

The Guidance Pack

Wittenborg University of Applied Sciences

Wittenborg Research Centre

In Collaboration with Project Partners and School
Teams

Eco-Systems of Open Science Schooling: Making open science
schooling a reality for secondary school students

2020.10.01 – 2022.09.30



With the support of the
Erasmus+ Programme
of the European Union



The Eco-Systems of Open Science Schooling Consortium

Knowledge Partners



Practice Partners



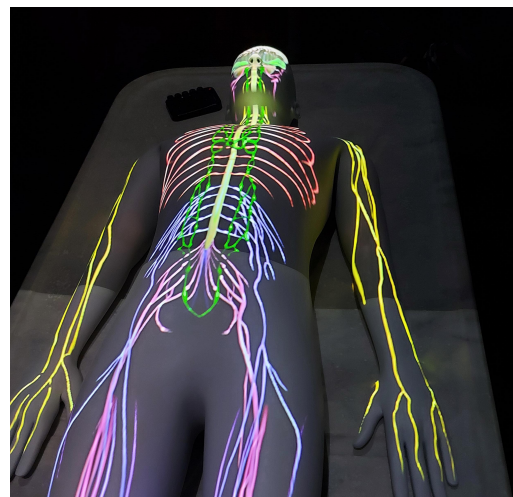
Quality Partner



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Part I Overview



1. The Guidance Pack is created for **science teachers** and **students** in secondary school.

2. The material in this guide includes a variety of narrative forms, such as texts, videos, illustrations, interviews and authentic cases collected throughout the project.



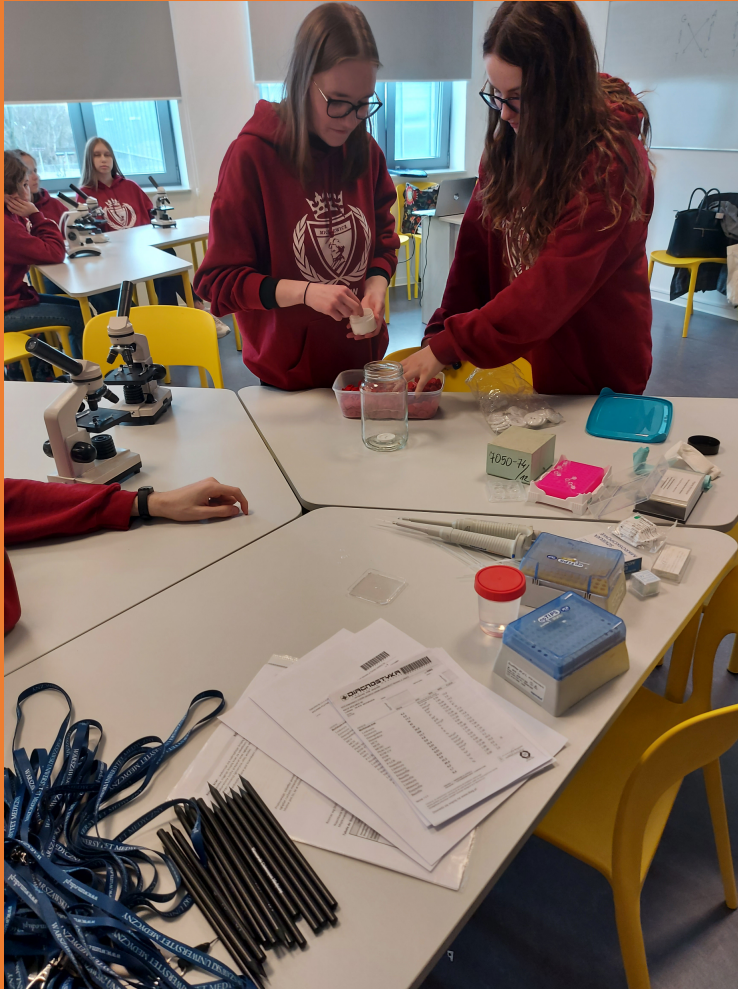
3. All the elements of the Guidance Pack are produced alongside the project and in direct presentation of science teachers' and students experience.



4. The Guidance Pack aims to provide science teachers with methodologies, inspiration and good practices to take the first steps to establish open science schooling activities in the community.

5. At the same time, it will guide the schools towards establishing permanent eco-systems of science collaboration with relevant science and other resources in the community.

6. The Guidance Pack will be available on the project's website – www.eco-OSS.eu



What makes this
Guidance Pack
innovative?

It reflects the deep and
immersive practice of the
students themselves

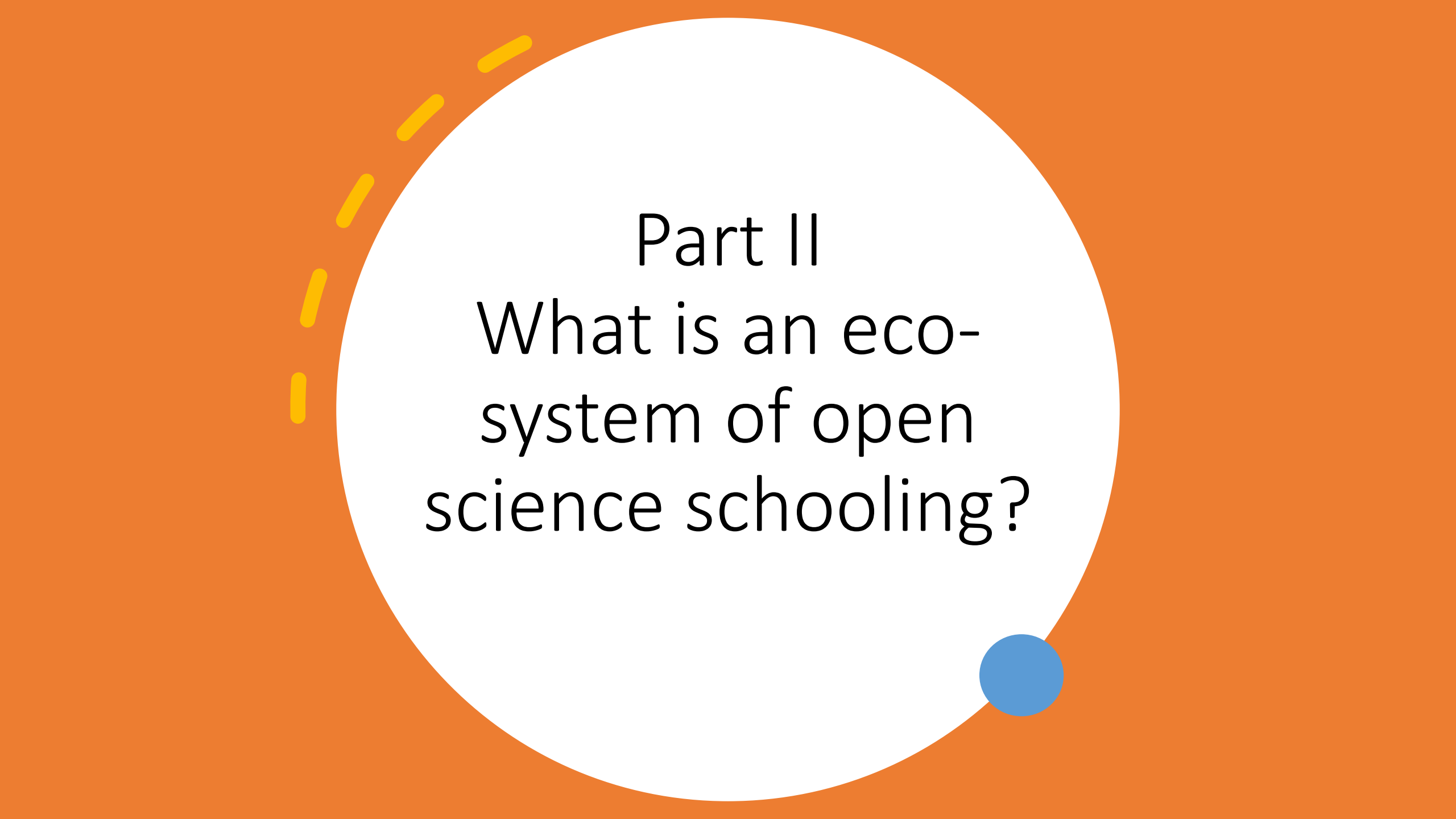
-It offers science teachers
open science schooling in
the full and true version, not
punctual or superficial out
of school activity

