every part of the city, houses, parks, traffic lights, many trees and flowers. Also, a sign to inform city residents about the temperature and a car charging station. Each piece of the city was printed on the 3D printer of the school.

In order to convert solar energy into electricity, a solar collector was used. For all the automations of the city, the Arduino microcontroller and the Scratch4Arduino software (S4A) was used. For moving to the city pupils built a rechargeable vehicle using the Lego WeDo2 training package and programmed it using the WeDo2 software.

In order to sensitize the local community to the use of renewable energy sources the pupils presented their idea to the 9th Student's Digital Creation Festival and to local media.

Project links:

THE CITY OF THE SUN

5th Primary School of Rhodes

Project: EARTHQUAKE AND VOLCANOS – I am not afraid of earthquakes, I am an Earthquake Specialist

Teacher: Papazachariou Eirini Anthi

18 students

Country: **Greece**

Location: Rhodes Island

Project links:
Students' projects
Teacher's web page
Brief presentation of the program

The pupils of the C2 class of the 5th Primary school of Rhodes participated in a Program called Open Schools for Open Societies (OSOS - IDiverSE – STEM) with the title "Earthquakes and Volcanos: I am not afraid of earthquakes, I am an Earthquake specialist".

This project's basic aim is to raise consciousness and awareness and prepare students in case of an earthquake. In addition it aims to help them become acquainted with measures that should be taken before, during and after the end of an earthquake. The project's main objective is to enable children a) to get to know the phenomenon of earthquakes, b) to confront and handle their feelings regarding earthquakes and c) to learn ways to successfully protect themselves from earthquakes.

This project is divided in four units: 1) Feel, 2) Imagine, 3) Create, 4) Share. It started with a journey in learning about earthquakes, people's first beliefs about earthquakes and stories from greek mythology. They became acquainted with scientific information about Earth's structure, the mechanism that makes the Earth tremble, the rocks of solid crust that break, the crevasses and volcanos. Subsequently the project focuses on the preparation and the prevention measures before, during and after an earthquake. Getting to know about earthquakes mostly with an experiential way and with the use of lab experiments, urged students to have a positive disposition towards research. They acquired the appropriate information about earthquakes and volcanos and furthermore they realized that they must keep calm during an earthquake. To end with, the program was concluded with the construction of two seismographs: a) a simple seismograph from recyclable material, and b) a second seismograph which resembled more a real seismograph. The first seismograph was the motivation for the construction of the second.

High School of Vamos

Project: RESTLESS EARTH

Country: **Greece**

Location: Crete

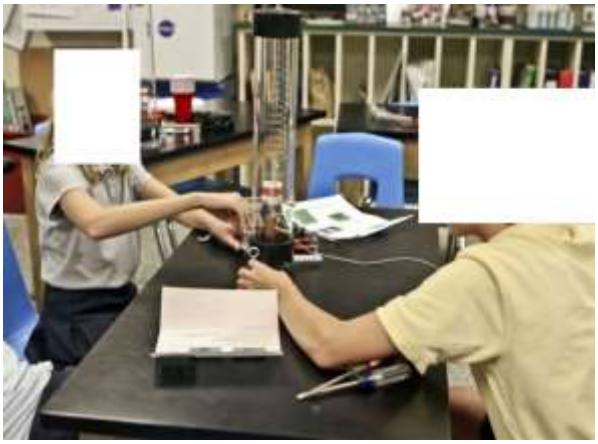
Our school implemented a project on the seismic activity of Crete and its impact on the Minoan Civilization that thrived on our island from c. 2700 to c. 1450 BC. Our students studied the origin of earthquakes and their frequency, making use of a TC1 seismograph that we received from the Institute of Geodynamics of the National Observatory of Athens.

