UNIVERSITY OF EASTERN FINLAND

SCHOOL OF EDUCATIONAL SCIENCES AND PSYCHOLOGY

YOUNG CO-CREATORS

STUDENTS' PERSONAL DOCUMENTATION OF THEIR OSS JOURNEY

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In Collaboration with the Project Practice Partners and their School Team

Open Science Schooling Project (OSS)

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Fostering Re-engagement in Science Learning through Open Science Schooling

Knowledge and Quality Assurance Partners

Practice Partners

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EXECUTIVE SUMMARY

"OPEN SCIENCE SCHOOLING (OSS) PRACTICE IS REALISED IN STUDENTS' ENGAGEMENT IN FINDING REAL SCIENCE IN THEIR LOCAL CONTEXT THROUGH PRACTICAL ACTIVITIES OUTSIDE THE SCHOOL AND BRINGING THE ACQUIRED KNOWLEDGE BACK INTO SCHOOL. IN THIS WAY, STUDENTS GET A BETTER UNDERSTANDING OF HOW SCIENCE IS APPLIED IN REAL LIFE"

From the OSS Project Deployment

The OSS practice engages teachers, students and schools, and based on state-of-the-art research it focuses on deeply involving students through co-creation practices in the development of immersive missions to propose solutions to problems that they perceived in their context. The OSS project advocates that this is the way that an innovation in science learning should be expected to be: the innovation needs to be driven primarily from students, not from science teachers.

This document is a consolidated report of the practical co-creation work that has taken place during the Erasmus+ Open Science Schooling Project. It shows the journey of that the students in their teams took from the beginning of understanding what science was in practical terms and in their lives until the end of their missions as young co-creators of tangible outcomes. Within the context of students' involvement in the OSS practice, co-creation is viewed through the full participation of student teams all along the project development, including their participation in international project meetings. Through co-creation, students beyond being mere recipient of information and spectators of activities became active actors in the development of their learning projects and the advancement of the project deployment as a whole.

The practice of OSS has taken place through various activities that demonstrate the value of science learning for students in their own living contexts including:

- offering direct participation in epic, immersive and exciting missions (i.e., tasks and project selected by them) and inviting cross-subject and cross-class approaches,
- engaging in real-life science challenges in their society in general or their learning contexts in particular (e.g., their school grounds),

- fostering a collaborative attitude to problem solving where all members of a team are able to contribute their views and strengths in order to support their opinion about the subject of the teamwork, and
- promoting the students' documentation of their thoughts and feelings, as well as reflections about their selected project's development, among other benefits.

The co-creation of the OSS practice, as it was implemented by the student teams during their immersive missions undertook the processes indicated below:

** The pictures in the diagram are from the student teams, Łukow, Poland*

Problem identification and contextualisation

During this process, students engage in understanding what are the real problems that affect their local community and how science can offer support to understand and meliorate the situation. In order to understand the problems, students are prompted to involve the local community as collaborators in their investigations, through activities that involve interviews and practical workshops with experts at research and innovation centres, industries, NGOs, as well as other social stakeholders. During the OSS project, the problems identified by the student teams varied from biology related to wine making to physics learning at a local playground, for example. Each team chose the issues to tackle in accordance to their interest as well as the issue importance to their local communities.

Knowledge and competences acquisition

During this process, students receive training and information on demand from schoolteachers and other stakeholders from the local community as well as from their own investigations. This invites the acquisition of digital literacy skills, cross-subject matter and cross-disciplinary knowledge as well as the development of self-regulation, collaboration and communication skills, cultural awareness, creativity and problem-solving efficacy. Here the students benefit from learning through a variety of practice-oriented work forms that support different learning styles.

Documentation

During this process, students are encouraged to keep a record of their progress and involvement on their projects. This serves the students as a tool for self-reflection on the work accomplished and provides them with a narrative of their experiences for self-awareness. This process also supports their organisational skills as students need reflect on what they have done to achieve their goals in their project and what else they need to do to get there. Creativity is also supported by this process since various method of documentation are encouraged including drawings, pictures, doodles, text, and so forth.

Sharing

During this process, students are encouraged to share their experiences with their peers throughout their journeys, as well as their proposed solutions with their schools and with their local community. This could be done through workshops, websites and social media, scientific conferences, etc.

It is important to highlight that these processes are flexible and afford the students freedom to explore and relate to the problems that fulfil their curiosity while at the same time supports their cognitive learning of practical science. The processes could be seen at times as supporting trial and error, particularly when a problem is being identified and understood.

These four processes are the pedagogical framework within which the open science schooling didactical approach to science learning is carried out. Of importance is to note that the processes are not linear and can be carried out by the students simultaneously in parallel. That is, as students advance in their learning experience, they could work on the problem identification and contextualisation while at the same time acquire knowledge and competences about relevant topics, for instance. Similarly, knowledge acquisition could happen at the same time that students are sharing with peers or with the community their experiences or when they are documenting their progress.

Within the context of the project, co-creation is seen as the full involvement of the students in forging their science learning experience locally as well as the participation of the student teams all along the project development including the international project meetings. This was done in this way since the project is an exploratory one in nature and the voices of the students needed to be taken into account not only from the cognitive learning perspective but also from the project steering and development activities as well. This ensures that the outcome presented showcase students' authentic activities.

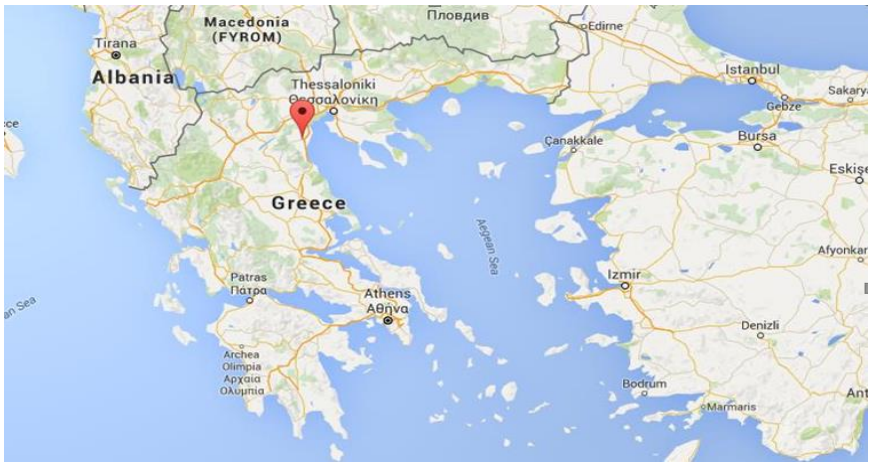
In order to present the reader with an easy to follow account of the student teams' co-creation of their learning experience journey on their implementation of OSS practices, the immersive missions that the students took place in are described here within the pedagogical framework provided by the four processes presented above. The content of this document is, hence, arranged country-wise in alphabetical order. Each country-wise chapter showcases where and how OSS has been implemented., describing the context of the work as well as the missions that were undertook. The students' and teachers' perspectives on their experiences in participating and materializing respectively, in Open Science Schooling as a pedagogical method in their schools provokes a variety of reactions in both the teachers and the students. A detailed account of the perspectives from both sets of participants is presented as a separate section in the document. This document concludes with general perspectives and tips from participating teachers and students to all interested in implementing this methodology successfully in their schools.

OPEN SCIENCE SCHOOLING
STUDENTS' JOURNEY

SCHOOL TEAM GREECE

PLATON SCHOOL OF KATERINI

GREECE



PLATON SCHOOL OF KATERINI is a private school situated in the urban area of Katerini, Greece. The city has an approximate population of 70,000 inhabitants. The number of students over 12 years of age studying at the school, is 172. The school practices traditional system of pedagogy. A view of the school outer façade is given here.

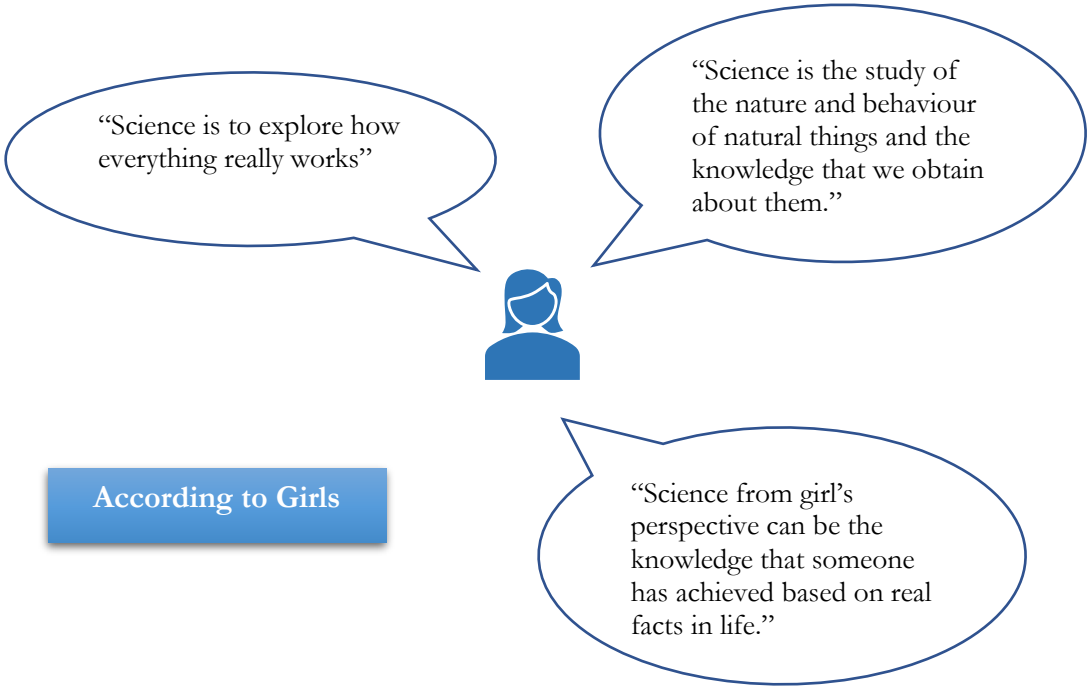
The teams consisted of three teachers, and 22 students segregated into two groups of four to six students per group. The project-related activities were conducted 2 hours per week within school hours embedding them in 4 subjects of the curriculum. Additional 2-3 hours of extracurricular activities related to OSS were conducted during the week and on Saturdays and Sundays. Students were encouraged to research their local community and come up with a list of topics they would like to work on as their OSS mission. Team leaders for the groups were chosen based on the ability to take responsibility for tasks and speak English confidently, among the team members.

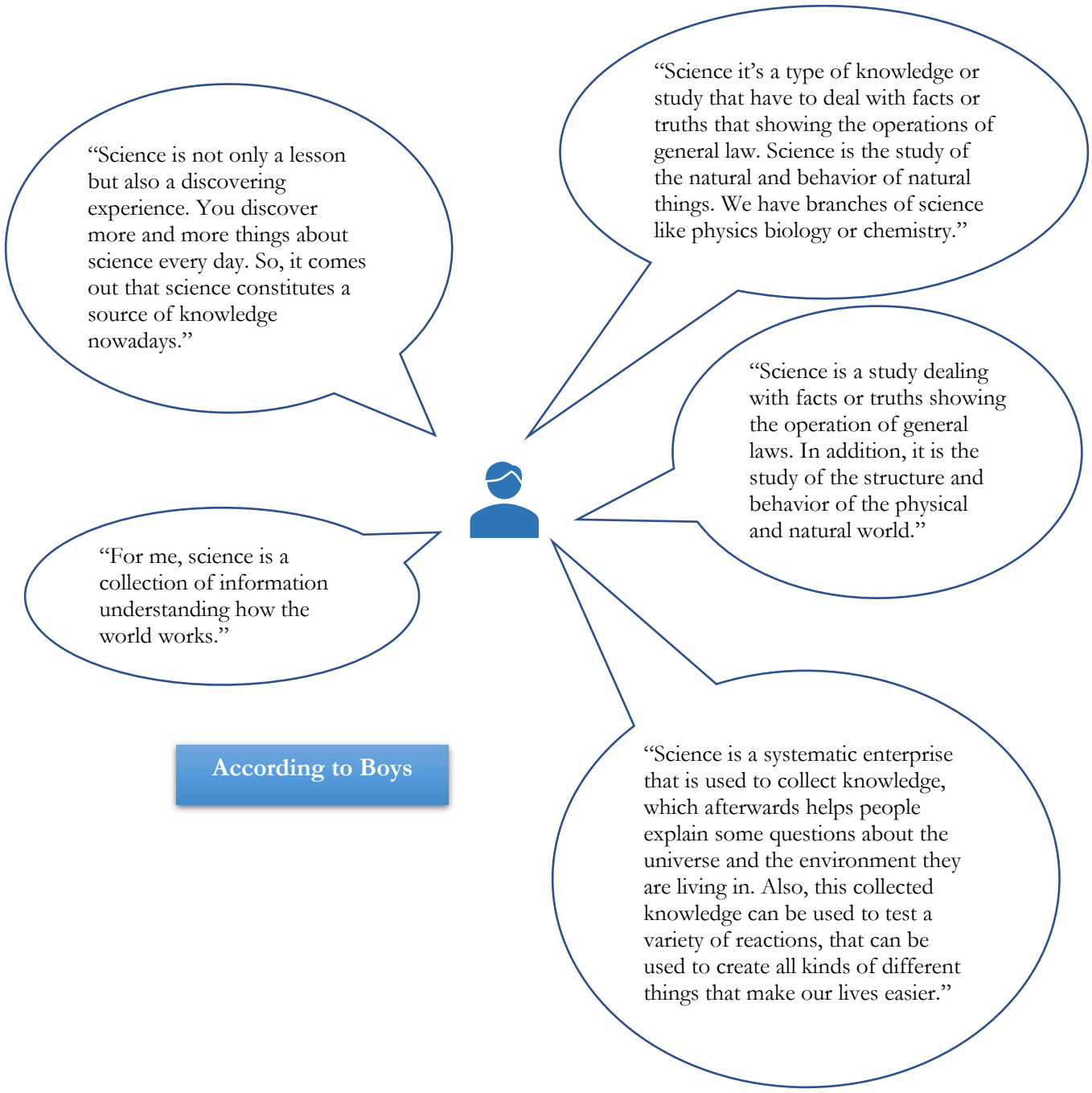
PROBLEM IDENTIFICATION AND CONTEXTUALISATION

Understanding what science is, was the first step of the student teams' OSS journey. In this light, they actively took part in group discussions among themselves and with the teachers, keenly contemplating and understanding the different aspects of the project.

WHAT IS SCIENCE?

PERSONAL PERSPECTIVES (REPRESENTATIVE ANSWERS




"Science it's a type of knowledge or study that have to deal with facts or truths that showing the operations of general law. Science is the study of the natural and behavior of natural things. We have branches of science like physics biology or chemistry."
"Science is not only a lesson but also a discovering experience. You discover more and more things about science every day. So, it comes out that science constitutes a source of knowledge nowadays."
"Science is a study dealing with facts or truths showing the operation of general laws. In addition, it is the study of the structure and behavior of the physical and natural world."
"For me, science is a collection of information understanding how the world works."
According to Boys
"Science is a systematic enterprise that is used to collect knowledge, which afterwards helps people explain some questions about the universe and the environment they are living in. Also, this collected knowledge can be used to test a variety of reactions, that can be used to create all kinds of different things that make our lives easier."

Where can we find Science?

Personal perspectives (representative answers)

"We can find science everywhere in our everyday life."

"Science can be found absolutely everywhere. In the nature, in our homes, in things that we utilize in our daily routine, even in our own bodies."

"We can find science everywhere. all discoveries of what we know today came from science."

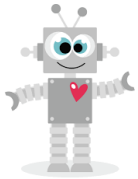
"Science takes place all around us, but more specifically in labs with scientists."

"Science can be found everywhere around us in our everyday lives and is very important for everything we do."

"Science can be found in many fields. We can find it in two large fields: social science and natural science."

"Science is a thing that can be found everywhere in the world around us."

"We can find science everywhere in our everyday lives especially in the nature."



What is Science in the past and what is it now?

Personal perspectives (representative answers)

"Scientific knowledge allows us to develop new technologies, solve practical problems, and make informed decisions — both individually and collectively."

"In the past, science was just a lesson that everyone was ignoring it. Only few people wanted to discover its "magic". Nowadays, it is a very complicated but at the same time a very interesting lesson that it contributes to many sectors."

"Science in the past was only for scientists. Now is for the hall world."

"Science: it is the development of science and scientific knowledge, both in the natural and social sciences. This is true from the beginning of the history of mankind to the present day."

"In the past science was often presented as a progressive accumulation of knowledge, in which true theories replaced false beliefs. Nowadays science is defined as, an attitude of observation and experimentation quite often with the inclusion of mathematics to explain those observations."

"Science in the past was very important as today but, in the past, we learned all the important stuff about it and we solve some things about it. Nowadays we have a lot of science laboratory and a great number of students learn about it."

WHY IS SCIENCE IMPORTANT?

PERSONAL PERSPECTIVES (REPRESENTATIVE ANSWERS)

"Because its products are so useful, the process of science is intertwined with those applications."

"Science is significant for lots of reasons. Firstly, it conduces to many people's jobs, especially in our days, such as doctors or scientists. Furthermore, it concurs to our daily lives through the basic things that we use like a fridge or an oven."