-It provides secondary
schools with realistic ways
of developing eco-systems
of science learning in their
community

-It guides the science
teachers and schools to
integrate open science
schooling and science
missions without waiting for
the entire educational
system to change

-It provides the schools with
a method to continuously
expand and deepen the
collaboration with science
resources in the community
to make it more and more
easy for science teachers to
establish open science
schooling for their students

It provides science teachers
with the extremely
attractive game-like science
missions methodology,
known to be a very strong
engager of students not
interested in science and
science learning



Part II

What is an eco- system of open science schooling?

Introduction

As strongly recommended by the European Commission we are trying to re-think and fundamentally innovate science education in secondary school, as very many young people grow a strong resistance to science education precisely in secondary school and in their teenage years. The most efficient and attractive innovation of science education is precisely open science schooling.

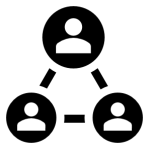


The open science schooling (OSS) approach is based on young students learning science through science missions carried out in the communities. This is where the *eco-systems* come in. If open science schooling is to be made a reality and yield the expected innovation, then the student teams' science missions must be realistic, possible and efficient.



The problem is that student teams cannot be expected to build up important collaborative infrastructures each time they set out to accomplish a science mission. For the student teams to act successfully in the community, the schools also need to act successfully in the community.

The basic *science and community resources* should therefore be permanent resources the students can tap directly into and get support from in their science missions.



Building on Previous Project Success

The current Eco-OSS Project, "Making open science schooling a reality for secondary school students" co-funded by the European Commission under the ERASMUS+ Programme, is built upon the success of a previous Eco-OSS Project entitled "Fostering Re-engagement in Science, Learning through Open Science Schooling".

This previous project took place between September 2017 and February 2020 and involved partners from Finland, Catalonia, Romania, Poland, Greece, Portugal, Lithuania and Israel. It was funded by the European Commission within the Erasmus + KA2, Cooperation for Innovation and Good Practice Exchange program. It aimed to engage students in REAL-LIFE science challenges in the society and to engage schools and students in practical science collaboration with resources in the community, including research, science, innovation and social resources and stakeholders.

This project resulted in the dissemination of A Guide to Open Science Schooling in Secondary Schools; The Open Science Schooling Movie, a student narrative document entitled "*Young Co-Creators: Students' Personal Documentation of their OSS Journey*"; and a policy document entitled "*Integrating Open Science Schooling in Secondary Schools – Policy Recommendations*".

Further information on the progression and completion of this project can be found on the project website: <https://openscienceschooling.eu/>



What is an eco-system of OSS

As stated by the Commission, such infrastructures of science resources must be readily available to teachers and students.

These permanent open science schooling resources are called “eco-systems”, as the resources are expected to be a living organism of a wide range of different resources – and therefore adjusting and changing according to the needs of the students’ science learning.

Examples of such eco-system players are:



Private companies with science-related activity



Public authorities with an interest in science learning and science in the community



Various forms of science educations and research bodies, private or public



Open science centers in the community or region



Entrepreneurial hubs engaged in science in various ways



Citizens’ organizations working with science-related challenges in the community, such as science in society

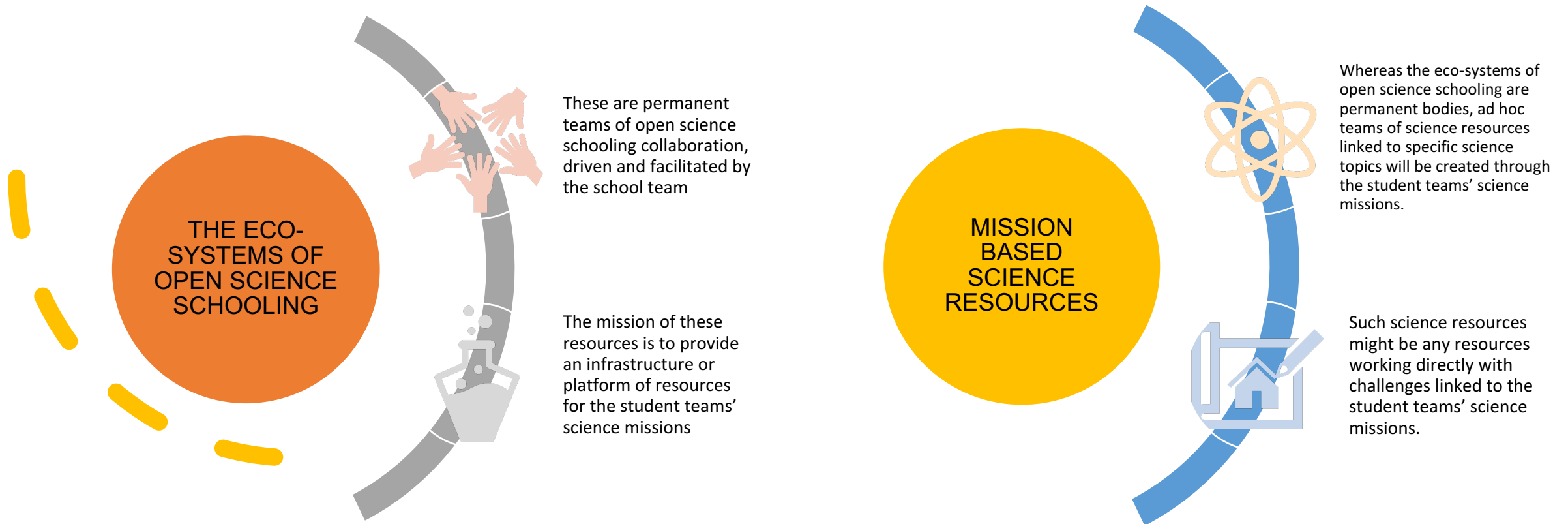
Role of community

- In the Eco-systems of Open Schooling project “community” should be understood in its widest sense: local physical community, the region, various science communities and virtual communities.
- The globalized world and the 21st century students do not separate these worlds in the way the present educational systems do.
- They work with the physical and virtual communities as one world – and local science engagement might very well include considerable virtual social networking.
- Therefore, in this project the student teams worked in different forms of communities in the two long science mission phases. This enabled them to experience different types of community members and tap into rich community resources.