The students used the seismograph, learned how it works, and processed the data it generated during the whole year. To further understand the phenomenon, we also visited an earthquake simulator located at the Natural History Museum of Crete. Using the simulator, the students had the opportunity to feel real, large-scale earthquakes from all around the world. Through this project, students had the opportunity to better understand earthquakes as well as the role modern technology plays in preparing and monitoring them.

Student testemonial:

X.A: "*We are very happy we participated in this program. Never before did we have a chance to see and work with a seismograph or have the opportunity to feel first-hand what a really big earthquake feels like. It was a great experience and very useful to us, as we learned what we have to do if an earthquake occurs.*"

Δ.Z: "*Even though we have experienced many earthquakes in Crete, we always forget what we are expected to do so. By participating in this program, we had the opportunity to learn about taking precautions and how to react during an earthquake through hands-on activities. It was very interesting to work with the data from our seismograph and calculate the epicenter and the magnitude of earthquakes.*"



Primary School of Nenita

Project: RESTLESS EARTH

Country: **Greece**

Location: Chios Island

The 5th Grade of the primary school of Nenita in Chios implemented an IDiverSE project following the 'Restless Earth' activity to study earthquakes and underground activity.

During the project the students had the opportunity to recall past knowledge and record their own experience with earthquakes. They studied the phenomenon through multiple viewpoints, they created their own tectonic plates models and engaged in drills to prepare for a potential earthquake.

Our students used a real seismograph and they also designed their own model of a seismograph using legos, which they presented it in the "Athens Science Festival 2019".

Project links:

Seismograph video

Student testemonial:

"I liked studying earthquakes and learning about how seismographs work. I particularly enjoyed creating our own seismograph with legos." – Anna (11 years old)

"Now that I know more about earthquakes, I feel I am less scared of them." – Thodoris (11 years old)

"The experience of making our own seismograph was unique!" – Argiro (11 years old)

Experimental High School of Heraklion

Project: VOLCANOES AND EARTHQUAKES IN GREECE
EARTH'S CLIMATE AND CLIMATE CHANGE
IN THE PATHS OF SCIENCE
2 Teachers: Alexandra Bakou, Maria Eleftheriou, Nikolaos Psaroudakis

Country: **Greece**

Location: Crete Island

Teacher testemonial:

"My participation in the project has helped me to explore scientific issues with a creative and research mode in the classroom. Students sought information and provided answers to scientific problems on topics not included in the school curriculum. The students also designed and performed experiments with simple materials. They learned to cooperate with each other and present their views with arguments. They have acquired the skills of creativity and critical thinking in scientific matters. I worked effectively with other teachers and we exchanged ideas about the project." – Alexandra Bakou

"IDiversE program gave us the opportunity to work interdisciplinary and to combine different activities with our pupils. The tool of personal geography was very interesting and pupils found it very creative. " – Maria Eleftheriou

Project links:

VOLCANOES AND EARTHQUAKES IN GREECE
EARTH'S CLIMATE AND CLIMATE CHANGE
IN THE PATHS OF SCIENCE – Awareness of students and the local community on issues of ecology, environmental destruction and climate change

IES San Juan de la Rambla

Projects: TECHNOLOGICAL RECYCLING

1 teacher: Wilme Rodríguez

18 students

Country: **Spain**

Location: Santa Cruz de Tenerife, Canary Islands

IES San Juan de la Rambla is a public school located in Santa Cruz de Tenerife. In this school, one teacher has been involved in the implementation of the iDiverSE methodology during the 2018-2019 academic year.

Since it is a secondary school, the teacher has decided to design his own project based on the iDiverSE methodology but more in line with the training of his students, their academic level and the specific needs of their environment.

In this project have participated 18 middle school computer science students. The problem identified has been the recycling of mobiles. The students identified a problem of accumulation of technological waste and decided to carry out a campaign in the neighbourhood for the recovery of mobiles. The students organised an open day at the school so that the neighbours could bring their old mobile phones and take part in a recycling or reuse process. In the campaign, useful technological components for other devices were extracted, test mobiles were identified for the programming and design workshops, and an exchange of parts was also made between members of the neighbourhood.