"Science is important because it has helped form the world that we live in today."

"Science has led us to finding out things that give us what we have today. It is also valued by society because the application of scientific knowledge helps to satisfy many basic human needs and improve living standards."

"Science doesn't just help people find answers to a variety of questions, but also helps the human brain to grow. Furthermore, science helps people find jobs and helps them with small and easy or even with harder tasks that they have to do every day."

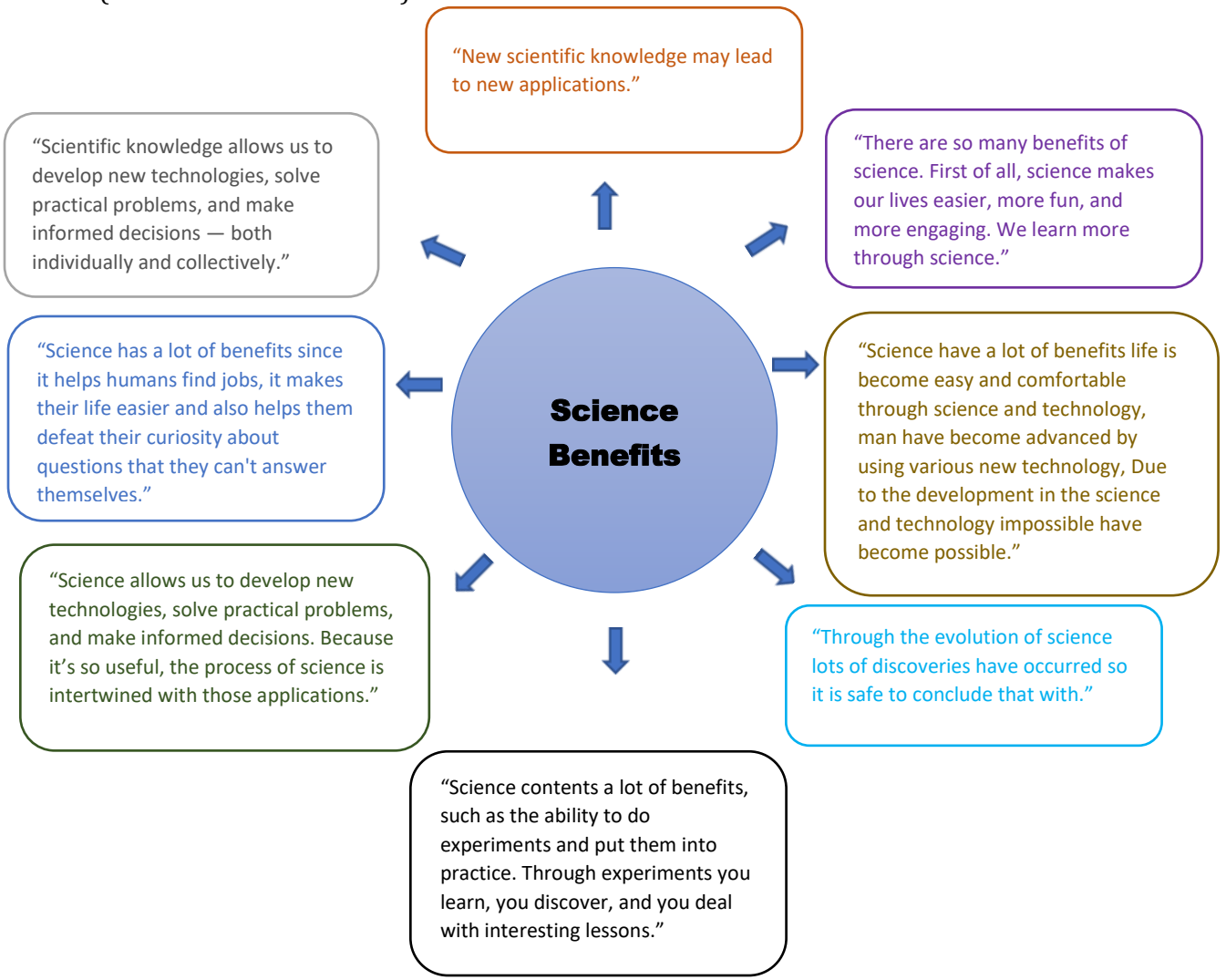
Science is very important in our everyday lives because it help people to do great things in their jobs and in their lives."

"Science is important because it can help people be conscious of how everything changes from time to time."

Science is a way of helping the brain grow in finding new knowledge and helps us defeat our curiosity of how the world develops and works."

WHAT ARE THE BENEFITS OF SCIENCE?

PERSONAL PERSPECTIVES (REPRESENTATIVE ANSWERS)



HOW WOULD THE WORLD LOOK LIKE WITHOUT SCIENCE?

PERSONAL PERSPECTIVES (REPRESENTATIVE ANSWERS)

- → *"The world is nothing without science because science is everything in this world."*
- → *"I don't think there is one person in the world that wishes a world without science. I cannot imagine the world without science existing. It would be awful. And I think lots of people agree with my opinion."*
- → *"Without science the world would not come up to this point. Because of science we have Technology, buildings, bridges, structures and transportation. However, the most important thing that we wouldn't have if science didn't exist is knowledge."*
- → *"A world without science would mean that we would still be living in a very different way to that of what we live today. In fact without science we would not have electricity which would mean no mobiles, cars to travel in, fridges to keep food fresh and other important things."*
- → *"Without science the world would be a lot different and it would look like we still live in the prehistoric era and people would never be able to evolve."*
- → *"We wouldn't know a lot of things about ourselves and about the stuff around us, we would be still afraid of thunders and natural things like that and we wouldn't have so many cool things we have today."*
- → *"Since we have made science part of our lives, I would imagine that it would be a lot harder. Also, we would be clueless when it comes to the general laws of the world."*
- → *"From my perspective a world without science would be a meaningless world as nothing can be discovered due to the lack of knowledge needed."*

Contextualising science in their community was the next step in which, the students at first researched to find companies in their community, networked with them discussing the possibilities of working with some of them. Chimar Chemics Company was one of the community organisations to which the students made a field trip. Chimar Hellas provides state-of-the-art resin binder technology to industries all over the world. During the field visit, the students had the opportunity to by informed on safety issues before taking a tour on the company's facilities and then they visited the Chemistry labs to see the company's scientists work on producing special resin compounds. After the tour to the company's facilities, the students had a briefing from Chimar's public relations spokesperson on STEM career opportunities and the company's research unit.

☞ ***Students involved local companies in their quest to understand what science is and how it is applied in their local community.***

Platon School student teams at Chimar Chemics interacting with expert regarding what science was and how it was applied in the company.

Additionally, the students contacted the Head of Katerini region's Secondary educational office and discussed about the project with him. They also involved the Parent's Association of our school by informing them about the project. The students reported that

"All the people that are informed about the OSS project, think that it is a great idea to show to the students that science is related with everyday life. They also think that it will be a great advantage for the students to work on this project and cooperate with people outside the school."

Once the students understood practical aspects of science in their community, they chose the issues that they were interested in further investigating through immersive missions after the students researched their community organizations and discussed with their teachers. The students choose two different activities to work on as their immersive missions, within the framework of OSS project. This mission was selected because students wanted to investigate science in their everyday life. They wanted to implement practically the content they learn at school and discern the importance of science and how science makes our lives easier.

KNOWLEDGE AND COMPETENCES ACQUISITION

IMMERSIVE MISSION 1: WORKING ON THE EMERGENCY LIGHTNING OF OUR SCHOOL

The students were interested in improving the emergency lighting system of their school grounds since it was 7 years old. In this light, with guidance from their teachers, they studied their current lighting system that was made seven years ago followed by researching on topics related to light engineering and design that were also part of their curriculum. Armed with theoretical knowledge, they then approached a local enterprise that produces emergency lighting and fire alarm systems.

The student team networked with engineers at local enterprises and other professionals in this field and gathered information they would need to develop a new emergency lighting system at their school. Their outcome was evaluated by an electrical engineer who guided them with suggestions and open discussions.

Student teams discussing their plans with local engineer and getting practical feedback and new knowledge.

IMMERSIVE MISSION 2: WINE PRODUCTION

For this mission, the students wanted to explore the wine making process since the beverage is widely consumed in their country. In preparation to materializing this activity, the students learnt about wine production in ancient times and the evolution of the process through watching videos, they learnt about the chemistry behind and engineering of the process, in classrooms. They visited a local winery where they witnessed the different stages of wine making process and the science behind it. The teachers reported that it was very important for the students to practically witness the wine making process that they had theoretically studied in their classrooms.

Understanding the science behind winemaking in a local brewery.

DOCUMENTATION

Documentation of the student teams' journey was made mainly through pictures and videos that were to form part of the project's video contest. The team's video showcased the difference between traditional and innovative pedagogical methods and its effects on students and teachers alike. The plot was developed in collaboration with the teacher after having watched many videos of similar nature, that inspired them *"…we got inspiration from other videos and in order to have a more fulfilled outcome." (team captain, Greece)*

☞ ***As a part of the Video contest, of the project. the students presented a short video which depicts their work during the immersive mission activity of emergency lighting system building.***

Click on the image above or on this link to watch the video https://youtu.be/-bJrNz-jp1w

The students worked as a team and the planning process resulted in identifying the skills and determining the roles of the students in the video.

> *"During the time of our progress we found out which one is more skilful to do each task of the video."*

Regarding the use of technology in the video making, the students used smartphones for recording video footages and an IOS application was adopted to work on the editing. The students claim that since they already had personal experience of video editing, they did not have any additional training in doing the same.

> *"We basically took advantage of our phone cameras due to the fact that baller smartphones have excellent resolution. Also, because we wanted to have better voice quality, we the phone up with a microphone." (sic)*

> *"We used an app on app store and the cuts were made on an iPad."*

The field work in the video making itself was not considered difficult, after the planning phase, the team was divided into groups to film different sections of the video's plotline. The solidarity towards their end vision enabled them to work well as a team without conflicts.

> *"…we were all determined to have a nice outcome."*

Akin to Team Poland, Team Greece too mark that coming up with the plotline was challenging for them, since there were so many ideas that came along in this phase.

> *"The challenges were found in the plot of the video. By watching other videos online, we had a lot of inspiration but in the end with the help of our teacher we faced this problem and we went on with the process."*

Despite the above being a challenge, the students state that it was a new learning for them and working together as a team was both enjoyable and rewarding.

> *"We think that doing things together is always rewarding and to choose the best idea is the hardest part of the task."*

The second challenge they faced was the lack of time for making the video albeit their video was up to their expectations. If they could do this all over again, they would like to have more time to invest in making the video.

> *"The only problem was time; we didn't have enough time…"*

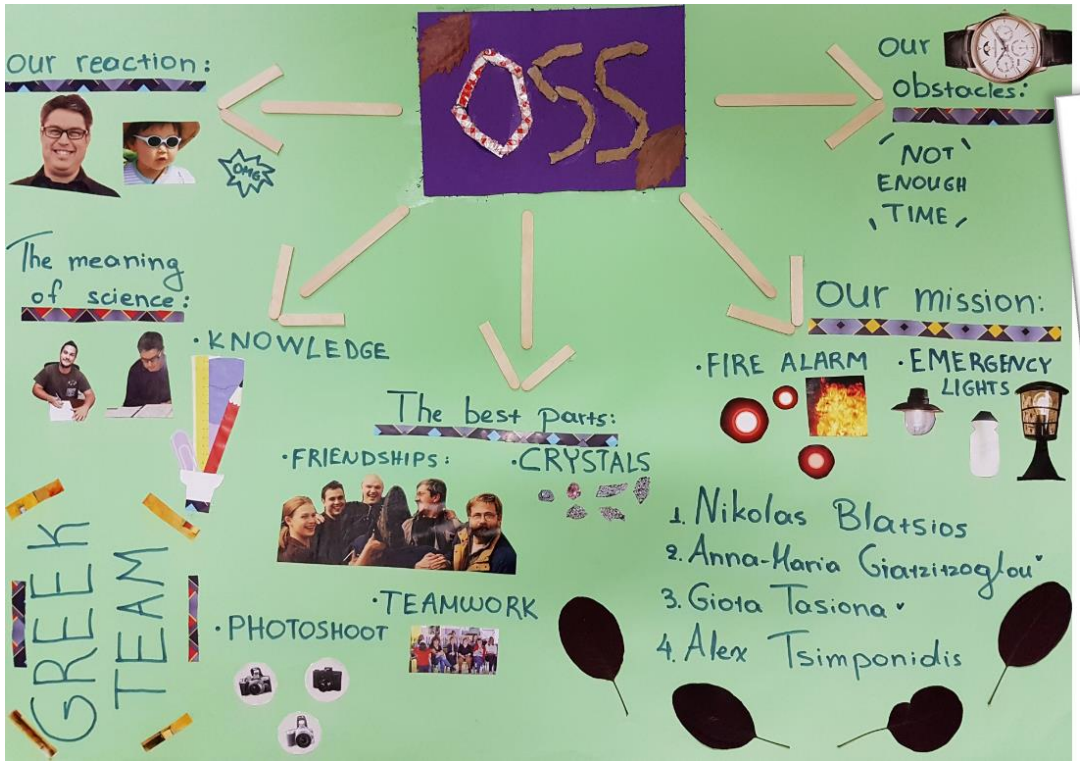
SHARING

The student teams shared their science learning journey with their local community through various channels including social networks (e.g., Facebook) and local radio stations. On the 11th and 12th October 2018, the European Ideas Network hosted a seminar on "Investing in Education and Innovation", in Thessaloniki, Greece. On the second day of the seminar schools from Northern Greece presented innovative ideas during the "Increasing digital innovation: Encouraging innovation in schools" workshop. In this workshop Platon School students presented the Open Science Schooling project and their actions.

Student teams sharing their learning experience with OSS at the regional level.

☞ ***Students showcased that EU can promote a better framework for innovative educational projects to flourish among schools and universities and shape teaching methods accordingly to the new reality. It is also crucial to talk about how it is possible to integrate innovation and digital technologies in the current Educational systems, especially since the new generations will increase the scientific potential of EU in the upcoming years.***

During the Project's Mobility event in Łukow, Poland in September 2019, the student teams showcased their OSS Immersive Missions journey in the form of a collage presentation. They designed, printed and distributed flyers in order to inform their local community about the project.



Student teams' graphical representation of their science learning journey as a retrospective reflection of the process.

Student Teams' Voices – Journey Description in Greek

TEAM 1

Όταν ξεκινήσαμε το πρόγραμμα δεν γνωρίζαμε το τι ακριβώς έπρεπε να κάνουμε. Μετά από αρκετές συζητήσεις καταλάβαμε ότι έπρεπε να ψάξουμε στην παροχή μας (εκτός σχολείου) για το που βρίσκονται οι επιστήμες γύρω μας.

Αρχίσαμε λοιπόν να ψάχνουμε σε επιχειρήσεις που έχουν να κάνουν με τις επιστήμες και για τους φορείς που θα μπορούσαν να μας βοηθήσουν σε αυτό το πρόγραμμα. Επισκεφτήκαμε την Δρ. Ελένη Παβλίδου που εξειδικεύεται στον τομέα του Microstructure Of Materials with Electronic Microspy. Με την οποία είχαμε μία υπέροχη συζήτηση όπου μας εξήγησε από τι δική της πλευρά το τί είναι επιστήμη. Η επομένη συνέντευξη ήταν με την κύρια Μαρία Κατιονική η όποια σπούδασε στο τομέας φυσικών επιστήμων στο Αριστοτέλειο Πανεπιστήμιο της Θεσσαλονίκης. Με το πέρασμα του χρόνου είχε κερδίσει πολλές υποτροφίες καθώς και πολλά βραβεία. Πρόσφατα κέρδισε το βραβείο L Ordeal- UNESCO για τις γυναίκες.

Επιπλέον πήραμε συνέντευξη από τοπικούς επιστήμονες σχετικά με τις επιρροές όταν ήταν στο σχολειό /πανεπιστήμιο και γιατί επέλεξαν αυτόν τον τομέα καθώς και τι αλλά ενδιαφέροντα είχαν εκτός της φυσικής. Επιπλέον τους ρωτήσαμε διάφορες συμβουλές σχετικά με το πώς μπορεί κανείς να έχει μια λάμπρη καριέρα στην φυσική.

Κατά την διάρκεια των μαθημάτων μας ο δάσκαλος της φυσικής μας μας έθεσε να βρούμε ένα τρόπο ώστε να κάνουμε έναν λειτουργικό καταπέλτη ο όποιος μπορεί να εκτοξεύσει ένα μπαλάκι του τένις σε απόσταση δυο μέτρων. Έπειτα διοργανώσαμε έναν διαγωνισμό με αυτούς τους καταπέλτες και ο καλύτερος κέρδισε ένα βραβείο.

Στη συνέχεια, πήγαμε σε εργαστήρια και κάναμε διάφορα πειράματα έτσι ώστε να λάβουμε μια γεύση από τον τροπο τον οποίο δουλεύουν οι επιστήμονες αλλά και δουλέψαμε σε προσομοιώσεις στο υπολογιστή.