Community and science collaborators

- When secondary schools and student teams start acting in the community, they will collaborate with a wide range of people and institutions. These community collaborating resources have many names, so to speak.
- Therefore, some clarification might be useful. In the field of “eco-systems of open science schooling” - where schools become agents of science collaboration in the community and students become agents of science missions in the community – there are basically two types of people and institutions collaborating with the schools and the student teams:



Students' perspective on eco-systems of OSS

"Exactly like in our biology class, uh, for me ecosystem means to be connected with all around us. I understood the ecosystem as a whole."

"I think it is the same as partnership with each other."

"For me, it means that we should focus on our actions, closest surroundings and generally, what we could do to preserve and maintain the natural environment around us. Also, looking wider, it could be describing all the processes that take part in maintaining the balance in nature, like biodiversity or people's actions."

"Well, ecosystem for me is basically a collection of all the elements of my community, all the faculties, all the people, all the driving factors behind improvements in our environment and movements in our economy, even for a small town like us, every little part that any person plays, is a part of my answer. I think every little part of it, it's, it makes up the whole."



Teachers' perspective on eco-systems of OSS

"Eco-system means the collection of all people in the community and the work they do in and out of it, whether science-based or not."

"...as the creation of interrelationships between those who learn and those who teach."

"In general, ecosystem means the whole environment. At first it was strange but then thought it could be the ecosystem of education with all components."



"I understand the 'eco-system' as a group of entities that collaborate, help each-other to achieve their goals."

Schools' perspective on eco-systems of OSS

"I think it is all our community, the environment of our community? And of course, we in it."

"For our school, however, the eco-system is the necessary resource to create open scientific opportunities and access to modern resources for students in the study of science, of course through their permanent collaboration with science teachers to the detriment of traditional teaching."

"This is kind of a multi-task or how to tell; the school and environment of the school, all of them are involved to education activities. For me, the school is in the middle of educational activities, but it is not alone and all other collaborators are related to it."

"OK, idea started because, UM, the school wanted to come to start the cooperation with the Cardinal Wiszynski University on one hand to motivate students for harder work, but also to motivate them to gain some knowledge and to get some level right. Higher level success is OK, mostly in terms in terms of enhancing their knowledge about biological studies, science. "



Partners' perspective on eco-systems of OSS

The science is the main thing of Ecosystem. Ecosystem is living and non-living things on earth, living in a harmony. OSS aims to maintain this harmony. Our lives also depend this system. It is our duty to maintain this system.

"Yeah, meeting with it for the first time and it's a name that may mean for me various things. I'm a biologist, so it's a familiar term, yeah? This means something that other the plants, animals, bacteria together with humans, etc. But I don't know eco system of the OSS, I don't know what to put into that."

"An eco-system is an area in which various parties or organisations can interact with each other and exchange ideas. A school as an ecosystem symbolizes such a unified system led by teachers and students.

"For us as a partner, the ecosystem in the school means the ability to develop the new climate and culture in the classrooms, to accommodate different learning styles, and to acknowledge and adjust teaching to suit our students' moods, emotions, and motivations."



Schools as drivers of change

Secondary schools need a fundamental change: from traditional classroom (teacher based) to real-life (open schooling based) learning, through which the students acquire the capacity to act in society, to take initiatives and to manage constant change. In normal school education, it is about KNOWING. When innovation engagement is introduced, it becomes about ACTING and CHANGING.

Innovation engagement expands the learning to include changing things in the realities around us. Innovation interest invites the students to interact with how things are. As this is what Schools as drivers of change will do: practical real-life engagement.

This is called capacity to agency, capacity to be change agents. The capacity to agency can only happen if the SCHOOL BECOMES A CHANGE AGENT - A DRIVER OF CHANGE

Key players



Student Teams

- ❖ openly and voluntarily recruited
- ❖ Include students with strong needs for community changes (minorities, students with special education needs, low socio-economic status, etc.).
- ❖ Drive community change missions



School Teams

- ❖ Help the school act in the community to create a basic platform (an “eco-system”) for the student teams
- ❖ Help students identify needs for change and innovation in the community
- ❖ Assist the students through their missions



Community teams and mission collaborators

- ❖ Community team is a permanent group of collaborators with school teams
- ❖ Mission collaborators assist students in specific projects and missions

Schools as drivers of change

It is a very innovative approach to the traditional classroom learning, because:



STUDENTS become CHANGE AGENTS through new open schooling and taking action



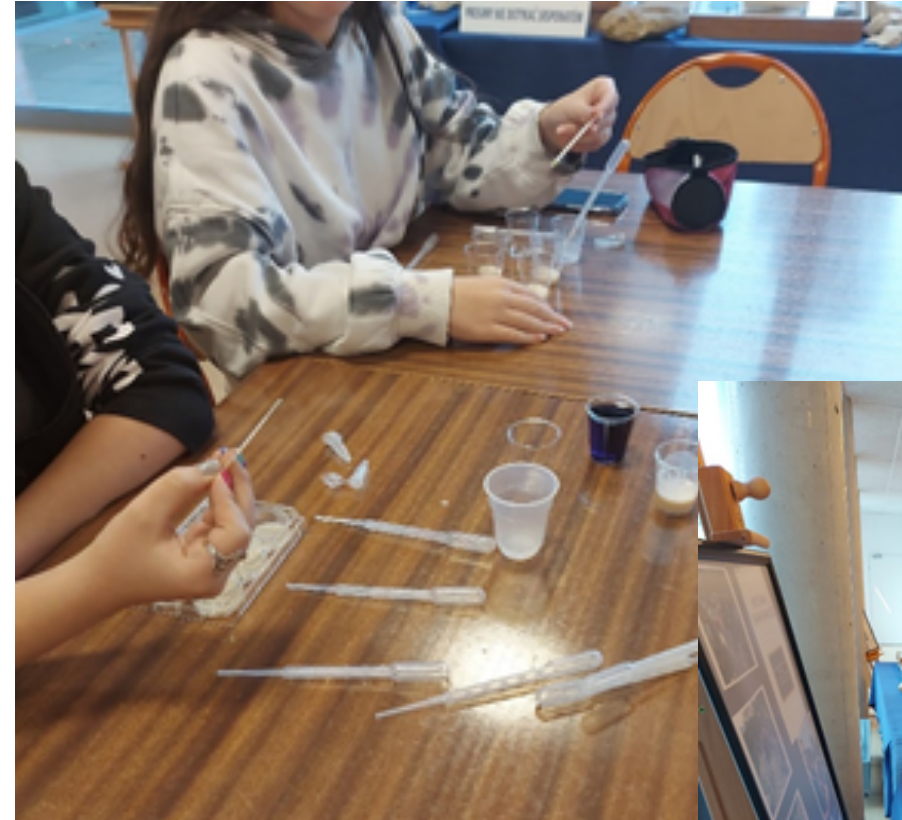
SCHOOLS open the doors to REAL-LIFE LEARNING



SCHOOLS become AGENTS OF WELL-BEING AND CHANGE in the community



SCHOOLS are ENGAGED in the project at management level, not only at teacher level.