The students involved in the project have valued very positively the implementation of technical knowledge to respond to a social problem close to them. There is no graphic evidence of this project.

IES La Orotava-Manuel González Pérez

Projects: STUDENTS STUDY VOLCANOES + GOC TENERIFE

3 teachers: Sonia Fleitas, María Concepción Molina, Héctor Saavedra

50 students

Country: **Spain**

Location: Santa Cruz de Tenerife, Canary Islands

IES La Orotava-Manuel González Pérez is a public school located in a semi-rural area and very close to the historical centre of La Orotava.

Several teachers of this school engaged to the methodology of iDiverSE because of a multiplier event of the project. As soon as they knew the philosophy of the project, they thought of several ideas to carry it out in their school.

At the beginning, during the 2018-2019 academic year they implemented the iDiverSE activity STUDENTS STUDY VOLCANOES with 50 students in the 2nd year of secondary education, i.e. students aged 13-14.

During the 2019-2020 academic year, they decided to design a more concrete project with 28 students of the middle grade of tourism. The students of the superior cycle of Animation, social-cultural and tourist aimed to open the island to the outside through the creation of a WEB that contains gastronomy, leisure and culture of Tenerife, giving to know the island in different ways, with many experiences.

The name of the project is GOC Tenerife and this is a web dedicated to tourism, culture and leisure and gastronomy in Tenerife.

Project links:

STUDENTS STUDY VOLCANOS

GOC TENERIFE

Short video about the project

IES Mencey Acaymo

Project: APADRINA

1 teacher: América Tejera

40 students

Country: **Spain**

Location: Santa Cruz de Tenerife, Canary Islands

IES Mencey Acaymo is a public school located in Santa Cruz de Tenerife. In this school one teacher has been involved in the implementation of the iDiverSE methodology during the 2018-2019 academic year.

Since it is a secondary school, the teacher has decided to design his own project based on the iDiverSE methodology but more in line with the training of his students, their academic level and the specific needs of their environment.

In this project have participated 40 students in the 3rd year of secondary education, i.e. students aged 14-15. The students have decided to address the problem of invasive plants because the presence of alien species is one of the main threat factors and the second cause of habitat loss worldwide.

The objective of this project is to use service learning to, while acting on a specific area of their territory to eradicate an invasive silver, actively involve the entire population in this project, culminating in a citizen participation activity that is coordinated by the students of the school for the eradication of the invasive plant in the municipality. The central axes of the project are the protection of nature, the improvement of the environment, the protection of the natural heritage of the Canary Islands and the intervention in the environment. There is no graphic evidence of this project.

In the academic year 2019-2020 the teacher of this school had planned to carry out the iDiverSE activity "MARINE LITTER IN MY BEACH" but due to the problems caused by the pandemic they have not been able to finish the activity. Possibly, they will carry it out in the next academic year.