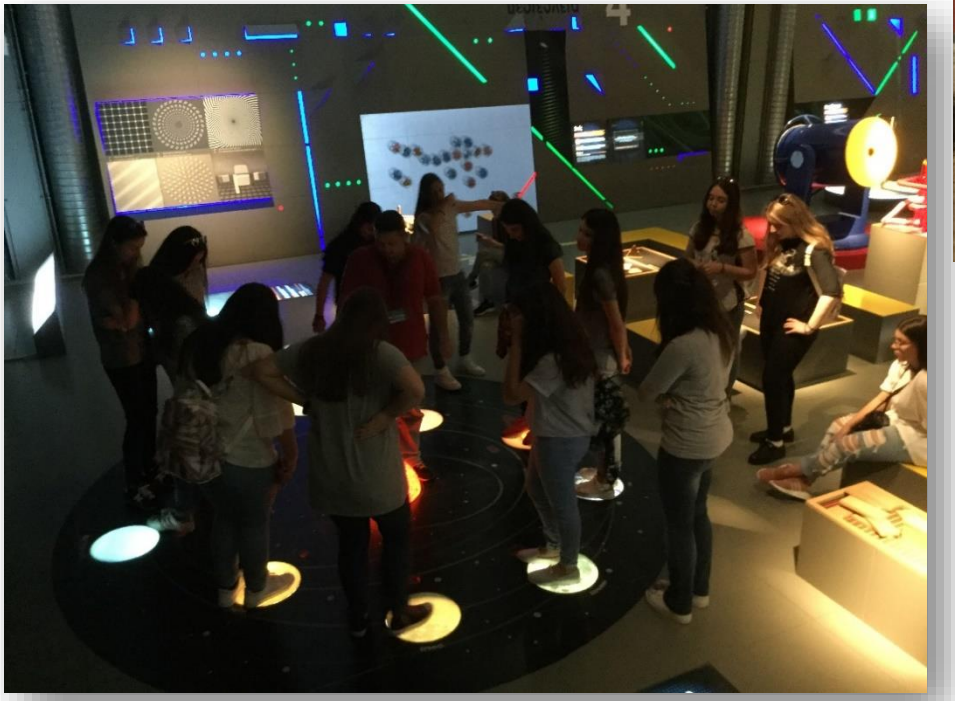
Τέλος, αποφασίσαμε να επισκεφτούμε δυο οινοποιία. Το πρώτο είναι το οινοποιείο Γεροβασιλείου οπού είδαμε πως δημιουργείται, ζυμώνεται και συσκευάζεται το κρασί. Το δεύτερο οινοποιείο ονομάζεται Κτήμα Γαρυπίδη το όποιο βρίσκεται πιο κοντά στην περιοχή μας. Εκεί συζητήσαμε με τους οινοποιούς οπού μας μίλησαν για την επεξεργασία του κρασιού και την ιστορία του στην Ελλάδα και πιο συγκεκριμένα στον τόπο μας.

Εν κατακλείδι, συμμετέχοντας σε αυτό το πρόγραμμα αντιληφθήκαμε ποσό σημαντικές είναι οι επιστήμες και η φυσική στην ζωή του ανθρώπου. Πριν από όλα αυτά είχαμε τις φυσικές επιστήμες στο μυαλό μας ως ένα βαρετό μάθημα διότι το μονό πράγμα που κάναμε ήταν να μαθαίνουμε θεωρίες και λύνουμε ασκήσεις οι όποιες δεν μας χρησίμευαν, αλλά με την εμπειρία που ζήσαμε μέσα από αυτό πρόγραμμα και με όλες τις δραστηριότητες που κάναμε συνειδητοποιήσαμε ποσό σημαντικές και ενδιαφέρουσες είναι.

TEAM 2

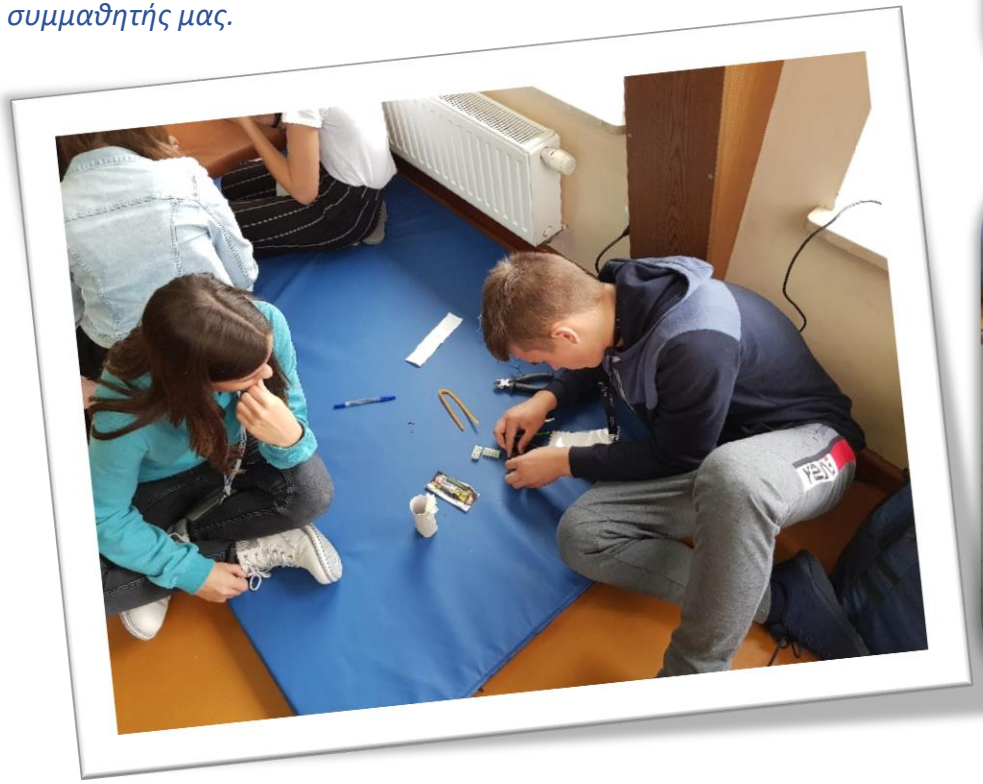
Κατά τη διάρκεια της συμμετοχής μας στο πρόγραμμα του open science schooling είχαμε την ευκαιρία να επεκτείνουμε την αντίληψή μας αλλά και τις γνώσεις μας πάνω στις φυσικές επιστήμες. Για να συμβεί αυτό πραγματοποιήσαμε αρκετές συζητήσεις με τους καθηγητές μας αλλά και με άλλους επιστήμονες από την περιοχή που ζούμε.

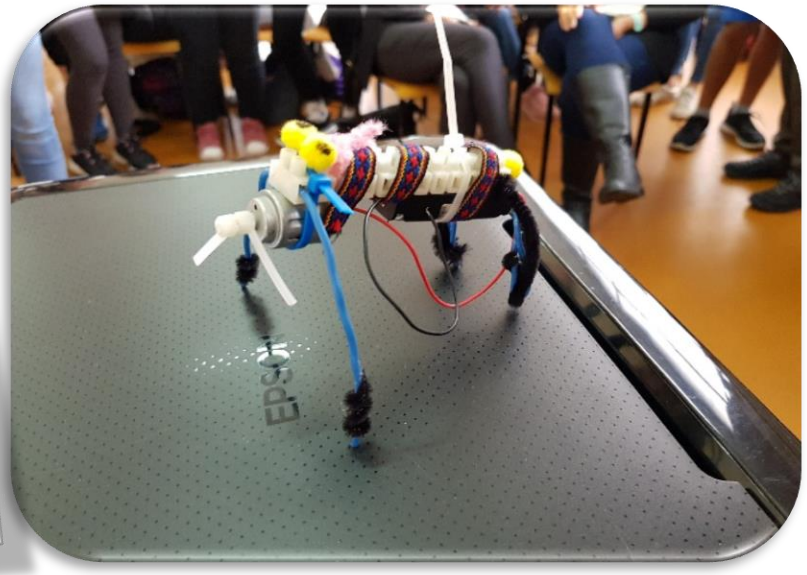
Πραγματοποιήσαμε αρκετές επισκέψεις σε χώρους όπου πιστεύαμε ότι «κρύβονται» οι φυσικές επιστήμες όπως το πανεπιστήμιο, το κέντρο ερευνών Noisis αλλά και χώρους εργαστηρίων φυσικών επιστημών.
Στη συνέχεια πραγματοποιήσαμε με τη σειρά μας και εμείς κάποια πειράματα σε πραγματικό αλλά και εικονικό εργαστήριο



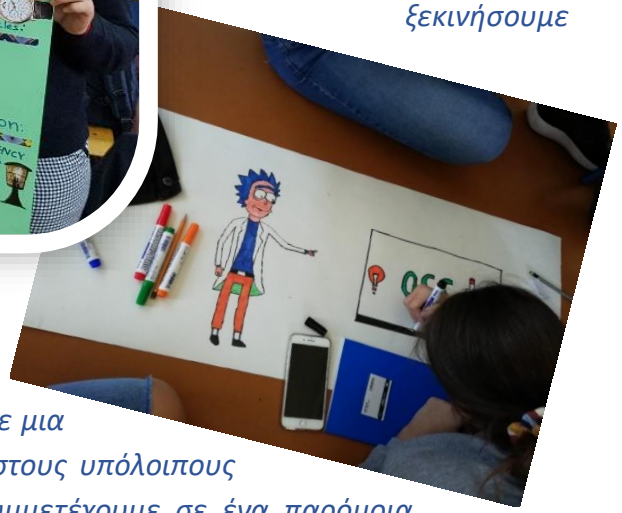
Μετά από αρκετή έρευνα που πραγματοποιήσαμε για τις επιχειρήσεις που βρίσκονται στην περιοχή μας, αποφασίσαμε να ασχοληθούμε με το θέμα της πυρασφάλειας και των φωτιστικών ασφαλείας. Καθοριστικό ρόλο για την ολοκλήρωση της έρευνας και της εργασίας έπαιξε η εταιρεία Olympia Electronics, η οποία είχε την καλοσύνη να μας παρέχει πληροφορίες για τον τομέα αυτόν. Με αυτές τις πληροφορίες να αποτελούν μια βάση για την έρευνα αναζητήσαμε πληροφορίες όπως κανονισμοί και πρωτόκολλά που έπρεπε να τηρηθούν για την αναδιαμόρφωση του συστήματος πυρασφάλειας του σχολείου μας. Στην προσπάθειά μας αυτή είχαμε και τη βοήθεια του κυρίου Αχιλλέα ο οποίος είναι και ο μηχανικός που κατασκεύασε το κτήριο.

Όσον αφορά την επίσκεψή μας στην Πολωνία, είχαμε την ευκαιρία ως μαθητές να αποκομίσουμε επιπλέον γνώσεις στο πλαίσιο των Φυσικών Επιστημών. Συγκεκριμένα αποκομίσαμε γνώσεις για τις Φυσικές επιστήμες και το ποιος είναι ο σκοπός τους, που είναι η μελέτη της ύλης και των κινήσεων. Επιπλέον είχαμε την ευκαιρία να πειραματιστούμε με την δημιουργία κρυστάλλων από απλά υλικά όπως και την κατασκευή αυτοκινούμενων ρομπότ χρησιμοποιώντας μερικά σύρματα, μια μπαταρία και καλώδια ηλεκτροδότησης. Με σκοπό την κατανόηση των πραγμάτων που μάθαμε για τα creative media συμμετείχαμε σε έναν διαγωνισμό γνώσεων τον οποίο κέρδισε ένας συμμαθητής μας.





Το κολλάζ που ασχοληθήκαμε στη Πολωνία είχε θέμα πως περάσαμε στη διάρκεια του πρότζεκτ. Εξηγήσαμε τα συναισθήματα μας, τα προβλήματα μας, τί μας άρεσε πιο πολύ σε αυτό το πρόγραμμα μέσα από εικόνες που βρήκαμε σε περιοδικά. Ακόμη, χρησιμοποιήσαμε κάποια υλικά που μας έδωσαν οι καθηγητές προσπαθώντας να κάνουμε το κολλάζ μας όσο πιο καλλιτεχνικό γίνεται . Ήταν η πρώτη φορά που είχαμε φτιάξει κολλάζ και μας άρεσε αυτή η εμπειρία γιατί συνεργαστήκαμε όσο πιο ομαδικά γινόταν για να καταφέρουμε το καλύτερο. Το αρνητικό που βρήκαμε στο δρόμο μας ήταν ότι δεν ξέραμε πως να κάνουμε κολλάζ όποτε αργήσαμε να ξεκινήσουμε και δεν καταφέραμε να το ολοκληρώσουμε. Μπορούσαμε να το κάνουμε ακόμα καλύτερο αλλά δεν αποθαρρυνθήκαμε και κάναμε μια προσπάθεια για να επιτύχουμε τον στόχο μας . Στο κολλάζ αυτό ενωθήκαμε, συνεργαστήκαμε και δουλέψαμε ως μια ενωμένη ομάδα.



Πιστεύουμε πως το project του open science schooling μας βοήθησε να δημιουργήσουμε μια παρουσίαση αφοσιωμένη στην πυρασφάλεια και τον φωτισμό για να προβάλλουμε στους υπόλοιπους μαθητές και καθηγητές. Κοινή γνώμη της ομάδας ήταν πως όλοι θα θέλαμε να συμμετέχουμε σε ένα παρόμοια πρόγραμμα μιας και μας άρεσε η εμπειρία. Επίσης μέσα από αυτό το πρότζεκτ μάθαμε να συνεργαζόμαστε με παιδιά από άλλες εθνικότητες, να εκφραζόμαστε ελεύθερα και να επιλύουμε τα προβλήματα μας με ώριμο τρόπο.

OPEN SCIENCE SCHOOLING
STUDENTS' JOURNEY

SCHOOL TEAM ISRAEL

IRONI BET ISRAEL

ISRAEL

IRONI BET ISRAEL, is a public school situated in the urban area of Modiin City. The city has an approximate population of 100,000 inhabitants. The number of students over 12 years of age studying at the school is 1300. The school practices traditional system of pedagogy. A view of the school ground is given here.

Multi Disciplinary Center
Modiin • Maccabim • Reut

The teams consisted of two teachers, and seven students in the leading group. Over 90 middle-school students took part in the lessons which were organized by the leading group. The project related activities were conducted both within and outside of school hours. A total of 70 hours was spent for the project, including 10 hours for the younger class that participated in the co-creation activities (8 hours of the lessons in the park and 2 hours of concluding discussion and presentations in classes). The choice of topics for the activities was made by the students which was then discussed with the science teachers who tutored them partly.

Israeli team

In Israel, the student team implemented a tutoring system to share with other students their progress and learning of science related topics.

PROBLEM IDENTIFICATION AND CONTEXTUALISATION

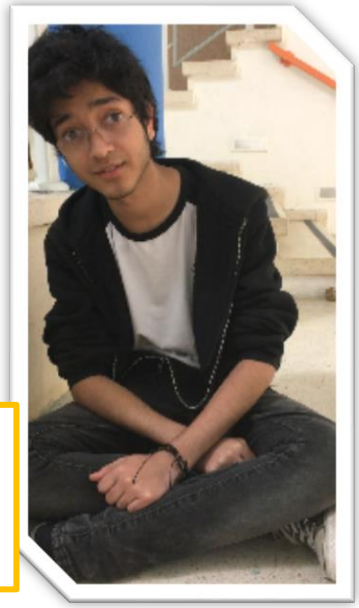
Understanding science was the first step of students' OSS journey. During this process they carried out the following activities:

- → constant revision of possible plans,
- → brainstorming and discussing various ideas on how to facilitate the activities were the key to students' success in understanding science,
- → interviewing peers, teachers, family members and other stakeholders to gain their views on what science was for them. the students received a fascinating variety of different answers, which served them for identifying the relation of their community towards science, in order to determine the idea for their project. Here are just a few of them:

"I think that science is all kinds of interesting things about nature, what plants are made of, materials... we observe what is found around us. If you don't know, you discover these things at science class" 2nd grade student

"Science for me is actually everything! everything is made of science, all that happens is science… this chair- is science!" School student

"Science for me is what forces the person to think about the essence, about how this world is built… It's not like superstition or religions, science is to think critically…" Math teacher



"Basically, there is no such thing as science, but if you're asking, it's human's way of exploiting nature, for his personal favor." School student

WHAT IS SCIENCE?

PERSONAL PERSPECTIVES (REPRESENTATIVE ANSWERS)

"Science is a form of knowledge that is always around us. We lean on it round us. We lean on it in nearly everything we do in our day to day life."

"Science is a way for us to learn and get to know our world."

"Science consists of observing the world by watching, listening, observing, and recording."

"Science is curiosity in thoughtful action about the world and how it behaves."

According to Girls

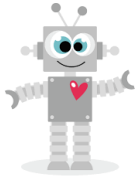
According to Boys

WHERE CAN WE FIND SCIENCE?

PERSONAL PERSPECTIVES (REPRESENTATIVE ANSWERS)

"We can find science everywhere- we just need to open our eyes and look."

" You can find it everywhere. From food to cars, in school and in the mall- we are all affected by it.."



WHAT IS SCIENCE IN THE PAST AND WHAT IS IT NOW?

PERSONAL PERSPECTIVES (REPRESENTATIVE ANSWERS)

"In the past it was much more limited. But now it is thriving."