Based on the data collected from students, they learned new knowledge through the missions and gained new skills.



1. knowledge in the field of **psychology** including knowledge on emotional intelligence, emotions, animal behaviour, neurology, being one-self



2. **research methodology** knowledge: principles on conducting research (including retrieving fossils)



1. **COMMUNICATION SKILLS IN GENERAL (COMMUNICATION, COLLABORATION, TEAM BUILDING)**



2. **COMMUNICATION SKILLS USING ENGLISH LANGUAGE**



3. **SOCIAL SKILLS (EMPATHY, SOCIALIZATION, CONFIDENCE)**



3. **environmental** knowledge (including biodiversity, sustainable agriculture, ringing storks, protecting planet and environment)



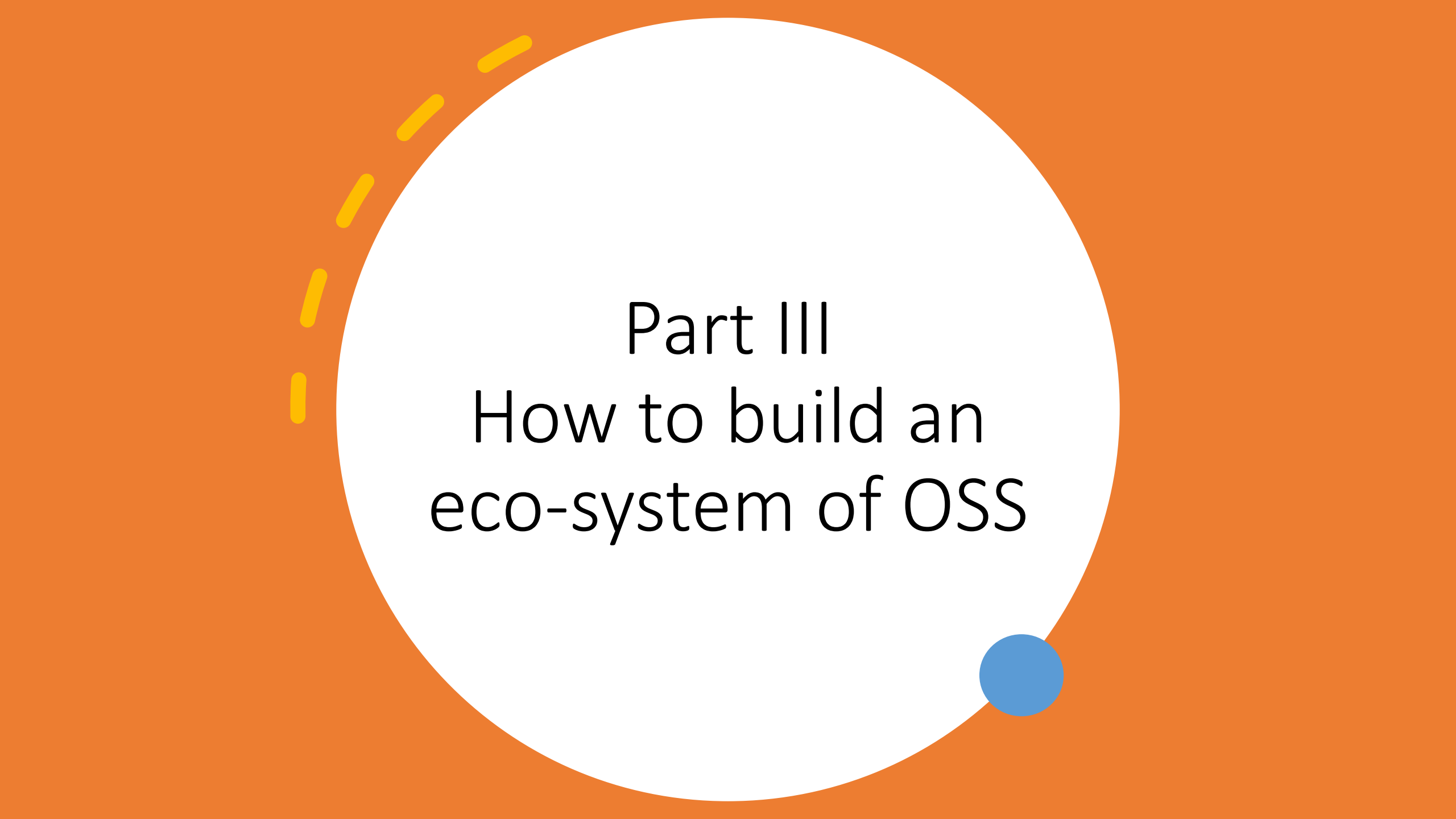
4. knowledge related to **art and design**