IES El Rincón

Project: OUR RESTLESS EARTH

2 teachers: Mª del Carmen Rodríguez + Angeles Zerpa

15 students

Country: **Spain**

Location: Las Palmas de Gran Canaria, Canary Islands

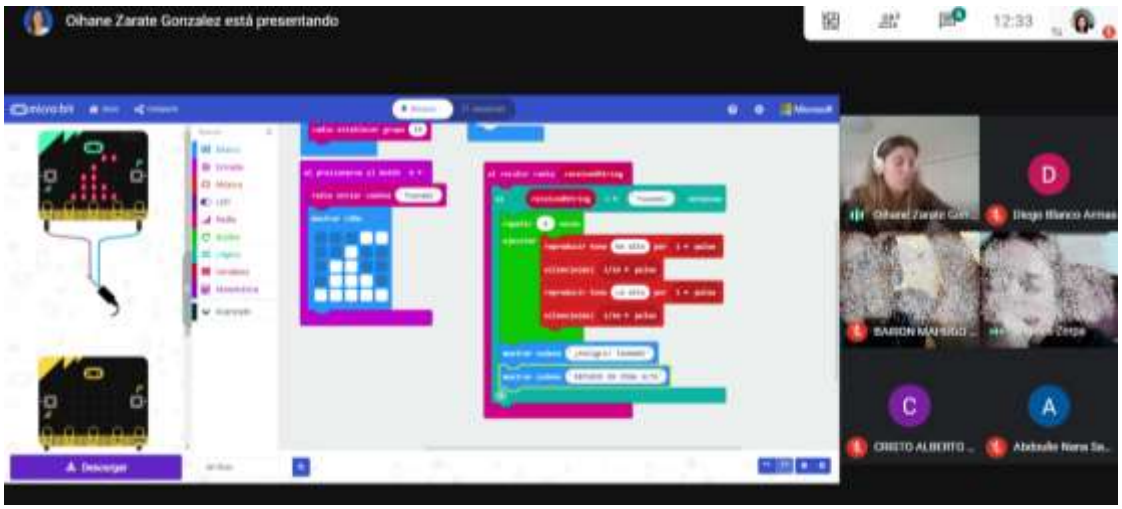
El Rincón Secondary School is located in the city of Las Palmas de Gran Canaria (Las Palmas, Spain). In the school, students can study secondary education, baccalaureate and higher and medium cycles of Vocational Training of the Computer and Communications Family.

IES EL Rincón has implemented the iDiverSE activity OUR RESTLESS EARTH with 15 students in the 4th year of secondary education. The students chose this activity because of the relevance of the topic to living on a volcanic island. In the first phase of the activity the students elaborated a work of information search and research in relation to the seismic activity in their island and the existing warning systems to warn the population in case of an earthquake. In a last phase, already in the middle of the pandemic process in Spain, the students decided to create a city alert program with the Micro:bit board and its programming language MakeCode.

For this purpose, the team from the University of Deusto, partners in the iDiverSE project, offered a master session for the students through a video conference system.

In the session, students learned the basic programming fundamentals and then they, on their own, elaborated a citizen alert system in case of earthquakes with the learned knowledge. The students were very motivated throughout the activity and valued the practical Micro:bit workshop very much. Furthermore, the workshop helped them to think of new and more advanced solutions to protect society in case of earthquakes.

The teachers involved in this project where very enthusiastic with the ideas their students developed and have valued very positively the learning process they have followed through this activity.



IES Arxiduc Lluís Salvador de Palma

Projects: ENERGY INTELLIGENCE
1 teacher: Cristofol Jaume Tugores
130 students

Country: **Spain**

Location: Palma de Mallorca, Balearic Islands

Project links:
ENERGY INTELLIGENCE

It is a secondary school that is located in the centre of the city of Palma de Mallorca, Balearic Islands. This school was one of the first in Spain to participate in iDiverSe.

Most of the school's teachers were trained in the iDiverSE methodology and have made small changes in their teaching style.

Finally, they decided to carry out a project at school level where they reflect the philosophy of iDiverSE and OSOS in a real problem of their environment.

IES Arxiduc has carried out a project to eradicate energy poverty in its local community. To this end, they have developed an educational project involving students in the 3rd year of secondary education and students in the Higher Technical Degree in Electrotechnical and Automated Systems.

A project that starts from the students' knowledge to make society literate in energy saving and in the management of electricity consumption in homes. Not only have informative talks been held, but also a popular inspection has been carried out to find out the energy consumption of each home and solutions have been proposed for energy saving, changing installations, etc.

It is a project that starts from a real need of the students' environment and that from the own resources of the centre, moreover, from the knowledge acquired from the students, a better solution has been offered to the community.

This project has involved 12 teachers, although a specific professor has led the project in iDiverSE, 130 students from different educational levels, 45 family, 60 neighbours and 150 people from companies and 25 administration.