"The Science in the past wasn't a very useful tool because the world was more religious, but now, I think that science is the most trusted tool in the world."

WHY IS SCIENCE IMPORTANT?

PERSONAL PERSPECTIVES (REPRESENTATIVE ANSWERS)

"Science is important because we are all affected by it, and because it can really change our view of the world around us- thanks to science we can solve problems and help each other."

"Science helps us understand the world and develop it using researches and technology."

WHAT ARE THE BENEFITS OF SCIENCE?

PERSONAL PERSPECTIVES (REPRESENTATIVE ANSWERS)

"Science encourages us to think outside of the box and think in a different way."."

Science Benefits

"One of the benefits of science is the fact that we can help each other cope with different problems thanks to it.."

HOW WOULD THE WORLD LOOK LIKE WITHOUT SCIENCE?

PERSONAL PERSPECTIVES (REPRESENTATIVE ANSWERS)

→ *" The world would be a much darker place. Reality would be something that we are afraid of. "*

→ *" The world would be less interesting and less creative. "*

From these enquiries the students report:

☞ ***"Being in contact with the community, with kids and adults at different ages, and engaging in an important real-life challenge makes learning deeper and transformative and doesn't feel like "Learning"."***

Contextualising science community was the second step that the students took. For this, students arranged series of communication events with social actors and presented OSS project ideas to classmates and senior citizens of their community. These activities gave the students the opportunity to reach a wider audience and tell their stories.

Student team in a workshop with senior citizens to demonstrate their project ideas, and during a science lesson in the playground

Student team then decided to investigate the topic *'Science in the Playground',* based on the results of their inquiries and discussions with local actors. They wanted to make the playground an interactive, self-exploratory avenue for science learning for all ages.

KNOWLEDGE AND COMPETENCES ACQUISITION

Student consulting with the science coordinator

IMMERSIVE MISSION: SCIENCE IN THE PLAYGROUND

The objectives of the immersive mission were:

- → to place signs in the playground with scientific content
- → to add videos in barcodes for parents to show their children
- → to prepare interactive lesson plans for middle-school students in the playground
- → to connect and share with parents through the parenting and family centre
- → to train students and retired teachers as volunteers for facilitating in the playground

According to the student team's investigations, the signs would carry for example physics explanations for swings, biological explanations for the surrounding nature, chemical explanations for materials used, etc. Some examples of the signs are shown here:

Signs containing physics explanations about the playground toys

SCIENCE IN THE PLAYGROUND – PHASE I

The first part of "Science in the Playground" immersive mission involved the students making a field research listing and taking inventory of the various facilities and structures existing at the playground. This was followed by meeting and consulting with an engineer on how the mission idea can be made possible.

Finally, the students met and consulted with teachers on planning how to conduct the project. The students broke down the project into smaller assignments which they divided among themselves, such as designing signs for each of the facilities, phrasing and formulating the wording of the signs. The students also met with the Mayor of Modiin Maccabim Reut, where they presented and described their project idea to receive his support for the cause.

The playground in Modiin where the student team develop their project

SCIENCE IN THE PLAYGROUND – PHASE II

In this mission, the students wanted to impart science education to middle school children focussing on the workings and dynamics of the playground facilities. They planned their work sequentially:

1. Starting with identifying the content be incorporated in the lessons.
2. Task division and creating work teams; overviewing different playgrounds in order to choose the one that answers the requirements of the project in the best way. In each of the playgrounds, the students wrote interesting questions about the facilities and the park environment, suggestions for activities, advantages and disadvantages of the playground etc.
3. Choosing the optimal playground through a joint discussion, based on the information collected.
4. Identifying the methods to be used to facilitate the lessons delivery.
5. Writing 4 worksheets about different playground facilities, using the ideas which were written in step 2. The worksheets will guide the middle-schoolers during their research.
6. Designing and structuring the worksheets, making the wording more attractive.

The goal of Phase II was to create active stations for students and the general public to be able to experiment themselves and construct their own scientific conclusions and results while learning in the park.

SCIENCE IN THE PLAYGROUND – PHASE III

This phase saw the implementation in the playground of the lesson plan created in Phase II. The students briefed middle-school students about what to expect in their lessons on the playground. The middle-schoolers were divided into 4 - 5 groups per activity and they were allocated a park facility to explore and investigate. Every facility exploration was led by a student team member who was responsible for the process and accompanying each of the groups through their activity, facilitating their progress to reach the objective of each research task given to them. When each team finished the research on one facility, it moved on to the next station. This way every group experienced 2-3 facilities. At the end of every lesson, the class was asked to fill a feedback questionnaire, which served the team members for improving the lesson plans.

The middle-schoolers experimenting with the physics behind the different playground items

SCIENCE IN THE PLAYGROUND – PHASE IV

During this phase, after the mobility in Poland, Sept 2019, the students wrote another worksheet, and consulted again with the science coordinator and other teachers about the level and topics of the questions. They improved all the worksheets once again and held lessons twice. After the lessons they interviewed the teacher and two middle-schoolers about the new way of learning which they have experienced. This time, they also asked the middle-schoolers to sum up their research experiences and conclusions in a collaborative presentation. The students presented it at science class, the team members came to watch and held a concluding discussion with them.

Interviewing a student and their science teacher. Groups' presentations of their science research at the playground.

DOCUMENTATION

The documentation of the project activities took the form of video making, which led the Israeli student team to win the second place in the video contest. In the video, the students discuss how they came up with their project idea and how they proceed. In addition, throughout the whole project the students documented their process in a shared Google Drive folder, where they put all the presentations and documents made by them, meetings protocols, material from interviews, photos etc.

Since team Israel's immersive mission was about creating a Scientific Playground, the idea was to incorporate signs related to physics, chemistry and biology in kids' everyday life in a playground. Turning a public area like a playground into a fun unconscious science learning environment and making it accessible for the entire community were the initial goals of this immersive mission. To achieve this, signs with scientific content were prepared and placed in the playground. To involve also parents, some videos in barcodes were created so that the parents could watch the videos together with their children. *"We decided that the best way possible to project all the work we've done is through a thorough video and voice over explaining everything we've done",* the team captain said.

Science in the playground (click on the image to watch the video!)

From the students' perspective, this experience was not very challenging or requiring teachers' guidance since they were familiar with filmmaking and already taken some courses at school related to it. Filmmaking was their longtime hobby, so the process was very much enjoyable for them. During the team interview, they expressed

"We knew how to use it because we are both learning filmmaking in school."

"We both learned it by ourselves, since filmmaking is a longtime hobby of ours."

With regards to cooperation and teamwork they said:

"We get along really well and know how to work together as a team with shared effort and understanding, therefore it was not hard to decide who does what."

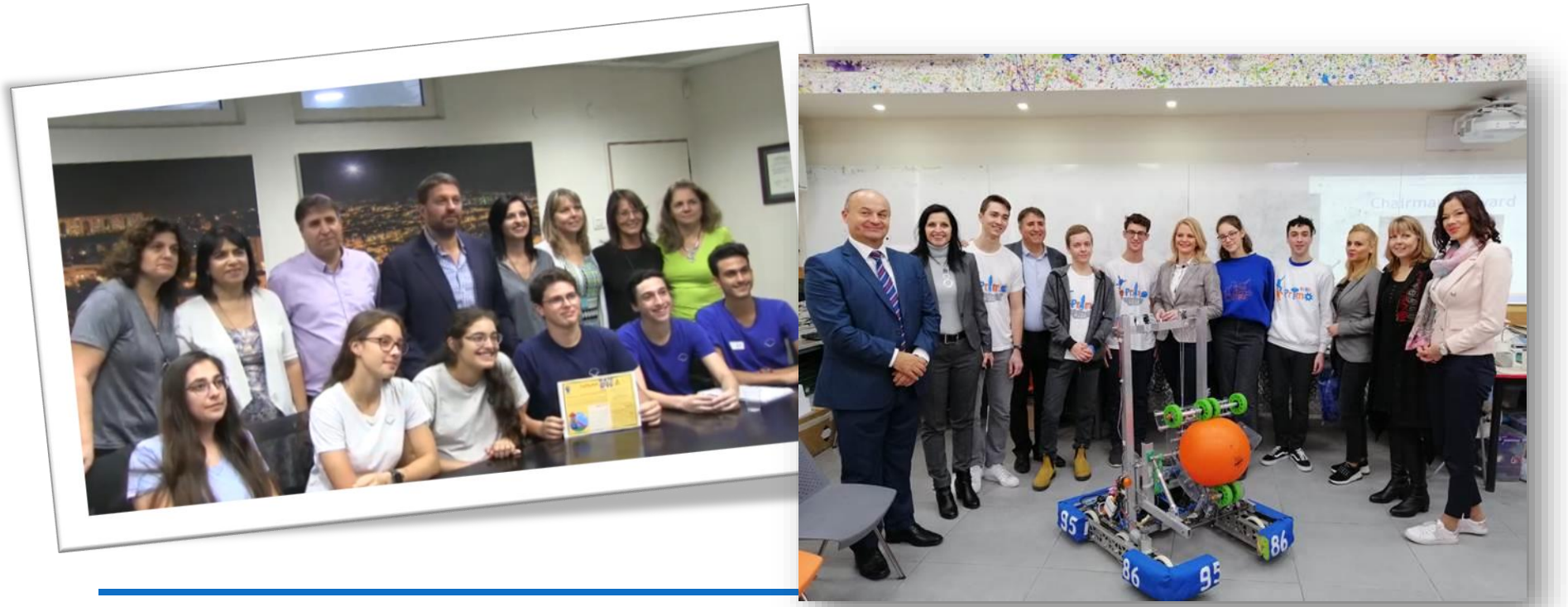
They dealt with different technical instruments like camera, smartphone cameras, and movie making and editing phone applications. They were confident in working alone but of course aware of the fact that if they encounter any problems, teachers would gladly help. What they claimed they learnt through this activity was having the chance to bond together more and to understand the project better: *"We mostly connected with each other and got an opportunity to understand the project better".*

Stating, *"We wouldn't do anything differently" and "we enjoyed video making very much"* shows that students had good time during the process, and they are happy about the outcomes.

SHARING

Sharing of their learning experience was a noticeable part of the student team's activities and progress. They presented their project to:

- → the mayor of the city
- → the Minister of Education of the Republic of Srpska, who came to school with a delegation, in order to watch different creative and unique innovative projects in school, and get inspiration from them
- → school students and teachers
- → senior citizens
- → the other OSS project partners and students during project mobility event in Łukow, Poland in the form of a collage



The student team sharing their project idea with Modiin City Major (left) and with the Minister of Education of the Republic of Srpska.

The student team were very satisfied with their work; however, they faced some challenges as reported below:

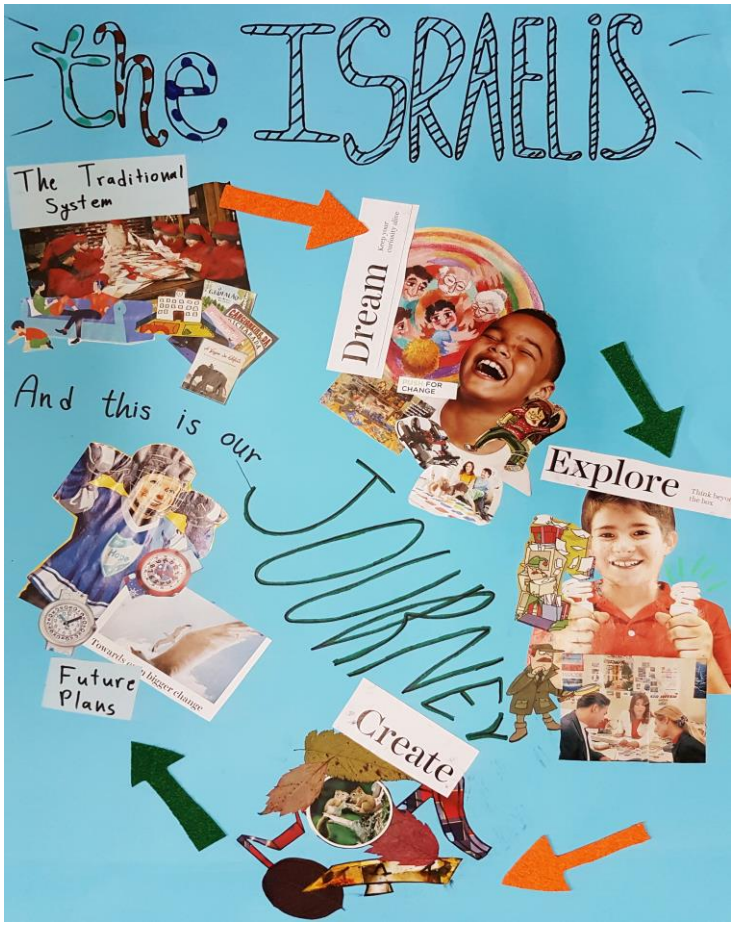
"The challenges we faced were to establish a cohesive student team that included students from different trends, levels, and disciplines."

Another very important challenge was the fact that part of the middle-schoolers were easily distracted at the park, and it was challenging to make them really interested in the activity. The students dealt with it by trying to take advantage of the situation, sometimes by improvising- connecting the questions to the interest fields of the younger students.

They also report to have overcome these challenges through 'communication and teamwork' as well as 'with the help of the teacher'.

The Israeli team during the OSS Mobility, Poland 2019

STUDENT TEAM'S VOICES – JOURNEY DESCRIPTION IN HEBREW



פרוייקט הOSS- תהליך העבודה

נושא החקר שלנו היה לימוד ילדים על המדעים שמאחורי גני השעשועים.

בתחילת תהליך החקר שלנו, שאלנו את האנשים מהסביבה הקרובה לנו את השאלה: מהו מדע בשבילכם? התשובות שקיבלנו היינו כה שונות ומגוונות, אך הגענו למסקנה אחת ברורה- על מנת שילדים ירצו ללמוד מקצועות מדעיים, עלינו להנחיל את המדע אצלם בגיל צעיר.

רצינו לקשר את המדע למשהו מחיי היום- יום שלם, וכך עלה הרעיון של גן השעשועים- המקום שבו ילדים מבלים וכולם מכירים.

היה חשוב לנו לחקור את הנושא, משום שאנו מעוניינים שכמו שאנחנו אוהבים את המדעים השונים, כך גם ילדים יוכלו להיחשף לתחומי מדע שונים ולהחליט מה המדע האהוב עליהם, או אולי להחליט שהם לא מתחברים למקצועות מדעיים. לפי דעתנו, חשוב מאוד שילדים ילמדו לימודי מדעים במוסדות להשכלה גבוהה, משום שמקצועות

מדעיים נוגעים בכל תחומי החיים והם תורמים רבות לידע של האדם,
גם מבחינת הידע שהוא מקבל וגם מבחינה מוסרית

בשלב הראשון בתהליך העבודה שלנו, קיבלנו החלטה שעל מנת שלפרויקט הזה תהייה אפקטיביות רבה, אנחנו צריכים לשנות את כל תהליך הלימוד- אם השיטה הפורמלית היא ללמד ילדים בתוך כיתה- אנחנו נוציא אותם החוצה, אם בשיטה הפורמלית יש מורה שמלמד את התלמידים- אנחנו (בני נוער) נלמד אותם.

לאחר מכן, בשלב השני, התחלנו לבנות דפי עבודה שיגרמו לילדים לשאול שאלות ולהתעניין כיצד המתקנים פועלים בגני השעשועים, התייעצנו עם מורים וחקרנו כיצד לנסח ולעצב שלטים ודפי העבודה שיהיו אטרקטיביים לילדים.

בשלב השלישי, התחלנו להוציא תלמידים אל גן השעשועים הסמוך לבית ספרנו ולהוציא לפועל את כל המחקר שלנו. היה לנו חשוב מאוד שהתלמידים ידברו בכנות ויחוו את דעתם על הפעילות- איפה הם נהנו יותר ואיפה פחות, מה לפי דעתם היה עוזר להם יותר להנות בפעילות. לקחנו את כל התגובות על הפעילות ושילבנו אותן בפעילויות הבאות. את הפעילות בגני השעשועים קיימנו 5 פעמים עם 5 כיתות שונות עם ילדים בגילאים שונים.

בשלב הרביעי, הבנו שהפעילות בגני השעשועים נחמדה מאוד אך היא לא אפקטיבית, משום שאם מורה רוצה ללמד את תלמידיו מדעים בצורה ייחודית, אין לו את האפשרות לוודא שהלמידה תהייה אפקטיבית בגני השעשועים משום שהוא רק בן אדם אחד.
לאחר שנתקלנו בבעיה הזו, מצאנו פתרון- התחלנו לכתוב מערכי שיעור שכל מורה שירצה יוכל להעביר אותם לתלמידיו, השיעור עצמו אמנם עדיין נעשה בכיתה אך הוא כלל המון כלים אטרקטיביים, לדוגמה: חידונים, יצירת סרטונים הקשורים לנושא ואפילו פרוייקט חקר פשוט שהתלמידים מבצעים בכוחות עצמם ומציגים לחבריהם.

כשקבוצה אחרת מבית ספרנו תמשיך את פרוייקט הOSS, היינו ממליצים להם להיות סבלניים, תהליך החקר הוא תהליך ממושך ואי אפשר לראות תוצאות באופן מיידי, התוצאות מגיעות רק לאחר עבודה קשה והשקעה אמיתית.