4. **PROBLEM-SOLVING SKILLS (INCLUDING CREATIVITY)**

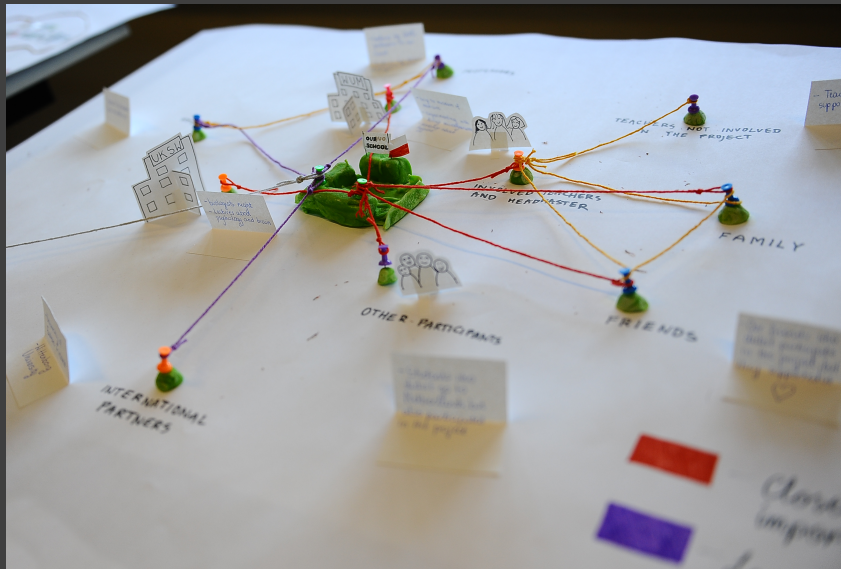


ICT SKILLS INCLUDING



Part III

How to build an eco-system of OSS

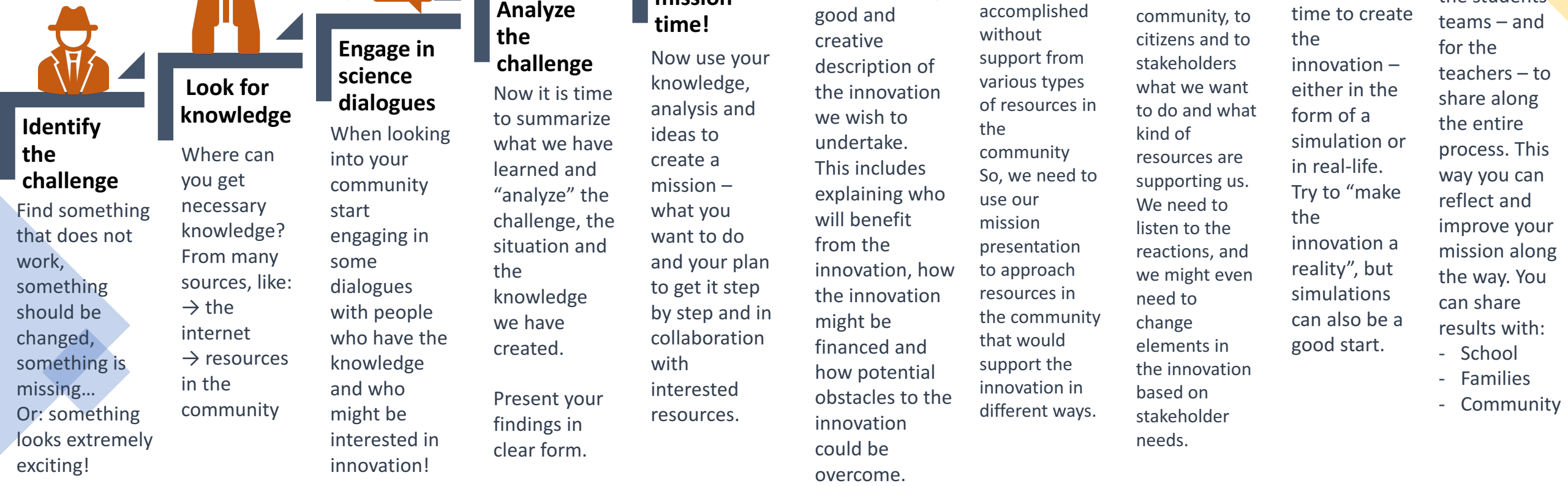




What is a mission?

- Missions are projects carried out in real-life and in collaboration with real-life science players.
- The term “mission” is much stronger: it refers to strong intentions, the will to accomplish and the ability to critical engagement.
- The term “mission” is used in all sorts of video games and most young people are familiar with the meaning of missions: working through levels and steps to be allowed to advance in the game and to finally accomplish.
- In traditional teaching, the students work with textbooks, artificial cases and lots of theory and abstract knowledge. The open science schooling concept allows students to learn through working with real-life science challenges and in real-time.
- Thus, students take action in their communities by defining, creating and accomplishing their science missions.

10 steps to follow to plan your science mission



10 steps to follow to plan your science mission



1. Identify the Challenge

Find something that does not work, something should be changed, something is missing...

Or: something looks extremely exciting!

2. Look for Knowledge

Where can you get necessary knowledge?
From many sources, like:
→ the internet
→ resources in the community

3. Engage in Science Dialogues

When looking into your community start engaging in some dialogues with people who have the knowledge and who might be interested in innovation!

4. Analyse the Challenge

Now it is time to summarize what we have learned and “analyze” the challenge, the situation and the knowledge we have created.

Present your findings in clear form.

5. It is Mission Time!

Now use your knowledge, analysis and ideas to create a mission – what you want to do and your plan to get it step by step and in collaboration with interested resources.

10 steps to follow to plan your science mission



6. Innovation

The mission includes a very good and creative description of the innovation we wish to undertake.

This includes explaining who will benefit from the innovation, how the innovation might be financed and how potential obstacles to the innovation could be overcome.

7. Work in Alliances

Most missions cannot be accomplished without support from various types of resources in the community. So, we need to use our mission presentation to approach resources in the community that would support the innovation in different ways.

8. Promote your mission

Now it is time to explain to the community, to citizens and to stakeholders what we want to do and what kind of resources are supporting us. We need to listen to the reactions, and we might even need to change elements in the innovation based on stakeholder needs.

9. Action!

Now, once all the resources are available and feedback is collected, it is time to create the innovation – either in the form of a simulation or in real-life. Try to “make the innovation a reality”, but simulations can also be a good start.

10. Share your results

Even if we put sharing at the end of the process, it is extremely important for the students' teams – and for the teachers – to share along the entire process. This way you can reflect and improve your mission along the way. You can share results with:
School
Families
Community

How to build your eco-system of open science schooling

1. Choose your partners

When you start your mission, you need to identify resources available in your community and choose those you want to work with on your missions.



Relevancy of knowledge – the partner you want to involve in your mission needs to have the relevant knowledge in the field you are going to investigate



Financial ability – if your mission needs some financial support to be able to carry out some activities, it is good to search for partners with some available resources



Accessibility – it would be easier if the partner you choose for your mission is easily accessible for visits/communication etc.



Suitability – the mission should be aligned with the partner's profile



Willingness to participate – partner you choose has to have aspiration and willingness to support your mission

2. Get prepared

In order for partners to join and support your mission, you need to provide some information on your mission. It can include the following:



What is your mission about – in other words, some background information on what problem you want to solve



Your action plan - How you want to solve the problem at hand



Resources needed for your mission - what is available to you and what is still missing



Role of the partner – how the partner can be involved in your mission and how they can support it (especially with resources that you need and still miss)



Expected results of the mission – how your mission will benefit the school, your partners and wider community

3. Reach out

You can contact your (future) partners by different ways of communication including the following:



Phone calls



E-mails



Parent meetings



School & other events



Online/social media posts



Personal contacts

4. Motivate

Each mission is unique and partners can benefit in different ways from collaborating with school teams, however some general tips can be used to engage them.



They can support students in **their studies and development of skills**



Have **positive impact** on the surrounding environment and community



Gain better **visibility** and **recognition** in the community



Inspire students to pursue their ambitions in the field



Join school missions that reflect **organisational mission**



Create opportunities for schools to help the community through their missions



Widen horizons and enrich **organisational culture** by exchanging experiences with schools

School's support to science missions

There are many ways in which the school administration can support the teachers and students with their missions and with building the eco-systems of open science schooling.