IES Arxiduc thanks to this project have achieved a high degree of innovation and openness and they have already established cooperation with community stakeholders. In fact, given the success of their project they have published it in the international conference EDULEARN 2019 that took place in the city of Palma de Mallorca.

San Felix de Ortuella

Projects: BEES ON THE FUTURE + OUR RESTLESS EARTH
2 teachers: Olaia Berinkua, Tomas Medina
100 students

Country: **Spain**

Location: Ortuella, Basque Country

Project links:
OUR RESTLESS EARTH – video of the developed projects

San Felix School is located in Ortuella, Biscay. It is not an island environment, but it is a school interested in the iDiverSE methodology and concerned with the issues addressed in the IDiverSE activities. In San Felix School, 2 teachers have been involved in the implementation of iDiverSE. One teacher has proposed the iDiverSE activity BEES ON THE FUTURE to 5th and 6th grade primary school students. A total of 100 students have carried out this activity. In a first phase they have studied the importance of bees, the pollination process, they have inquired about the protection of bees in their environment and finally they have carried out a Scratch project to make society aware of the importance of protecting bees.

In the last phase, since we were already immersed in the pandemic and there was no face-to-face class, students from each level had a video conference session presenting their final projects with Scratch. In the following images you can see the large number of students who attended these sessions.

Primary school students were very active in the development of the activity and were enthusiastic about the proposal to create an awareness campaign with Scratch.

On the other hand, secondary school students carried out the iDiverse activity OUR RESTLESS EARTH. In the first phase of the activity students elaborated a work of information search and research in relation to the seismic activity in Spain and in other countries and the existing warning systems to warn the population in case of an earthquake. In a last phase, already in the middle of the pandemic process in Spain, the students decided to create a city alert program with the Micro:bit board and its programming language MakeCode. For this purpose, the team from the University of Deusto, partners in the iDiverSE project, offered a master session for the students through a video conference system.

After the session, the students made a video explaining the seismic activity in a specific region and the citizen alert program they have designed. The projects created are really interesting.

Students have shown great interest during all phases of the activity and have learned new concepts applicable to their environment. The effort made by these students in carrying out the activities in English, which is not the official language, should be highlighted.

The teachers involved in these activities have positively valued the adaptability of the activities to the remote teaching situation and have been able to include both activities within their teaching plan.

Esclavas SC Fátima

Projects: BEES FOR THE FUTURE
1 teacher: Itziar Rodríguez
50 students

Country: **Spain**

Location: Bilbao, Basque Country

Esclavas Sagrado Corazón de Fátima is a concerted school located in Bilbao, Vizcaya. It is not an island environment, but it is a school interested in the iDiverse methodology and concerned with the issues addressed in the IDiverSE activities.
This school has mainly involved a teaching staff in the implementation of the iDiverSE methodology. These teachers have selected the iDiverSE activity BEES ON THE FUTURE to 6th grade primary school students.

Project links:
BEES FOR THE FUTURE:
Project 1
Project 2

A total of 50 students have carried out this activity. In a first phase they have studied the importance of bees, the pollination process, they have inquired about the protection of bees in their environment and finally they have carried out a Scratch project to make society aware of the importance of protecting bees.
The students have shown great motivation in the development of the activity and several have recognized that until now, they did not see the need for bees and that from now they would try to protect them and value their role in nature more. The teachers have also been satisfied with the results of the students and with the methodology of the activity.

Annexes

Annex 1 – Example of a Personal Geography Map

Personal geography map created by created by Eleftheria Tsourlidaki. See the full example here.

Annex 2 - IdiverSE Activity Template

Name:

Main topic(s) that includes:

Brief description (1 to 2 paragraphs):

Subject domain(s):

Keywords:

Didactical hours:

Links to important resources (ex. research activity platform):

Big Ideas of Science:

Choose the Big Ideas of Science to which this activity is related and write a brief explanation explaining the Intermediate and Small ideas that are involved. Erase the figures that don't apply to this activity. For an overview of the Big Ideas of Science and their progress from the Small and Intermediate Ideas, please visit the following mindmap.