בנוסף, זה לא תמיד פשוט כל כך לבנות מערך שיעור או להעביר פעילות לכיתה שלמה ויש תקלות בדרך, וזה בסדר, תהיו מודעים לכך שאם אתם נתקלים בבעיה ישם לכם מורים ואנשים עם יותר ניסיון שיכולים לעזור לכם, ברור לגמרי שהפרוייקט הוא בהובלת תלמידים אך חשוב מאוד גם להיעזר בבעלי מקצוע כדי להוציא ממנו את המקסימום ולהגיע לתוצאות הטובות ביותר.

לסיכום, היה לנו כבוד להשתתף בפרויקט הOSS, למדנו המון, בין אם זה להבין מה העקרונות הפיזיקליים שעומדים בפעולת המגלשה ובין אם זה ללמוד איך להעביר שיעור מול כיתה ולגרום להם להתעניין באמת שנושא שהם לומדים.

לפי דעתנו, הפרויקט הזה משמעותי מאוד משום שהוא מעודד את הדבר שמבחינתנו, הוא הדבר החשוב ביותר והוא- חשיבה יצירתית. במסגרת העבודה על הפרויקט נתקלנו בבעיות ובאמצעות חשיבה קבוצתית, הצלחנו להגיע לפתרונות יצירתיים ולהתגבר על הקשיים.

OPEN SCIENCE SCHOOLING
STUDENTS JOURNEY

SCHOOL TEAM LITHUANIA

PASVALYS LEVENS BASIC SCHOOL

LITHUANIA

PASVALYS LEVENS BASIC SCHOOL, LITHUANIA, is a public school situated in the urban area of Pasvalys. The city has an approximate population of 8000 inhabitants. The number of students over 12 years of age studying at the school, is 118. The school practices traditional system of pedagogy. A view of the school is provided here.

The school team consisted of 6 teachers, and 24 students. The project related activities were conducted both within and outside of school hours. An average of 1-2 hours per week of project activity was integrated into curriculum depending on the programmes requirements for the subjects including English, Science, Art, Technologies and Domestic science, Special education subjects, primary school subject called Nature and Human Studies, Human Health and Safety. About 2-3 hours of extracurricular activities, on average were conducted at school, at the city and in the library. Towards OSS, in addition to participating in the educational trips, student teams also took part in/organised project-inspired events in collaboration with the parents' club activities.

The project team at Pasvalys, Lithuania.

The project related activities were conducted both within and outside of school hours. 1-2 hours per week of project activity was integrated into curriculum depending on the curriculum requirements.

To combine the team of OSS participating students was one of the most exciting tasks of the project. **The teachers wanted to implement the OSS schooling school-wise, including the primary school students**. So, the main team of 14 participants was the core one and the rest of the participants were volunteers

but very important ones (as a link in the chain of an extended project-based activity). By encouraging different age students to work together, the teachers reported to help their school communities be more cohesive. Older students felt like they were making a difference in the lives of younger students, while younger students gained positive role models, support, and friends from the older students. The lead teachers wanted to unite all age groups doing an extended activity starting in the primary school which then led to continuation in high school but based on primary school findings. They reported to find out that peer learning when students teach and learn from each other, can help students take ownership of their own learning, increasing motivation. The combined knowledge and skills of different aged students increases the potential for creative solutions to problems. In this model students from different years take control of the learning process by planning their own lessons, creating their own presentations, and through teaching each other. The model can be used to teach several classes of students on topics included in the national curriculum.

The **innovation** combines goal-oriented "from hands-to-hands" peer learning with self-assessment and multidisciplinary learning units in an interesting way.

Impact: Collaboration and project-based learning become natural to students.

Expansion: This model can be implemented in all kinds of learning units and environments and can be carried out with resources that are usually readily available.

WHAT IS SCIENCE?

PERSONAL PERSPECTIVES (REPRESENTATIVE ANSWERS)

"I think, that science is very important for everyone these days, so science is like a lead to easier, better life. Our expanded scientific knowledge can help us to discover and invent something new. It can open the way for us to the new technologies and experiments. Science - is the most important thing in our lives."

According to Girls

"Science is a study, that can help us to understand the world better and help us improve our environment. But science can have also negative effects, such as polluting the environment which leads to climate change. That's why we shouldn't be carefree about some of the science experiments but think about what it will do for the environment."

"Science is the acquisition of objective knowledge of nature and society through the study of reality."

"Science is a particular branch of science such as physics, chemistry or biology."

"Science is a study of our world and a lot of different things in it. Science is also experimenting, searching, observing, listening, watching, testing, questioning, exploring, thinking, understanding, learning new things and making conclusions."

"For me science is a way of discovering what's in the universe and how those thinks work today, how they worked in the past, and how they are likely to work in the future. Also, for me science associates with word discovering."

"Science is an opportunity to explore the world and research the mysteries of it, it helps develop new stuff and technology"

"Science is an obtaining objective knowledge about nature and society."

According to Boys

WHERE CAN WE FIND SCIENCE?

PERSONAL PERSPECTIVES (REPRESENTATIVE ANSWERS)

"Maybe you won't believe me, when I tell you this, but I think Science is everywhere. It is in our everyday life, what we eat, how we come to who we are, how our body works, how we grow vegetables and plants, our environment, nature. The process of making medicine is also science. Doing a surgery to treat a condition such as injury or disease is also science. The fact that Earth orbits The Sun once a year is also science. There is so much information about Science, that 's why I don't think that one human could learn it all in his/her lifetime. But I want to learn as much as I can, I want to know why. Science gives me the WHY.I think all of us are still learning about it every day."

"We can find science in almost all technological stuff, we can hear about it in the news, we find it at school"

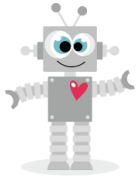
"We can find science everywhere: at our homes, environment, industry, in the internet, in our bodies."

"We can find science everywhere. Science is almost in everything between us."

"We can find science in everyday things. A few examples would be, a car going down a road, physics are involved. It may be that anywhere you look you will find at least one example of science."

"We can find science everywhere around us. Science affects us all, every day of the year from the moment we wake up, all day long, and through the night. For example: our digital alarm clock, the weather report, the asphalt we drive on, our cell phones, the light that we turn off at the end of the day and etc."

"Science is in our everyday life. We can find it mostly everywhere and that doesn't matter what we do, for example: we cook, grow plants, sleep. And not only in these actions we can find science. Thinking about bigger and a bit or sometimes even very dangerous things and actions where we can find science, for example, fires. There are many things that happen in nature and some of them can even be a catastrophe. Also, we can find science in humans' creations, for example: people create bombs and other dangerous stuff that could destroy the whole world."



What is Science in the past and what is it now?

Personal perspectives (representative answers)

"I think that in the past weren't any special machines or other things to help scientists, so they made o lot of guesses and some of them were wrong. Now, as we can see, people expanded their scientific knowledge. But that has some minuses and the results are that people now know how to create bombs and other dangerous things. Maybe that's not that bad because people are more advanced in science etc. But they could destroy the whole world, because they do experiments and it shows, that they don't really care about the world and other people and all this can go too far."

"Science is deeply interwoven with society, and as it has changed into what we have today and what we call science. In the past science wasn't that progressed as it is now, it progresses every day."

"Science evolved with time. Nowadays science is more advanced than in the past. Science in the past was based on myths so it wasn't as reliable as science now."

"I think science now and science in the past are very different. Science now is much more advanced, it improved. Modern science is more reliable and accurate. Ancient science (science in the past) was only based on observation and not tested. Science, before even the first remarkable discovery, was something based on myths and simply baffling thoughts on everything."

"In the past science was different because there wasn't that much technology. Nowadays, we have a lot of technology and that makes everything much easier."

"Science in the past wasn't so advanced as it is now. Now science is focused to make our lives more comfortable and enjoyable. Of course, it also focuses on space, nature and animals."

"I think that science in the past was more about discovering new continents, seas, exploring human body and everything that people didn't know about. Now science is more improved .Every year scientists are trying to make something that would help our planet, they are creating machines that are hard to make and requires a lot of effort, but the result is amazing. Because of science people now can live longer and they can avoid illness and live their life healthy. Also there are some minuses that can destroy our planet."

"In the early years scientists were not so well developed or equipped to do experiments, so science was undeveloped too, today scientists are more and more developed, so science and new technologies are developing with them too."

WHY IS SCIENCE IMPORTANT?

PERSONAL PERSPECTIVES (REPRESENTATIVE ANSWERS)

"Science is important because it lets people develop new technology, discover new things and animals. It helps the world to grow."

"Science is important in a lot of ways. It can help us to find a lot of new things about Earth and the life that's on it. Science can help us improve the quality of our lives. Science can help us find new medicine and help us cure diseases. Science can help us in a lot of ways, as long as we use it wisely."

"Without science there would be no computers, no television, no transport, no technologies but there would be more health problems, diseases, infections, disasters."

"I think that science is the most important thing our life. It is in everyday and every time, so it is very helpful for humans and it's very important and useful in their lives. Now, people can't imagine their everyday life without many machines and things that were invented according to scientific knowledge."

"Science has led us to finding out things that give us what we have today. In fact, without science we would not have electricity which would mean no mobiles and internet, we would not have fridges to keep food fresh, television to entertain or even cars to travel in. A world without science would mean that we would still be living in a very different way to that of what we live today. Science is everywhere in today's world. It is part of our daily lives, from cooking and gardening, to recycling and comprehending the daily weather report, to reading a map and using a computer. Advances in technology and science are transforming our world at an incredible pace."

"Science is very important because without it I don't imagine human existence at all. Scientific knowledge allows us to develop different technologies, solve important practical problems, make wise decisions and do different tasks in an easier way. Science helps us to understand the world around us and changes our mindset."

"Science is very important for everyone nowadays, without it we wouldn't know anything like history, math, biology, wouldn't invent new things."

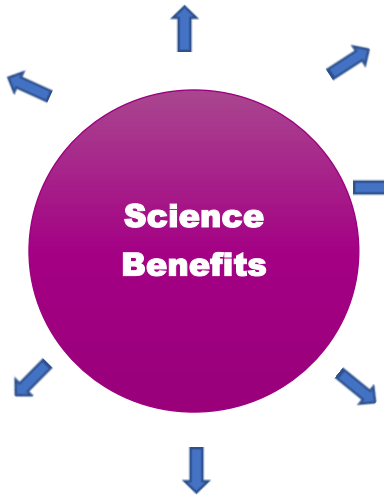
"All inventions that were made because of science changed our lives in a better way. People probably can't imagine life without electricity, transport, internet, knowledge. All those things are based on science. Advances in technology and science are transforming our world at an incredible pace, and our children's future will surely be filled with leaps in technology we can only imagine."

What are the benefits of science?

Personal perspectives (representative answers)

"Benefits of science are simple:
•You get new technology with it, that makes life easier
•You discover new things including (animals, microbes, plants, creatures in water), knowing all this you can be safer, because some creatures are dangerous. Science helps you learn how to treat all new things, how to react to unknown things."

"Science has a lot of benefits such as helping us understand about the environment, space and ocean. Another benefit would be that it helps us to study various illnesses and help us find a cure for them. It helps us understand the human nature and study various species of animals. The more we know about the earth, the more chances we have to take good care of it."



"Scientific knowledge allows us to develop new technologies, solve practical problems, and make informed decisions."

"With the help of science, we can solve social issues, build knowledge, satisfy curiosity, solve everyday problems."

"Science allows us to discover who we are and why we are here. Cars, busses and trains all originated from science and help us get around from place to place much faster. Also instead of needing to go talk to a person in person or to write them a letter, we can talk to them over a phone or video chat, even if they are hundreds of kilometres away. Science makes our lives much easier."

"Scientific knowledge allows us to develop new technologies, make informed decisions and solve some problems. Science is very useful in every person life. I think that new scientific knowledge may lead to new applications."

"Science has given us many benefits. Rocket science took us to the Moon and is allowing us to explore other planets. Like these pictures, taken by a robot on the surface of Mars. Modern medicine can cure diseases that used to be deadly. Breakthroughs in technology mean we can travel faster and further than ever before. We can communicate instantly using the Internet and can carry hours of entertainment in our pockets. Science and technology have improved our lives."

How would the world look like without science?

Personal perspectives (representative answers)

- → *"If there were no science, the world would be totally different. First of all, everyone would be dumber. We would have no technology; I could even say that everyone would still live in the stone age. We wouldn't know the simplest things, like: why is the rain raining? Science is all our life. Science is in our every step."*
- → *"The World would be primitive, not evolutionary."*
- → *"To imagine a world without science is really hard. Science is everywhere we look at. It helps us in our daily lives, and it has a big part in our lives. Without science we would have very little knowledge about the things that surround us. Of course, science has some negative effects. Some scientific experiments lead to pollution, which is not a good thing. Climate change is a very important subject right now and I'm not saying that we should stop using science, because that is impossible, but what I'm saying is that we should think about the side effects some of our experiments have."*
- → *"The life of the people would be very difficult. Mostly everything would be different than now. People would live much shorter, because medicine in the past wasn't that well known as now. All everyday jobs would have to be done by people, for example: mop the floor instead of a robot. But we can see pluses in that, because now our planet is way not that clean as it was in the past. People are destroying the world in many different ways. We need to use Science to save our planet, not destroy it. I hope we will manage that before it is too late."*
- → *"Without science the world would not come up to this point. Because of science we have Technology, buildings, bridges, structures and transportation. However, the most important thing that we wouldn't have if science didn't exist is knowledge, it is the most important thing in our lives. We could not do simple things such as washing dishes and turning on a computer. We wouldn't have invented cars, trucks, or other vehicles without science. Due to the contribution of science, human beings now a days live longer because of new inventions of medicine and treatment. Even doctors can transplant the vital organs such as heart, kidney, eyes etc. due the invention of science. So, science brought the modern civilization at this stage where we are today."*
- → *"The world without science would seem unknown, full of secrets and chaotic because we wouldn't be able to understand where we came from or how we supossed to survive. If there was no science and no answers to our questions people would panic and I don't think that they would easily get along with each other. If there was no science there wouldn't be any cure or medicine for disaeses. And with no understanding how to survive or keep ourselves safe we wouldn't live long. I think that science is deeply connected with art.Because both of them are human attempts to understand and describe the world around us. I love creating art and expiremenTing with it,overthinking what more I can add to it,I think that's connected with why I like science."*
- → *"Without science the world wouldn't come up to this point. Because of science we have Technology, buildings, bridges, structures,transportation and etc.However, the most important thing that we wouldn't have if science didn't exist is knowledge, it is the most important thing in our lives. We couldn't do simple things such as washing dishes and turning on a computer.Also if science didn't exist people would live shorter."*
- → *"Without science we wouldn't have technology, buildings, bridges and the most important thing knowledge. There wouldn't be many things invented also we wouldd live shorter lives because there wouldn't be any medicine."*

PROBLEM IDENTIFICATION AND CONTEXTUALISATION

Towards science learning and teaching innovative understanding, as a first step, the participating schoolteachers in collaboration with their students planned their work so that they could integrate OSS project ideas within the curriculum. They focused on the curricular subjects of Science, English, Art and Technologies. The next step was to consider a few reflective questions regarding how to practically implement the plans made for learning science.

- How can Science be exciting and interesting during the lessons?
- How can Science be useful and caring about the environment?
- How can we take our scientific knowledge to the afterschool activities?

To find answers to the above questions, as an experiment, the science teacher conducted a science lesson in a different location than the usual one: outside the school building. At the end of the lesson the students had to evaluate how well they had understood the topic. The teacher found that the students' understanding was higher than usual, as per the teacher's observations. Later in another evaluation on self-control work, the results were the same. i.e., the students' understanding of the lesson was higher than usual. The teacher reported following findings from this activity:

→ Changing the usual lesson environment into an outdoor lesson environment can be fun and even more productive.
→ This conclusion came as a result of the investigation done during the session with the school's psychologist.

These conclusions strengthened position of the teachers to ask for support from the school administration to implement the OSS approach to science learning, in terms of applying a different didactical approach to teaching and learning science.

The project team at Pasvalys, Lithuania changing perspectives of teaching and learning science – Outdoor experience.

☞ ***The teachers and the students collectively affirm that, "We tried this new approach and we liked it."***

Contextualising science in the community, the teachers and students organised educational spaces for the students to try an easy/passive way of learning while being at leisure. The topic of the lesson was, **"Types of the trees growing in Lithuanian climate".** In order to start identifying and contextualising science in their community students had to recognise the trees growing around the school and translate their names from Latin into Lithuanian, English, French and Russian. Approved findings were put up on the appropriate trees for the others to learn.

Finding science in trees – what is suitable to grow in Lithuania? Science learning at leisure.

Furthermore, **the students and teachers involved parents and other community members** into the science learning activities. Parents' initiative to help the environment was undertaken. They put up nest boxes on trees near the school premise. Another activity involving parents was, "Add some colours to your surrounding and help the trees survive winter! Enjoy the view!" The task was to collect from their homes old or unnecessary scarves and use them for trees decoration and warming. Both students and parents enthusiastically took part in the activities and the activities were considered successful and unforgettable.

Involving parents on science learning activities through games – the identified trees were dressed up for winter with clothes and bird nests!