Become an outward looking school



'get outside' – be open to exploring different ideas of place of learning



be open to the NEW culture and way of teaching and learning



Lend school equipment for the missions



Make the school premises available for mission activities with the eco-system partners



Support with financial resources



Develop **new eco-system partnerships**



Include collaboration activities **in curricula** ('to include them in the lessons of individual subjects as practical activities')



Adjust the school timetable to allocate time for collaborative activities



Facilitate collaboration and support the partnerships formally



Support in the organisation of **extracurricular** activities implemented in the community

Factors ensuring good school - eco-system partners collaboration



- Openness and good communication
- Involvement
- Partner's having an educational mission in their organization status
- Strong interest in developing the school
- Interest in mutual learning (learning from each other)
- Lack of administrative obstacles
- Partners who offer NEW educational value to the school



Part IV

Inspiration

Lithuania – Mission "Butterfly"



The students investigated how butterflies and bees can help the environment. This activity was partly integrated into Science lessons and partly done individually at home.

Students carried out research to find out what plants are bee and butterfly-friendly.

Students located a seed shop, a nursery or website that sell the seeds or butterfly-friendly plants; buy the seeds, plant them, watch them grow and attract bees and butterflies.

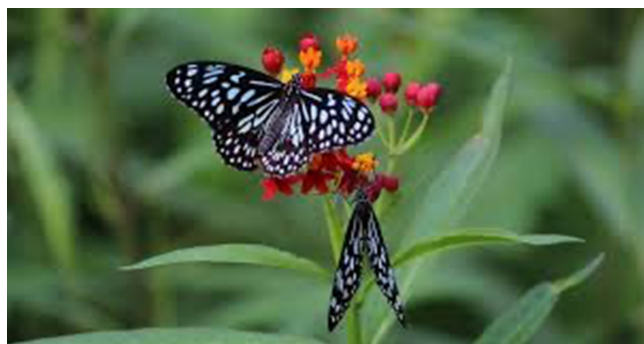
Students encouraged community and family members to start/grow bee and butterfly-friendly gardens or to choose insect-friendly flowers for flower pots on the balconies, etc.



Lithuania – Mission "Butterfly"

- Stakeholder companies were involved to support the mission. "The Darius Agro" company holding an agricultural business in Pasvalys and in other parts of Lithuania got interested and agreed to be a partner. They offered to provide seeds and other necessary material. They also advertised the idea of the "Butterfly" Mission among farmers.
- Providing the right habitat for Bees and Butterflies the students planted many butterfly gardens and organized the "Butterfly" outdoor painting and drawing activity





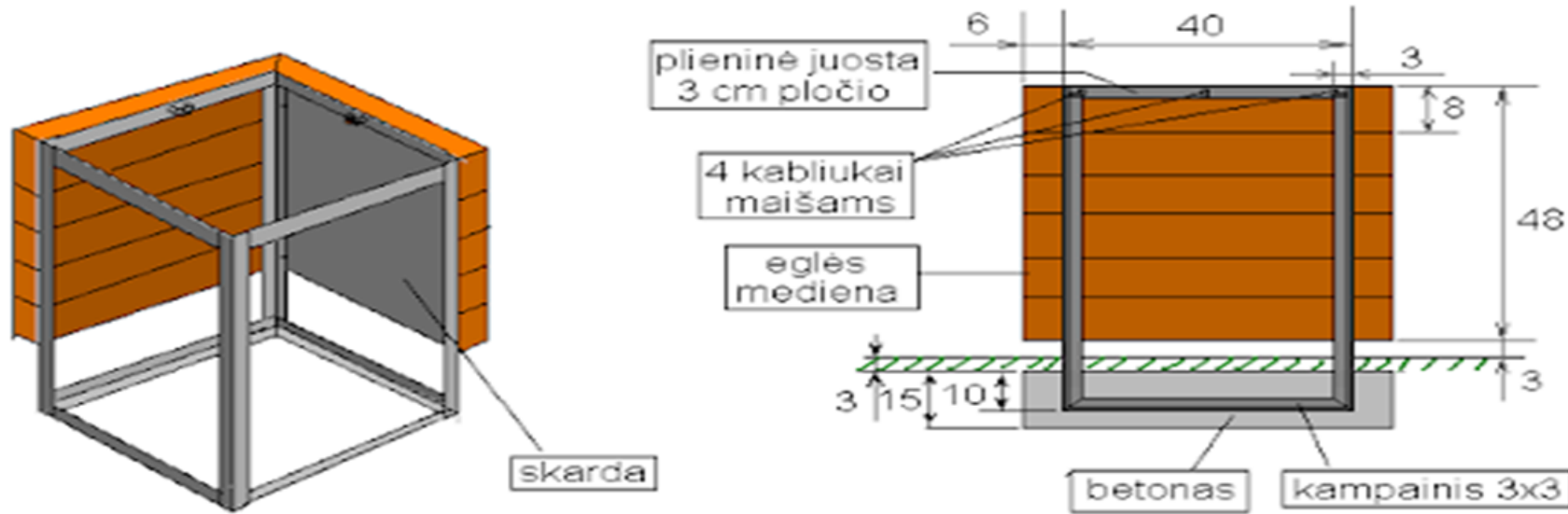
Lithuania – Mission Activity

Earth Day Activities

In conjunction with Earth Day (falling yearly on 22 April) the school community engaged in Earth Day Weekly Actions, an entire month of activities focused on the environmental issues that the world faces.

With the support of the
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Lithuania – Mission 1

Rubbish Bins for the Parks

The students made rubbish bins for the parks using their Maths lesson to make the necessary drawings and calculations for creating the bin, and then their Woodwork and Technologies lesson for working with the recycled wood and other material construct the bins.

Lithuania – Mission 2

Save Water

- Integrated the project activity into Geography and Environmental Studies and English classes
- Research into the amount of drinking water in Pasvalys, Lithuania, in the World;
- Studying the findings and making conclusions;
- Suggesting possible solutions;
- Sharing the obtained knowledge and information.
- Video on tips on saving water at home/school: <https://streamable.com/hodup9#>

on: Let's Save Water!
What can we do?

The solution begins at home.....
When you pour yourself a glass of water, don't waste it and save it for later.
Turn off the water when you're scrubbing the dishes.

3. Take short showers instead of baths.

Mission: Let's Save Water!

What can we do?

The solution begins at home.....

1. In the bath don't run much water.
2. If you want to have a bath, at spill the water for your garden - this would save many litres every day, especially in summer

Water,
Water
everywhere ..



Imagine a world with no drinking water, and no water to wash. It's hard to imagine this, because we use water every day without thinking about it. Yet there are terrible water shortages all over the world. In Africa and China, for example, many people don't even have enough water to drink. In fact, over half of the people in the world have no access to clean water every day. We all need water — not just for our homes, but to survive. Fortunately, there are things that we can do to save water.