1. Feel

Description

Main skills being developed:

Useful tools and resources:

Accompanying files:

2. Imagine

Description:

Main skills being developed:

Useful tools and resources:

Accompanying files:

3. Create

Description:

Main skills being developed:

Useful tools and resources:

Accompanying files:

4. Share

Description:

Main skills being developed:

Useful tools and resources:

Accompanying files:

Annex 3 – Activity Sheet | Create your own trail on Wikiloc

Goals:

- Motivate learning by discovery;
- Recognize elements of the natural ecosystem and the urban landscape
- Identify sustainability indicators in the territory and landscape
- Use available applications for science and learning;
- Streamline knowledge sharing through collaborative work.

Stage 1 | Before going to the field

Formation of groups

1. Division into groups so that, in each group, one of the elements dominates the new technologies and has a mobile phone with mobile data that allows access to the application (preferably one or more powerbanks per group as the mobile phone will be connected all the way).
2. Explore the "wikiloc" application
3. Use a smartphone with camera and internet (data) and GPS.
4. Download the "wikiloc" application
5. Register
6. Confirm your registration
7. Click on the "record track" step.

Notes: You must have GPS on the route. You must pause recording at stops.

IMPORTANT:

If you like, install applications that help you identify the flora:

ex: PlantNet | Plantsnap | Arbolapp | invasoras.pt

Plantnet

Plantsnap

Arbolapp

Stage 2 | Create a trail

Walk the trail using your 5 senses. Capture images and / or short videos of what you see and atract you. Think that you will create at least 4 stations /stops with different themes.

Use the stops to photograph:

1- the landscape - photos with different orientations, integrating the various existing elements, natural and / or human, such as geology, relief, vegetation cover or other forms of occupation of the territory: the settlement, streets, circulation / mobility commercial / industrial areas, residential, leisure areas, parks and gardens, green spaces, etc.

2- a detail that caught your attention in that place: an animal, a plant, a leaf, an indigenous species, an exotic species, a drinking fountain, a lake, a pond, a nest, an animal, a stone, soil, a garden bench, a statue. Or even a bus stop, a bicycle park, a traffic light, a monument, a theater, a residents' association, a painting (urban art, etc.

It can also be a threat to the sustainability of the site: erosion, invasive species, etc.

The main objective of at least some of the photographs is to mark points on the trail that may constitute stations dedicated to different themes.

Stage 3 | Create and share the trail

- Collaborative work | sharing observations

Each group download and share their photos. They can design the tracks individually, but collaborative work is recommended. They will be able to consult the internet to document the observed aspects.

SUGGESTION

If you created a group on whatsapp it is suggested that the trail editor open your whatsapp on the computer, so that you can quickly access all the photos shared by the group.

To access whatsapp web, on your computer, go to https://web.whatsapp.com/

Trail edition

In the classroom, use a computer with internet to view and edit the track you recorded. Go to https://en.wikiloc.com/ and login with the user you created on your smartphone

After entering, look for “Your trails” in the upper right corner and edit your trail:

1. Write information about the route in the description space: weaknesses, strengths, opportunities and threats; or: what you liked best and what you liked least. You can also leave some suggestions or advice for those who will undertake the trail / route.

2. Edit the caption for each photo and provide relevant information related to what was photographed. Example: history of a photographed element; information on vegetation cover and biodiversity; geological aspects; etc.

3. Record the complete track and share.

Create a Track on the Computer

1. Upload your track and choose the option “Draw your trail by hand”
2. Choose the starting point of the route
3. Click on the map at the beginning of the route and trace the route and add stations
4. Edit the track and stations (see editing the track)
5. Publish and share the created trail