KNOWLEDGE AND COMPETENCES ACQUISITION

From the experiences with science contextualisation, student teams decided the type of immersive missions they wanted to carry out. Student teams were interested in **exploring nature through arts** as well as possible business opportunities by creating art from nature. The students investigated the shape, colour changing properties and benefits of the leaves of local trees and bushes in their forest. Several immersive missions were developed under this umbrella idea. Furthermore, interviews with role models, e.g., Doctor of Science Mrs Renata Česuniene, were arranged by the teachers. The interviews were filmed and shared between the students, teachers and stakeholders. This activity rose awareness and popularity of the project.

"We invited an outstanding role model, Doctor of Science Mrs Renata Česuniene who gave us a lecture on the most interesting scientific discoveries and then involved our students into unforgettable scientific experiments. After this event many pupils started considering to make a scientific career."

Pasvalys School Teacher

IMMERSIVE MISSION 1: INCLUSIVE SCIENCE LEARNING

In this mission, **the OSS practice into the learning process of children with special needs**. The students with special needs revisited each geometrical shape they were likely to see outside in nature. Once out in nature settings, the students were encouraged to use their imagination to find objects that resembled a geometric shape they had studied in the classroom.

What shapes are found in nature? A leaf with hand shape.

Shapes and geometry for all.

IMMERSIVE MISSION 2: LOCAL SOIL BENEFITS

During this immersive mission, the student teams studied the **types and properties of the local soil**. Target task: starting students' own business using the soil of Pasvalys.

The student team needed to identify during the science and geography lessons the most suitable types of soil to start their own business without too many costly investments. They first learnt about different types of soil, their properties in the classroom. They were to consider the uses of soil in the everyday life of the local community, and then explore which soils are best for making certain things/ products if they wanted to start their own business using the priorities of the soil.

They were then grouped into three groups of 6 students each and were given the task to look for and identify 3 types of soil: ***clayey***, ***loamy*** and ***sandy***. Once the soils were identified, collected and brought into the classroom, the samples were subjected to investigation in order to understand the soil composition and structure. Based on the results of the investigation the students concluded that ***clayey*** type of soil keeps its shape well and is suitable to be used for making pottery or souvenirs and decorations. Together with the teacher of Art they tried the clayey samples in practice by making attractive pottery or small souvenirs for decoration. Furthermore, looking at business ventures, during the economics lesson the students counted the expenses and possible profits using the soil of Pasvalys area as a raw source of material for souvenirs.

School administration and teachers welcomed the idea to integrate OSS project activities into curriculum. Together with the team members we brainstormed the most interesting/relevant topic for the Science lesson. The result of brainstorming and final choice of the topic for the immersive mission was: "Types and properties of the soil. Types of the soil dominating in Pasvalys area" Cross subjects (Science, Geography, Art, Economics).

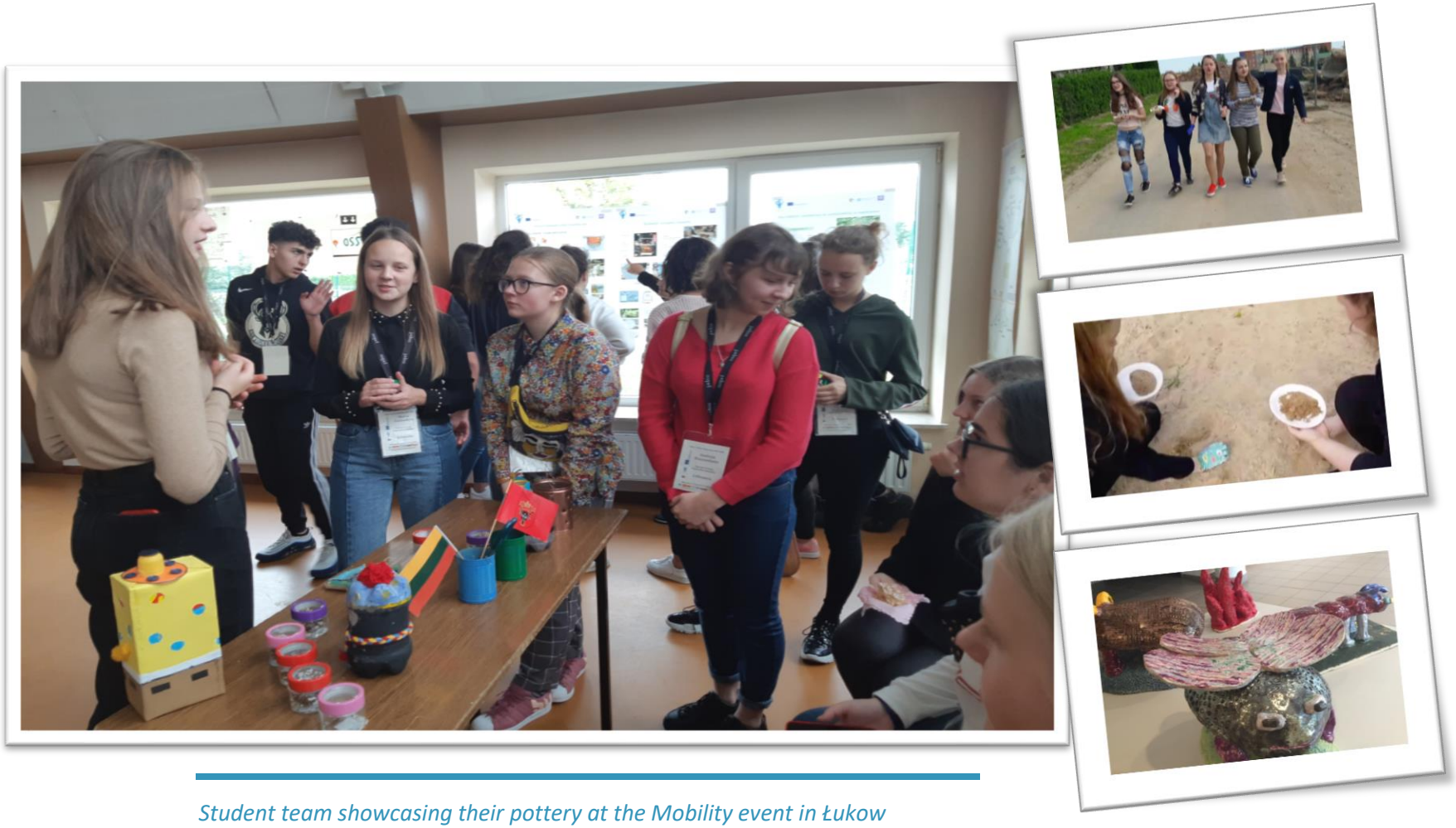
Based on the development of this mission the students decided:

→ To display the works in public places, like school assembly hall, museum, library, etc.

→ To take part in St. Kazimiras' Fair as an opportunity to sell the products and make first profit.

In addition, students discovered the properties of the soil in Pasvalys that make it unique and, by doing the experiments together with Science and Arts teachers, prepared a step-by-step description/recommendation focused on showing how a lesson in school may help foster a business idea.

Impact on pupils: scientific curiosity rising, logical and creative thinking development, individual business promotion



Student team showcasing their pottery at the Mobility event in Łukow

Immersive Mission 3: Nature Bookmarks

During this immersive mission the student teams used dried leaves of different shapes, texture and colours to make bookmarks that could be sold. The students went on a nature hunt to collect and identify different kinds of leaves, dried them for dried them out for two weeks, laminated them and made them into bookmarks. These artistic compositions they called **Nature Bookmarks.** The student teams used the Herbariums prepared during Biology lessons and documented the process in a video.

Nature Bookmarks – from collection to final product

☞ ***SIDEWORK ARTISTIC ACTIVITY- School walls painting conducted by another professional-artist Arvydas Gudas. He proved that knowing some scientific secrets can add much to becoming a successful artist. Even those students not interested in Science admitted its importance***

DOCUMENTATION

The student teams documented their journey through photos and videos. As a part of the project video contest, the student teams presented two short videos which depicts their work during the immersive mission activities. One video showcased students exploring the types and properties of soil predominantly present in Pasvalys area. They observed, studied and learnt to classify different types of soils during Science and English lessons. Additionally, their immersive mission depicted in the video also aimed at identifying the most suitable types of soil to start your own business without too many costly investments. They concluded that clayey type of soil keeps its shape well and is suitable to be used for making pottery or souvenirs and decorations.

☞ ***In the first video, the students discuss how they worked towards identifying the types and properties of soil. Click the image below or the link https://youtu.be/bXmP4qCzkAE***

Regarding the videomaking process, the students reported that the plotline of the video was created through brainstorming sessions where the students and teachers discussed many interesting and relevant topics.

> *"The result of brainstorming and final choice of the topic: Types and properties of the soil. Types of the soil dominating in Pasvalys area. "*

Once the topic was finalised, the teachers talked about soils in general to the students and explained the idea behind the mission. Students who had experience in video making were delegated to film video footages and editing of the videos. While the equipment used for the purpose was a SONY video camera and smart phones, editing of the videos were done on free video editing software.

> *"Free Windows in-built Movie Maker and Photos APP, VideoPad Video Editor, Avidemux, VSDC Video Editor."*

The knowhow of the technology and the software was gained through internet and professional consultation.

> *"…watching the demonstrational tutorials on YouTube, consulting the ICT professional working at school."*

The team members marks that the video making process was enjoyable, with students from different classes taking part, being co-operative and working collaboratively.

> *"Yes, everybody was cooperative, even those who are usually shy or silent during the regular lessons."*

Regarding the teachers' involvement in the project, they were present throughout the video-making process especially in the video editing.

> *"The teachers edited the language in the descriptions or subtitles."*

Apart from the scientific content on different types and properties of the soil, the students mark that in this process they learnt,

> "*… you need imagination and strong will if you want to reach your aim.*"

In light of their biggest challenge in terms of maintaining the quality of the end outcome, the students stated that they would like to get better equipped and acquainted with technology so that the quality of the video is enhanced, next time.

> *"The biggest challenge was to send the ready-made material without losing its quality to the contest organizers. We tried using different ways, but we did not succeed, and the quality of images was not the best."*

"We would use better cameras (more pixels, etc), maybe, we could ask for a professional help or advice from the professionals outside the school. Our final video was amateur in comparison with the videos from the participants of other countries."

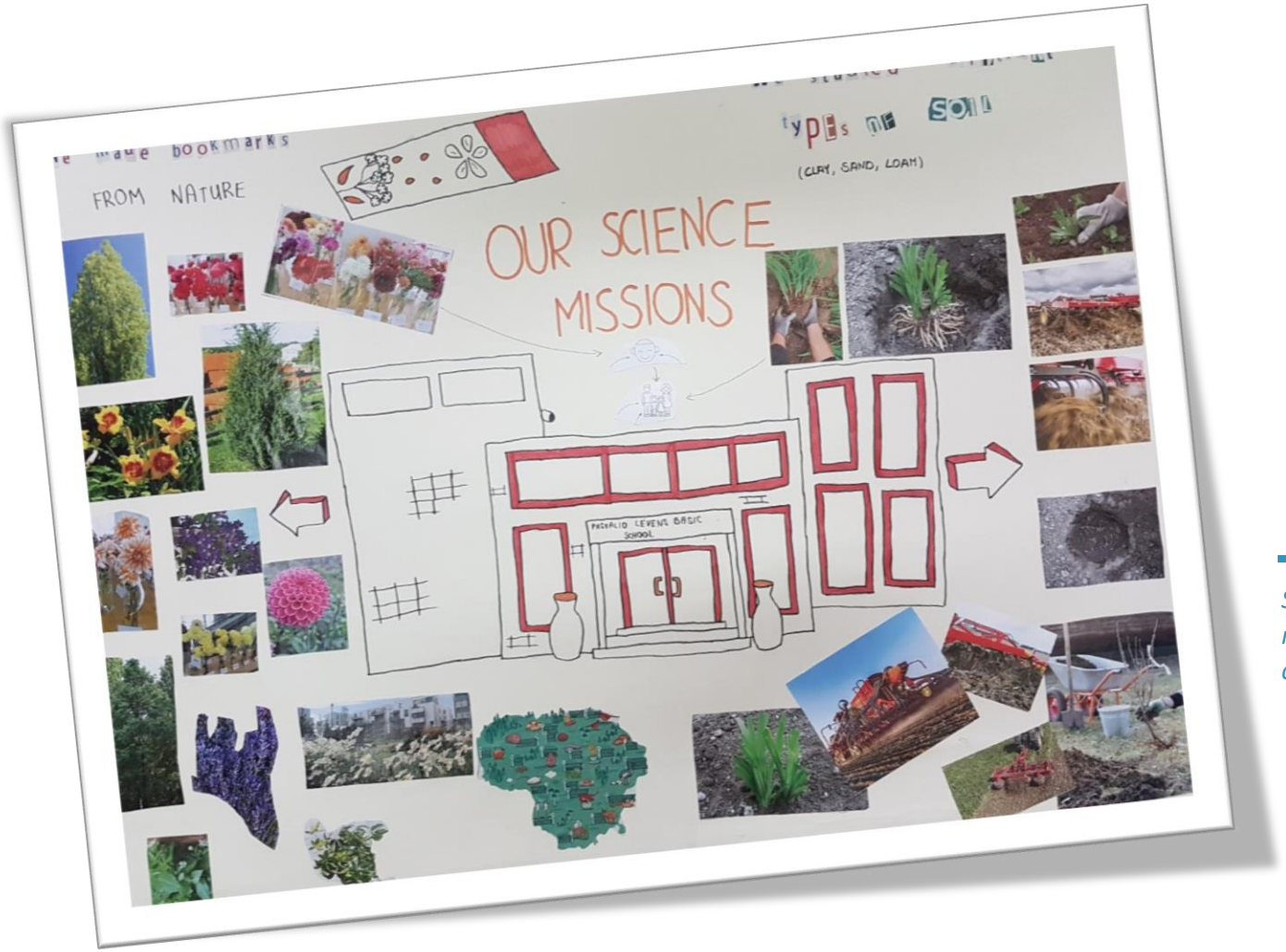
☞ ***In the second video, the younger students discuss the different methods of distillation and filtering water to get clear drinking water. Click the image below or the link https://youtu.be/4TFUMAwV4AA***

SHARING

The student teams shared their learning experience from the development of their projects to the following stakeholders:

- → to the school's community through project presentation PowerPoint presentations, activities and workshops, as well as online through the school Facebook page
- → to the parents of the teachers (during the parents' meetings)
- → to the local municipality by inviting them to the project introduction and activities presentation

→ to the international community during the Project's Mobility event in Łukow, Poland, September 2019. The students showcased their OSS Immersive missions in the form of a display and a collage presentation.

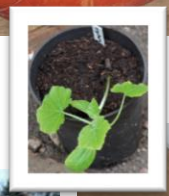


Student teams journey representation through a collage.

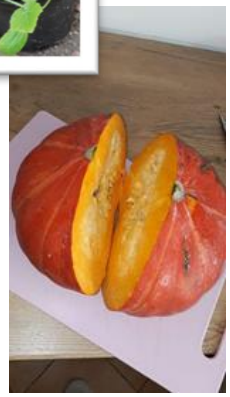
STUDENT TEAMS' VOICES – JOURNEY DESCRIPTION IN LITHUANIAN

Erasmus+ projektas „Open Science Schooling" – galimybė suprasti, kad mokslas yra neatsiejama mūsų kasdieninio gyvenimo dalis

2017 m. gruodžio mėnesį Suomijoje, Joensuu mieste, susitiko Erasmus + projekto „Open Science Schooling" dalyviai iš Suomijos, Lietuvos, Ispanijos, Rumunijos, Portugalijos, Graikijos, Lenkijos, Izraelio. Pirmajame susitikime dalyviai pristatė savo šalis, mokyklas bei aptarė projekto būsimas veiklas, planavo susitikimų laiką ir vietą. Diskutavome, kas yra atviras mokslas, kaip galime jį integruoti į įvairias mokyklos veiklas, ką galime padaryti realiame gyvenime kartu su vietos bendruomene. Jau pirmojo susitikimo metu supratome, kad mokslas yra ne tik pamokos. Tad ir veiklas planavome taip, kad sugebėtume pajusti, jog visa mūsų aplinka yra labai vieninga ir gamtos mokslus galime integruoti į dailės, technologijų, anglų kalbos bei kitas pamokas, popamokinę veiklą. Mums šio projekto temos labai aktualios, nes Pasvalys – molio kraštas, garsėjantis smegduobėmis. Mokyklos erdvių puošybai jau daug kelerius metus naudojamos antrinės žaliavos, taip mokant bendruomenės narius tausoti gamtą.



Projekto veiklos buvo suplanuotos taip, kad būtų įtraukta visa mokyklos bendruomenė. Mes buvo skatinami atrasti mokslą pačiose netikėčiausiose vietose, aktyviai dalyvauti patyriminėje veikloje, kur buvome ne stebėtojai, o aktyvūs dalyviai, tyrinėtojai, mokslininkai. Atlikdami užduotis, pradinių klasių mokiniai bendradarbiavo su mumis, vyresniaisiais jų draugais. Pradinukai domėjosi tinkama ir netinkama daigumui temperatūra, 3 klasės mokiniai pasodino



moliūgo sėklą, kad nustatytų tinkamą daigumui temperatūrą, išdygusius moliūgų daigus perdavė 6 klasės mokiniams, kurie atliko tolimesnius eksperimentus: pasodino augalų daigus šiaudų ritiniuose, stebėjo ir registravo rezultatus.