The solution begins at home. We can save the water from our showers for the garden, instead of wasting hundreds of litres of clean water on lawns and plants. This would help to save many litres of water, especially in the summer.

Governments can help by passing laws to stop factories from polluting water. If factories recycled water and stopped putting chemicals into our lakes and rivers, there would be a lot more clean water around.

► Governments could also stop water companies from wasting litres of water because of leaking pipes. Many cities have succeeded in saving water by repairing pipes.

► All in all, there are many things we can do to save our disappearing water supplies. The time has come to start understanding the value of water, before a world without clean water becomes a reality.

Lithuania – Mission 3

“Reduce air pollution” - A Day without a car

- Tasks: Involve family members and the community to spend a certain day without a car, encourage active lifestyle (you may do the research into what it takes to lead a healthy life);
- Prove the importance of such an activity for the people and the Earth by using all possible ways of spreading the information (note: you may use statistics on the pollution caused by the vehicles, you can also use drawings or posters, research summaries, show the famous people’s examples, etc.)
- Encourage people to use bikes or any environmentally friendly means of transport while travelling shorter distances and take selfies of good examples.



Poland – Mission Activity 1

Story Telling Eco-Systems

- On Monday, 4th October 2021, representatives of students participated in the international meeting of the partners of the Eco-Systems of Open Science Schooling program. The task was to explain the previous activities in the form of a story. The team from Piastów presented a story describing a fantastic dream of a person who had dreams of all of last year's Erasmus adventures.



Poland – Mission Activity 2

Fossil Exhibition



- On 1st September 2021, an exhibition of fossils was presented.
- It was partly an effect of students exploring in Nasiłów near Kazimierz Dolny who participate in the Erasmus + project EKO-SYSTEM OF OPEN SCIENCE SCHOOLING.
- Students investigated the layers on the slope of the ice-marginal valley 65 million years old.
- While splitting the rocks, the students discovered a lot of interesting things - fossilized remains of sponges, clams, snails, belemnites, and even starfish, spines sea urchins, and ammonites.
- The exhibition was created as a project initiative and it presented the collection of fossils thanks to cooperation with the Faculty of Biology and Environmental Sciences UKSW in Warsaw.

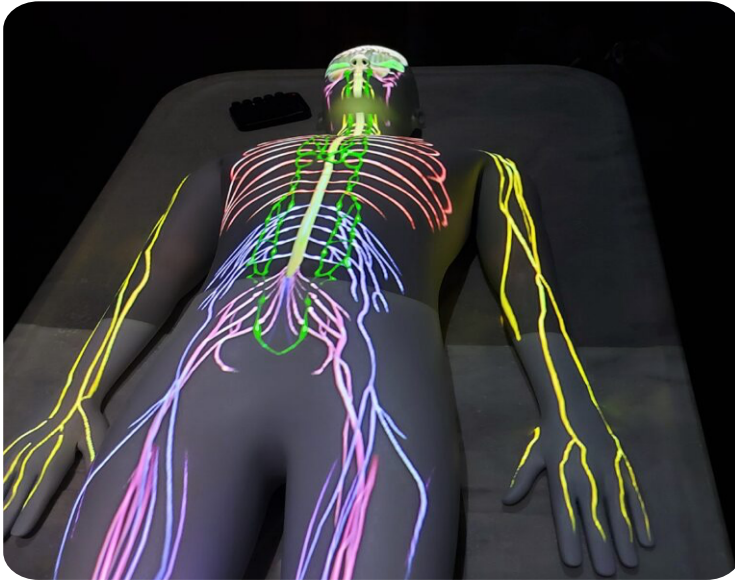


Poland – Mission Activity 3

Workshop at the Faculty of Health Sciences of the Medical University of Warsaw

- Organized on 11th October 2021 and conducted by Gabriela Olędzka Ph.D., Head of the Department of Health Sciences, with her assistants.
- Students received a Petri dish with agar and then introduced bacteria from unwashed hands. The same was done with a hand washed with soap and disinfected. Some students also touched the agar with other objects of their choice. The dishes were taken back to school and observed during the next lesson.
- In the second part of the workshop, the students' microscopic slides of the most popular Gram + and Gram – bacteria – and representatives of Protists: Plasmodium – causing malaria, Giargia – causing the so-called “Travelers’ diarrhea” and Toxoplasma. The huge number of tapeworm eggs seen in its uterine proglottids under a stereoscopic microscope made a big impression. The formalin-fixed tapeworms were cautions to avoid eating unwashed berries or raw meat.

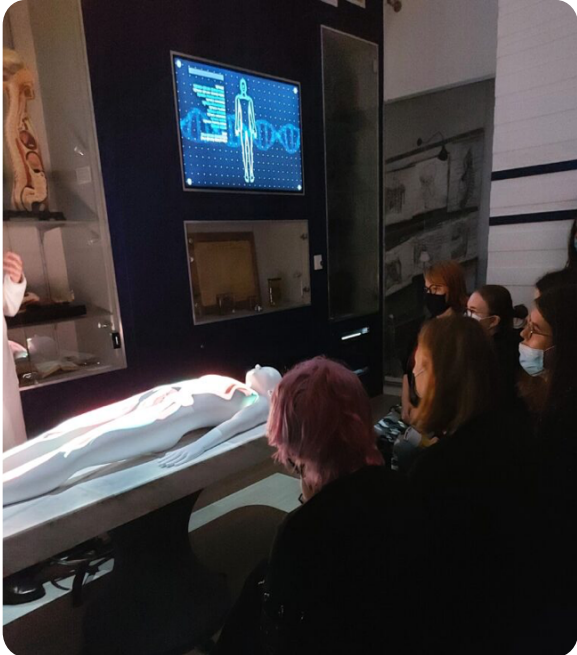




Poland – Mission Activity 4

Visit to the Museum of the History of Medicine at the Medical University of Warsaw

- On 25 November 2021, students visited the Museum of the History of Medicine at the Medical University of Warsaw.
- Students had the opportunity to participate in activities popularizing the history of anatomy, learn about outstanding representatives of this field, see the most important places at the University, see temporary exhibitions. The biggest attraction was the human anatomy lesson in a modern form of 3D mapping in the anatomical theater.



Poland – Mission Activity 5

DNA Isolation Workshop

- On 30 September 2021, students participated in school laboratory workshops organized by BioCen – Biocentre of Scientific Education.
- The first experiment was to practice the method of isolating DNA from cells, which each student took from the oral cavity. Students learned techniques commonly used in scientific research and lecturers described the scientific method; the structure and functions of DNA; what is genetic variation, and its application in forensics, research, and medical diagnostics.
- Control tests were prepared, and a second experiment was carried out to investigate what products are released during yeast respiration. The desire to experiment awakened in many of the students.