Integruojant gamtos mokslo, anglų kalbos, technologijų, dailės pamokas, vykdėme įvairius projektus, kurie mums ne tik labai patiko, bet ir galėjome savo kurtais darbais papuošti mokyklos erdves ar pradžiuginti svečius originaliomis, pačių sukurtomis dovanėlėmis. Mokslo žinias taikėme rinkdami augalų lapus, žiedus, juos džiovindami bei vėliau gamindami skirtukus knygoms.








Mūsų tėveliai taip pat įsitraukė į veiklas, puošdami mokyklos aplinką. Kūrybingos mamos puošia mokyklos kiemą gražiausioms šventėms, panaudodamos gamtines medžiagas. Jos ne tik aprangia mus, bet ir mokyklos aplinkoje augančius medžius – ne tik tam, kad nesušaltų, bet ir kad mūsų aplinka būtų spalvingesnė, žaismingesnė.




Kad sunkūs gamtos mokslai yra įdomūs, mums pademonstravo mokslininkės iš Vilniaus, kurios ne tik pasakojo apie mokslininkus, jų atradimus, rodė įvairius eksperimentus, bet ir mums patiems leido juos atlikti. Mobiliosios mokslo laboratorijos įkūrėjai parodė mums, kaip mokslą galima pritaikyti kasdieniame gyvenime ir koks jis svarbus pasauliui ir jo žmonėms.

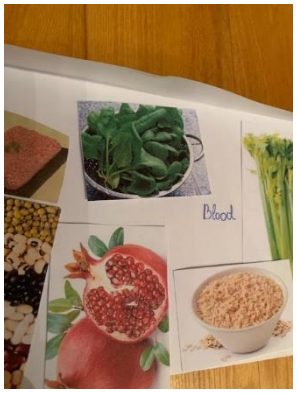


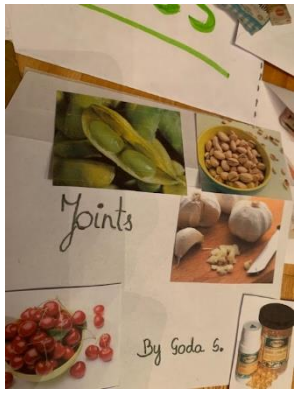

Kitokios technologijų pamokos vyko su virtuvės šefu, mūsų mokyklos draugu, Ruslanu Puskepaniu. Sukdamasis virtuvėje su 5-ų klasių mokiniais, jis pademonstravo mums dar neįprastą ir mažai žinomą molekulinę virtuvę.



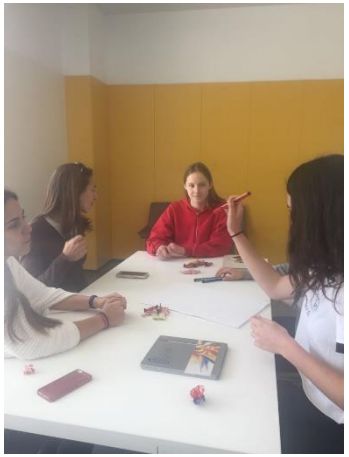
Ruošdamiesi karjeros dienai, mes pasirinkome profesiją ir sukūrėme tyrimais pagrįstą plakatą bei jį kūrybingai pristatėme auditorijai. Komandų plakatai buvo eksponuojami aktų salėje, kad visi galėtų pamatyti ir iš jų pasimokyti. Buvo smagu apsirengti savo pasirinktos profesijos darbuotojų apranga ar turėti bent užrašą, susijusį su tema ar profesija. Prieš karjeros dieną dalyvavome išvykose į įstaigas, gamyklas ir kt., kur galėjome iš arčiau pažinti konkrečią profesiją.


Mums labai patiko anglų kalbos ir gamtos mokslų integruota pamoka, kur net nepajutome, kaip išmokome, kas yra naudinga kiekvienam mūsų organui. Ieškojome sau reikalingos mokslinės medžiagos įvairiuose šaltiniuose, ją išanalizavome, kūrybingai paruošėme ir pristatėme savo draugams.





Visas savo veiklas mokykloje pristatėme projekto „Open Science Schooling" dalyviams, dalyvaudami projekto vizituose Katalonijoje, Madeiroje (Portugalija), Lenkijoje. Šie susitikimai – tai ne tik savo veiklos pristatymas, bet ir puiki galimybė pažinti kitas šalis, jų žmones. Lankydamiesi Katalonijoje ir Madeiroje gyvenome šeimose, tad turėjome puikią galimybę iš arčiau susipažinti su kitos kultūros žmonių kasdieniniu gyvenimu. Be abejo, nebuvo ir labai drąsu, bet dabar jau žinome, kad mokydamiesi anglų kalbos mes galime bendrauti su bet kurios šalies žmonėmis. Svarbiausia - neužsidaryti, bet patiems domėtis, klausti, stengtis kuo daugiau sužinoti. Projekto metu mes turėjome puikią galimybę tobulinti anglų kalbos ir apskritai bendravimo įgūdžius. Tobulinome komandinį darbą, nes projekto vizitų metu daugiausiai teko dirbti komandose, būti aktyviais dalyviais ir atidžiais klausytojais. Katalonijoje rengėme interviu, kur dalijomės mintimis, ką mes manome apie šį projektą, ką jis mums reiškia, koks mokslo ir technologijų poveikis mūsų kasdieniniam gyvenimui, kokias problemas padeda išspręsti. Veiklas paįvairino įvairūs žaidimai, kurie leido artimiau susipažinti su bendraamžiais iš kitų šalių, susirasti draugų.

Itin įsiminė vizitas nuostabaus grožio Portugalijos saloje Madeiroje. Pirmąją susitikimo dieną mokinių ir mokytojų komandos dirbo mokykloje, kurioje mokėsi futbolo žvaigždė K. Ronaldo, o popietinė veikla persikėlė į Porto Moniz, garsėjantį vulkaniniais baseinais, šiuo metu lankytojus žavinčiais dangun kylančiais bangų liežuviais. Antrą dieną dirbome Funšalio savivaldybės posėdžių salėje, kur šiandienos sprendimai priimami 1758 m. statytame pastate. Popietinėms veikloms sugrįžome į 1500 mokinių turinčią G. Zarco mokyklą. Ypatingai džiaugėmės galimybe aplankyti spalvingą Funšalio turgų, kur akys raibo nuo įvairiaspalvių gėlių, nepakartojamus aromatus skleidžiančių egzotinių vaisių, daugybės įvairių žuvų. Keliavome šalia levadų – drėkinimo kanalų – įrengtais takais, grožėdamiesi nepaprasta miško augmenija, o apžvalgos aikštelėje galėjome pamatyti nepaprastai gražią apylinkių panoramą. Pamatėme aukščiausią Europos kyšulį Kabo Žirao (Cabo Girao). Šis 580 m. aukščio iškyšulys yra antrasis aukščiausias pasaulyje. Pasakojo, jog prie jo krantų atplaukia delfinai, kartais išnyra vėžliai ir banginiai. Jų nepamatėme, tačiau pakerėjo ant skardžio įrengta apžvalgos aikštelė su stikliniu dugnu, ant kurio užlipus po kojomis atsiveria vaizdas į vandenyną.

Lenkijoje, Lukovo mieste, mes buvome itin įtraukti į projekto veiklas, aktyviai diskutavome, atlikome praktines užduotis. Dirbdami komandose, pristatėme savo šalį, mokyklą, kūrėme filmus, rengėme interviu, Labai įdomi patirtis – kristalų auginimas.

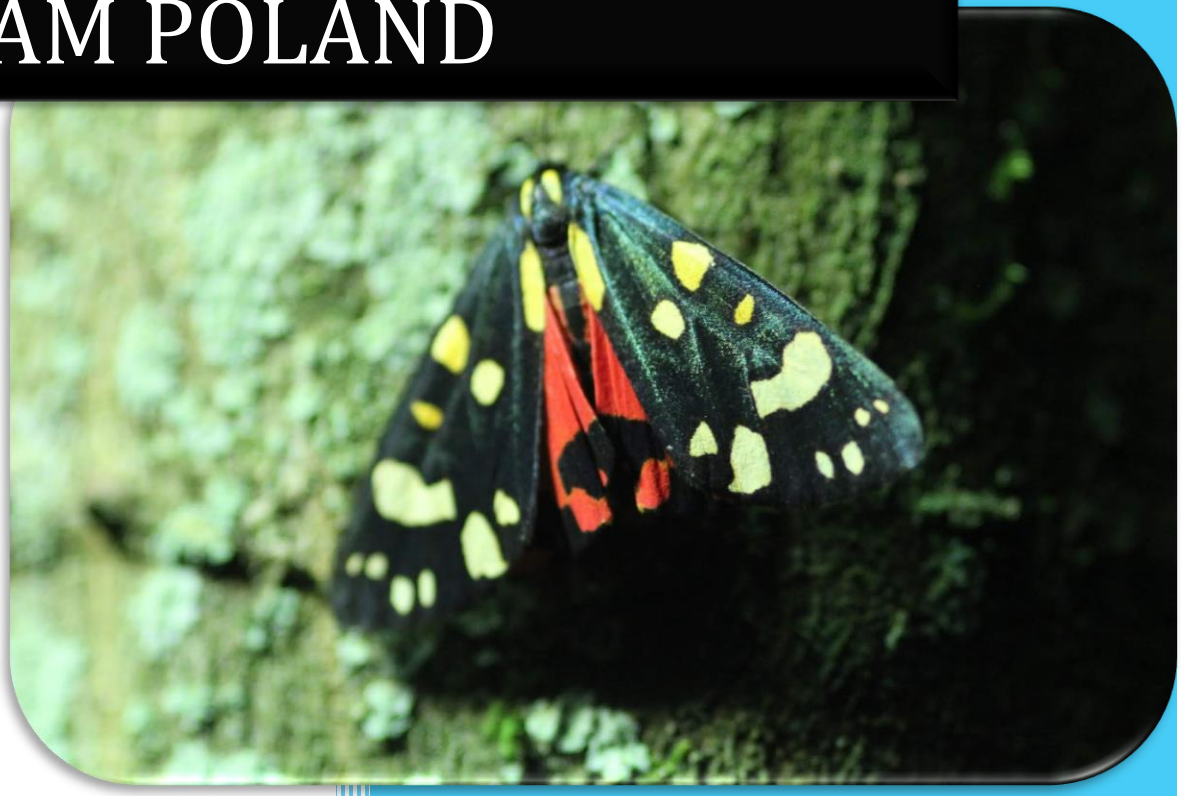



Laukia paskutinis projekto vizitas Graikijoje, Katerini mieste, kur apibendrinsime visą savo projekto metu įgytą patirtį. O ji didžiulė. Mes supratome, kad mokslas visuomet yra šalia mūsų – klasėje, virtuvėje, sode, darže, mokyklos kieme... Mokslas - ne tik tai, kas sudėtingai parašyta vadovėliuose ir ko vis dar nelabai mėgstame. Daugybė veiklų parodė, kad daugelį dalykų galime suprasti patys bandydami atlikti įvairius eksperimentus. Svarbu norėti sužinoti, norėti pažinti mus supančią kasdieninę aplinką. Be to, projekto metu mes pagilinome anglų kalbos žinias, tobulinome bendravimo, bendradarbiavimo įgūdžius, keliaudami patyrėme įvairių nuotykių, pažinome daug naujų žmonių, prisilietėme prie kitų šalių kultūros.

Projekto „Open Science Schooling“ komandos

OPEN SCIENCE SCHOOLING
STUDENTS' JOURNEY

SCHOOL TEAM POLAND



PRIMARY SCHOOL NO.2 WITH
BILINGUAL CLASSES **ŁUKÓW**

POLAND

PRIMARY SCHOOL NO. 2 WITH BILINGUAL CLASSES IN ŁUKÓW is a public school situated in the urban area of Łuków. The city has an approximate population of 32,000 inhabitants. The number of students over 12 years of age studying at the school is 60. The school practices traditional system of pedagogy. A view of the school ground is shown here.

The school team consisted of a group of 18 students and 3 teachers (Agnieszka Czerska-Pawlak, Dariusz Nikiel, and Artur Baranowski) that embarked on the project's activities, collaborating, co-creating, and learning from each other. The students worked in smaller groups based on their interest in their project tasks and ideas such as preparing posters and presentations for national conferences, as well as workshops for student peers during the Night for Biologists event at university, etc.

Student teams during different activities

PROBLEM IDENTIFICATION AND CONTEXTUALISATION

Understanding what science is, was the first objective of the student teams and in this light, they sought to find answers to some fundamental questions as stated below:

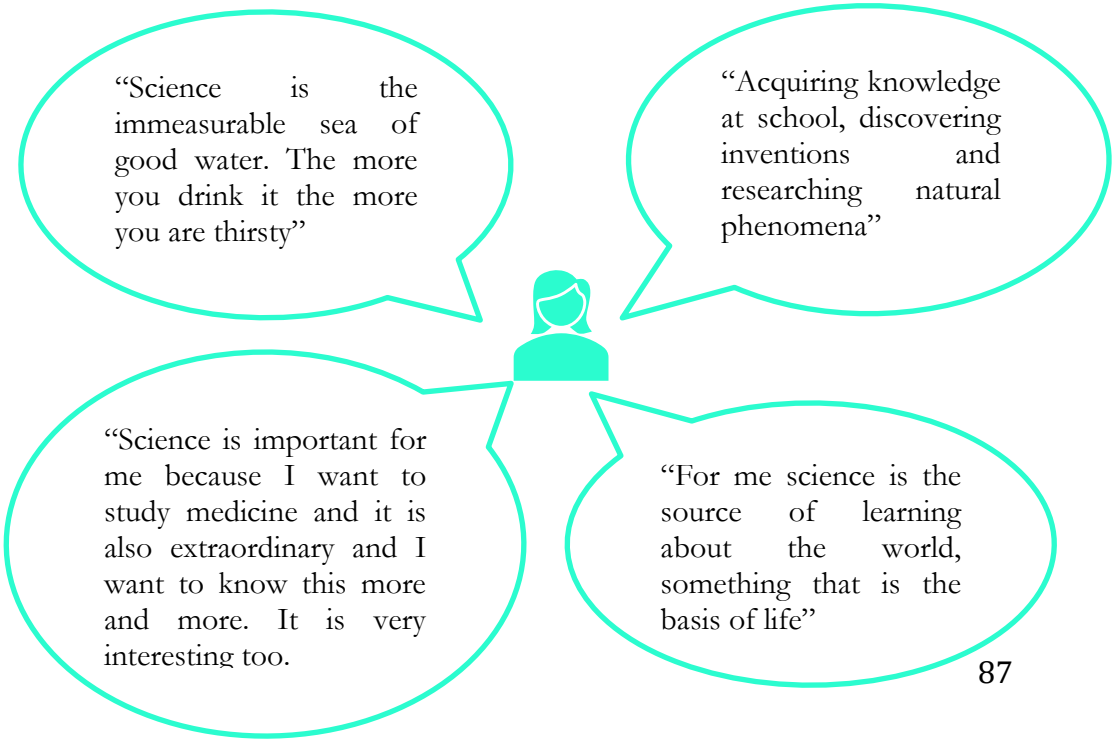
- → What is Science?
- → Where can we find it?
- → What is Science in the past and what is it now?
- → Is science important?
- → What are the benefits of science?
- → How would the world look like without science?

The student teams embarked on an avid exploration of their surroundings in and beyond their classroom in order to find answers. The ensuing section presents their perspectives in response to the above questions.

WHAT IS SCIENCE?

PERSONAL PERSPECTIVES (REPRESENTATIVE ANSWERS)

According to Girls



According to Boys

"It is more than learning, it's understanding the world, things, which happen around us"

"It's the way people know the world. It is very general, but science tries to discover the mechanisms of life, principles and theories in the universe but specially on the earth. It is done by testing hypothesis using special methods, for example, experiments."

"It's knowing the world and all things around us. For example, no one believes that earth is flat but knows its true form"

"It's everything around us what we can learn or get to know. It isn't only school. It's something more."

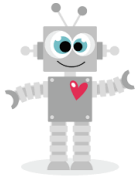
Where can we find Science?

Personal perspectives (representative answers)

"We can find science everywhere. In our life, body, books, internet, animals, plants and environment."

"In the world around us."

"There are many places where you can find education and you do not have to look for them for a long time."



WHAT IS SCIENCE IN THE PAST AND WHAT IS IT NOW?

PERSONAL PERSPECTIVES (REPRESENTATIVE ANSWERS)

"Science has always been the same, but now, it is more accessible to all people"

"Science once discovered different things of the phenomenon, and now it is improving itself"

"Science in the past was worse than now. Now we have got lots of new opportunities and we have got high-technology with new equipment"

WHY IS SCIENCE IMPORTANT?