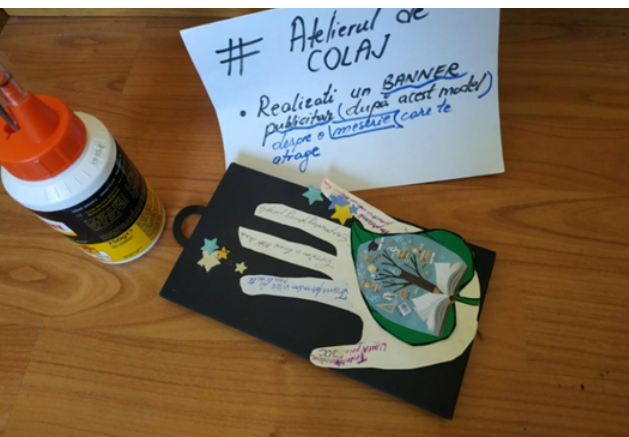


Romania

Mission 1 – Outdoor School, Outdoor Education

- Gheorghe Țițeica School joined the national project-contest "School In Nature" and became partners of Life Education For All Association
- School garden
- Workshops with volunteers from Youth Communities Association Craiova
- Transdisciplinarity - Collaboration, Creativity, Critical thinking, Communication





Romania

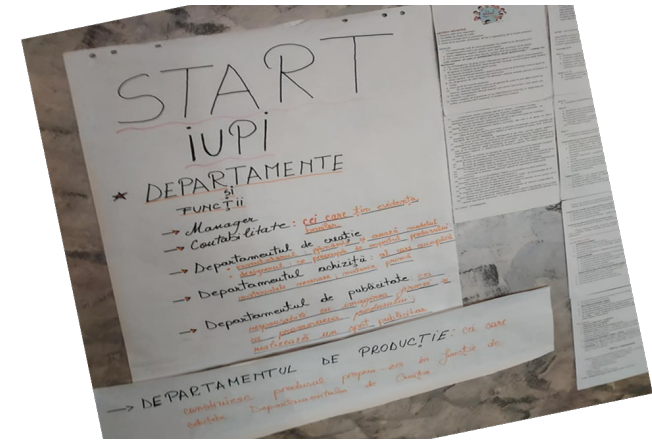
Mission 1 continued – Outdoor School, Outdoor Education

- Games and interesting discussions about Environment in the Romanescu Park
- Project-based learning - Stimulating students to appreciate the harmony of Nature
- Using real life resources – connected with Nature
- CARPATHIAN protected areas - Piatra Craiului National Park
- Discovering the relief forms with our senses - National protected areas from stories to Science

Romania

Mission 2 - Entrepreneurial Education

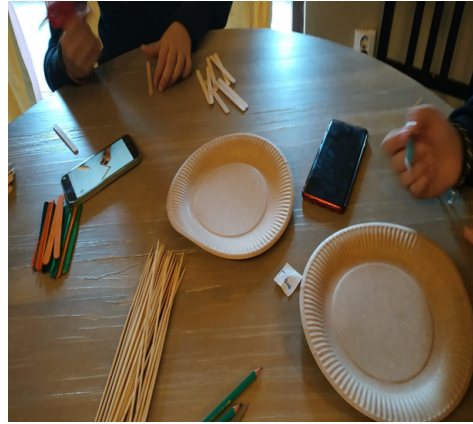
- Start Yupi Project
- Ready for Life Camp (22-29.08.2021, Bran, Brasov County)
- Entrepreneurial networking & communication skills and competences for a Start Up business
- Entrepreneurial skills for the 21st century
- 8 Target Groups and Member Cards
- Sharing responsibilities - Craft materials to be used



Romania

Mission 2 - Entrepreneurial Education continued

- Innovation and Creative Department
- Cultivating teamwork spirit from "I" to "We"
- Vegan Cooking Factory Start Up Business
- Set sail to Africa - Charity Society



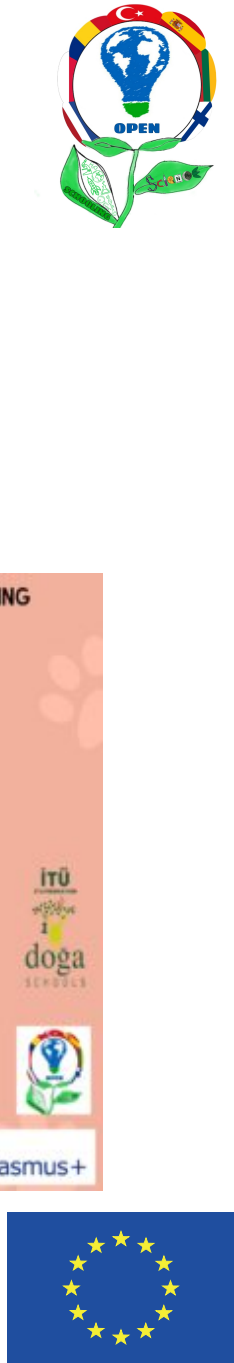
Turkey

Pet Therapy

- During the COVID-19 pandemic, students conducted research about the animals in their lives and their positive effects.
- Discussion between students via online meetings. Students created some questions to find answers and planned how to do all by sharing some duties to each other.



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Pet Therapy continued

Student shared activities included:

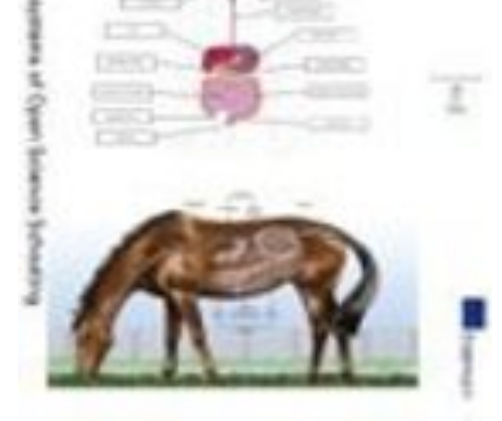
- Creating a google drive for project activities and results, follow up documents to upload google drive and sharing activities
- Creating schedule and setting dates for online meetings, organizing appointments
- Preparing some draft brochures and letters for to give information to students, school management and relevant stakeholders, having support via school social media managers.
- Organising appointment with relevant stakeholders
- Creating new schedule for visits to relevant institutions, including Firat University animal hospital.

Turkey



Supporting Science Teachers

- Students spoke to a science teacher who gave helpful information and guidance about the digestive systems of horses and humans and showed students how to find more information themselves.
- This gave a pathway to student about creating their ideas and formulating a plan.



Further info
available on
Eco-OSS Project
website and
social media

Eco-OSS Project website:

<https://www.eco-oss.eu/>

Eco-OSS YouTube

Channel: <https://www.youtube.com/watch?v=zp4ZnGNBueo&list=PLWKUz9JUmpmCZyVjajuC5Ejqo0QdGff1F>

Eco-OSS

Facebook community: <https://www.facebook.com/Open-Science-Schooling-108723328141840>



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