PERSONAL PERSPECTIVES (REPRESENTATIVE ANSWERS)

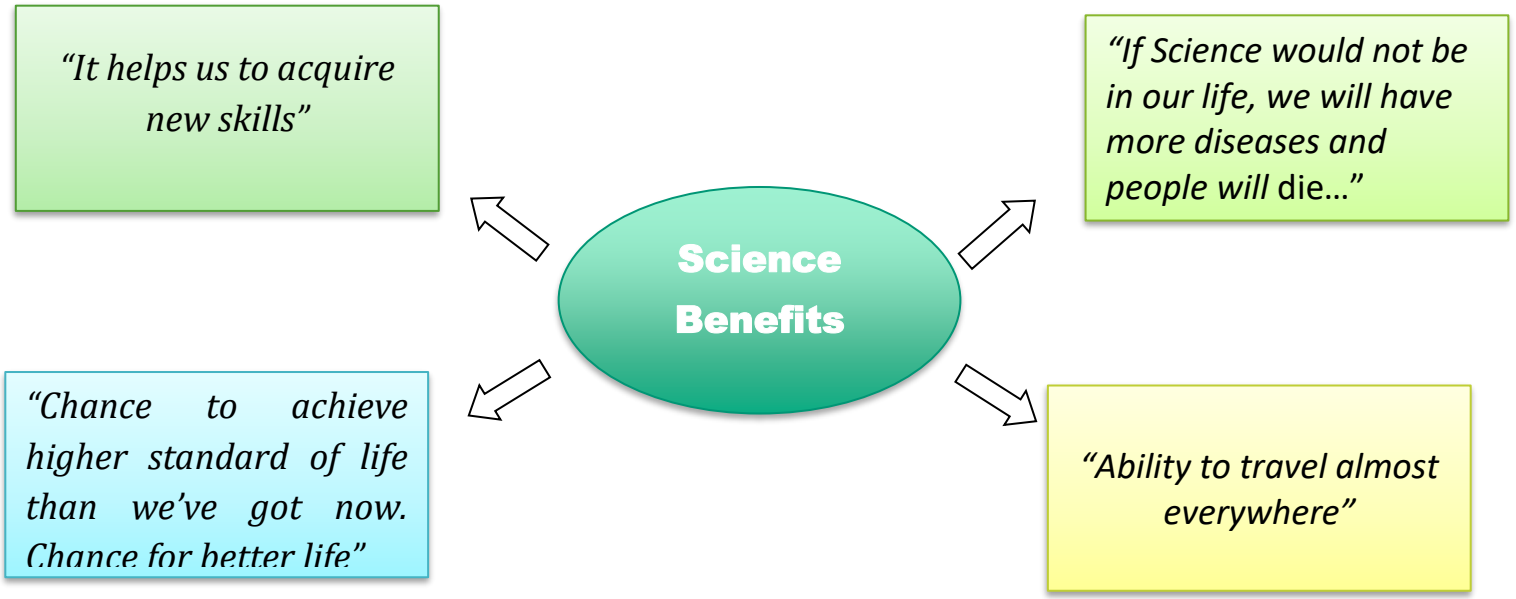
"Very Important!"

"Yes. In my opinion it is the most important study in our life."

"It is very important because thanks to it, we can have a good profession in the future and thus ensure a good life in good conditions."

WHAT ARE THE BENEFITS OF SCIENCE?

PERSONAL PERSPECTIVES (REPRESENTATIVE ANSWERS)



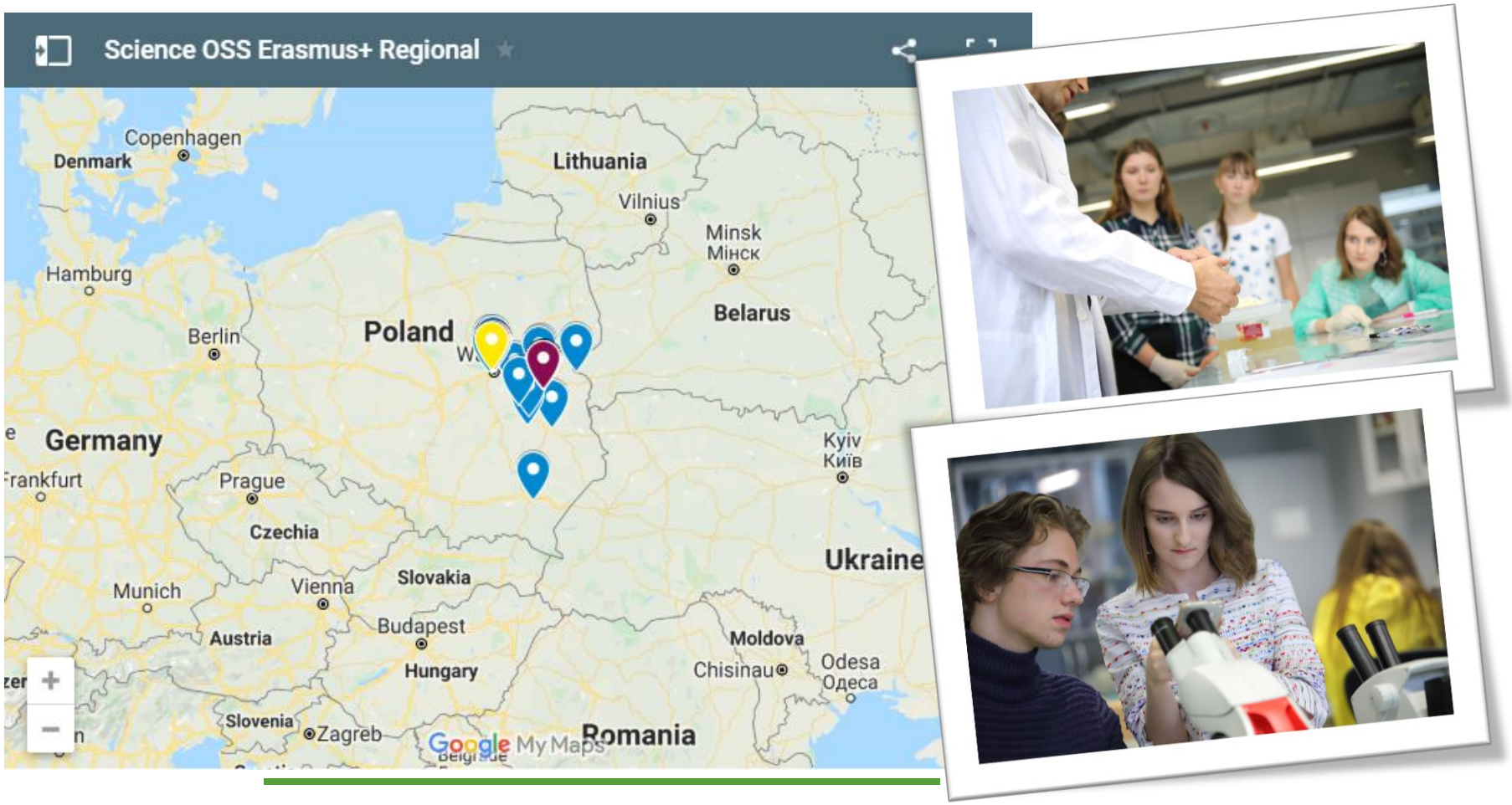
HOW WOULD THE WORLD LOOK LIKE WITHOUT SCIENCE?

PERSONAL PERSPECTIVES (REPRESENTATIVE ANSWERS)

→ *"We wouldn't know lots of things and might not have a technology like we have now. Our life would not be as amazing as we have."*

→ *"The world would be limited, with no possibility of development."*

Contextualising science in the local community, student teams having contemplated and shared their perspectives on what according to their investigations and perspectives Science is, they embarked into locating Science not only in their local area Łukow, but also in Warsaw and the whole region.



Student teams' identification of science activities in Poland

"WHERE IS SCIENCE IN THAT INSTITUTION?"

THE SCIENCE IN ŁUKÓW CINEMA

Łuków Cinema

They visited the Łuków Cinema and conducted interviews with the cinema personnel to get an insight into how science is used in the functioning of a movie screening.

"The science for me now is entertainment, I learn because I like it. Science is the challenge, new inventions, and discoveries. Everyone enjoys using the newest technological inventions which are very useful. The science in the cinema is in constant change as it is approached in technology. In the past, the cinema showed just pictures or slides, not real movies. Then we had tape spools and now we use the newest digital media and devices only. We even offer live events e.g. plays or symphonies. The cinema would definitely not exist without science. What is more, the cinema is in constant evolution. Although I did not like physics or chemistry in the past I love literature and mother language. Now all has changed. In the past, science has not had so many challenges as it has now. It was very limited probably because of the limited needs in comparison to modern times. Even in the past, science enabled people do discover the world e.g. the use of stones but today we investigate the space, nuclear issues or genetics what makes a huge difference. What we see in science-fiction is mainly a category of a fairy-tells but some things are a reality today. The science is very important of course because without it we would still be "on trees". The world without science would be much worse. The diseases would spread, and the general life would be much harder."

Regional Museum in Łuków

The SCIENCE in Regional Museum in Łuków

"Science enables to know the nature, environment and the world which surrounds us. The science is very important for all of us. It shapes our opinion and life. I liked learning in the past, albeit sometimes I went to play football. Although reading books or watching thematic channels was very inspiring. Our museum … provides workshops for pupils and also many educational events to foster national and local traditions to be commemorated. Museums like ours, are very important because they show us the way we went through to the point we are now and predict our future. The museum would not exist without science. The future is based on new inventions based on new discoveries in technology and media. New products on the market will be personally tailored to individual needs helping us a lot in everyday life."

The SCIENCE in Łuksja Clothes Factory

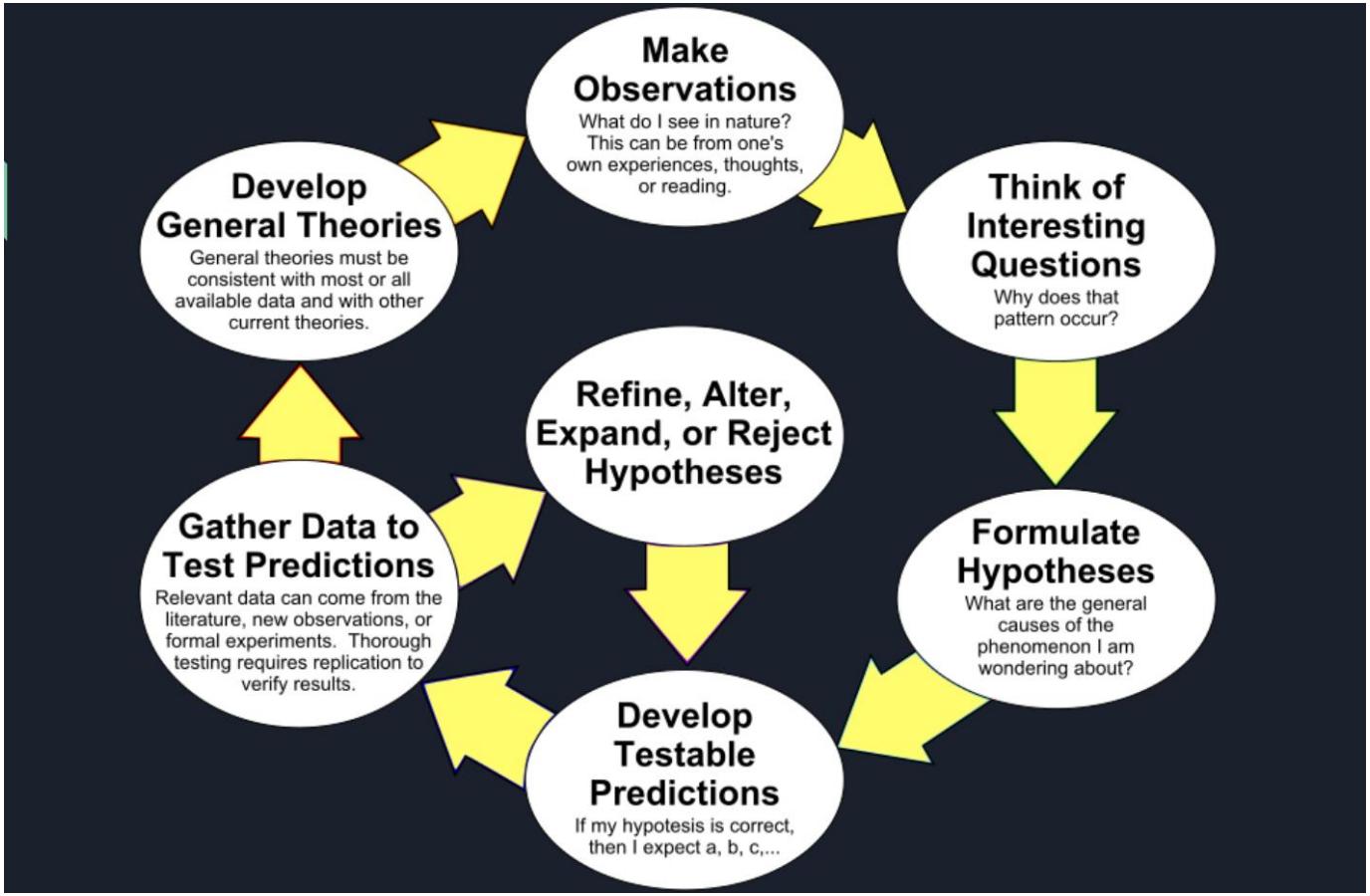
Science is the way we collect and enlarge the storage of knowledge. Our company uses achievement in science in a diverse way. First of all, why we are buying very modern machinery like 3D scanner, automatic cutter, and machines with electronic eyes which enable us to work with disabled people. Science is crucial for our company's development but also in individual growth which we as company support. Secondly, in a wider context, we use science in the projects where the partners come from universities. One of these projects is Ergo World where we were trying to tailor the works stations to disabled people. The project was successful and now we are participating in a new project Maturolight in Horizon 2020. The project concentrates on adding programmed metallic strings into clothes dedicated to older people. Such clothes by gathering information about the people's health condition and sending it to their mobile phone or doctors will definitely improve the care about their health state. I think it is the best example of how our factory can use science in everyday life.

SCIENCE according to the Mayor of Łuków Marcin Matelko, PhD

"Science has many sides but the core of it is to know the truth about our world. The world without science would be very strange and odd. We would not know the answers to many questions e.g. how the surrounding world works. Thanks to science our life is easier, more enjoyable, human-friendly, more understandable in social science and exact sciences. We can solve the demographic problems as well as find the treatment for many diseases. I represent social science and it is, in fact, an interdisciplinary branch deriving a lot from economy, law, and sociology. So, I can predict the future and future problems and start working on the solution potentially needed in close future. I like learning and I learn every day. Life is based on everyday learning. Learning is much more than school is much further than the school. It is everywhere, starting from here .... and having no end."

KNOWLEDGE AND COMPETENCES ACQUISITION

After investigating and understanding what science was and what it meant in their lives and to their community members, the students wanted to apply the knowledge of science in practical immersive science missions. They learnt in a research method workshop that a scientific experimentation, inquiry or project, needs to have a step-by step approach towards discovery. The student teams familiarised themselves with the different phases of the scientific method of exploration which they incorporated in their practical work.



The scientific method of inquiry as learnt by the student teams in a research workshop.

The student teams carried out three immersive missions as part of their OSS journey. Co-creation activities alongside teachers, researchers and other experts were conducted as a part of the student teams' immersive mission

The school used the existing formal cooperation between the school and the Cardinal Stefan Wyszynski University in Warsaw.

The missions involved **investigating the regional biodiversity** and **understanding the usefulness the ecological measurements** like abundance, body mass index and body weight used in population ecology at the Nature Jata Reserve, in Łukow. This Nature Reserve is located 12 kms from Łukow. In the first 6-8 months of being involved in the OSS project, both students and teachers proposed and considered many topics to work on. Finally, after discussions during project meetings, this activity was selected because students wanted to investigate science that was close to their school.

With the context of research established, a group of 18 students and 3 teachers embarked on the co-creation of the learning experience through the OSS practice. The immersive missions related tasks were conducted outside of school hours on Saturdays at the school ground, and sometimes outside the school grounds during the weekdays (afterschool hours).

The teachers facilitated the immersive missions by securing allowance from the local authorities to provide the field research in the Nature reserve. Owing to the facilitating teacher's and the collaborative University's keen interest in the chosen topic, a list of scientific literature was compiled and shared with the students in preparation of the activities. The students were familiarised with the different aspects of the topic to give them clarity as part of their immersive missions.

Student teams also participated in specialised workshops carried out by field experts that taught them specific knowledge according to the expertise of the topic.

WARSAW SCIENCE FESTIVAL, FESTIVAL OF SCIENCE & ART IN SIEDLCE AND BIOLOGISTS' NIGHT (2018-2020)

A brain dissection workshop held as a part of the Warsaw Science festival at the Faculty of Biology Cardinal Stefan Wyszyński University - during which the young people learned about the structure and functions of the brain, but also the exact structure of neurons. The partners mark that the most attractive part of the course was the opportunity to learn about the brain structure of a cow and a pig, both fresh and formally fixed. In this activity students had to face the correct markings of the main areas of the brain and indicate their functions. The lesson was provided in English using the Content and Language Integrated Learning (CLIL) approach. A **heart dissection workshop** was also held at the same event, where students had the opportunity to learn about the heart's structure, as well as the blood circulation in the human body and the detailed structure of various muscle cells as microscopic slides.

Student teams participating in specialised science-related workshops during different scientific events (2018-2020)

IMMERSIVE MISSION 1: INVESTIGATING MOTHS' DIVERSITY IN JATA RESERVE

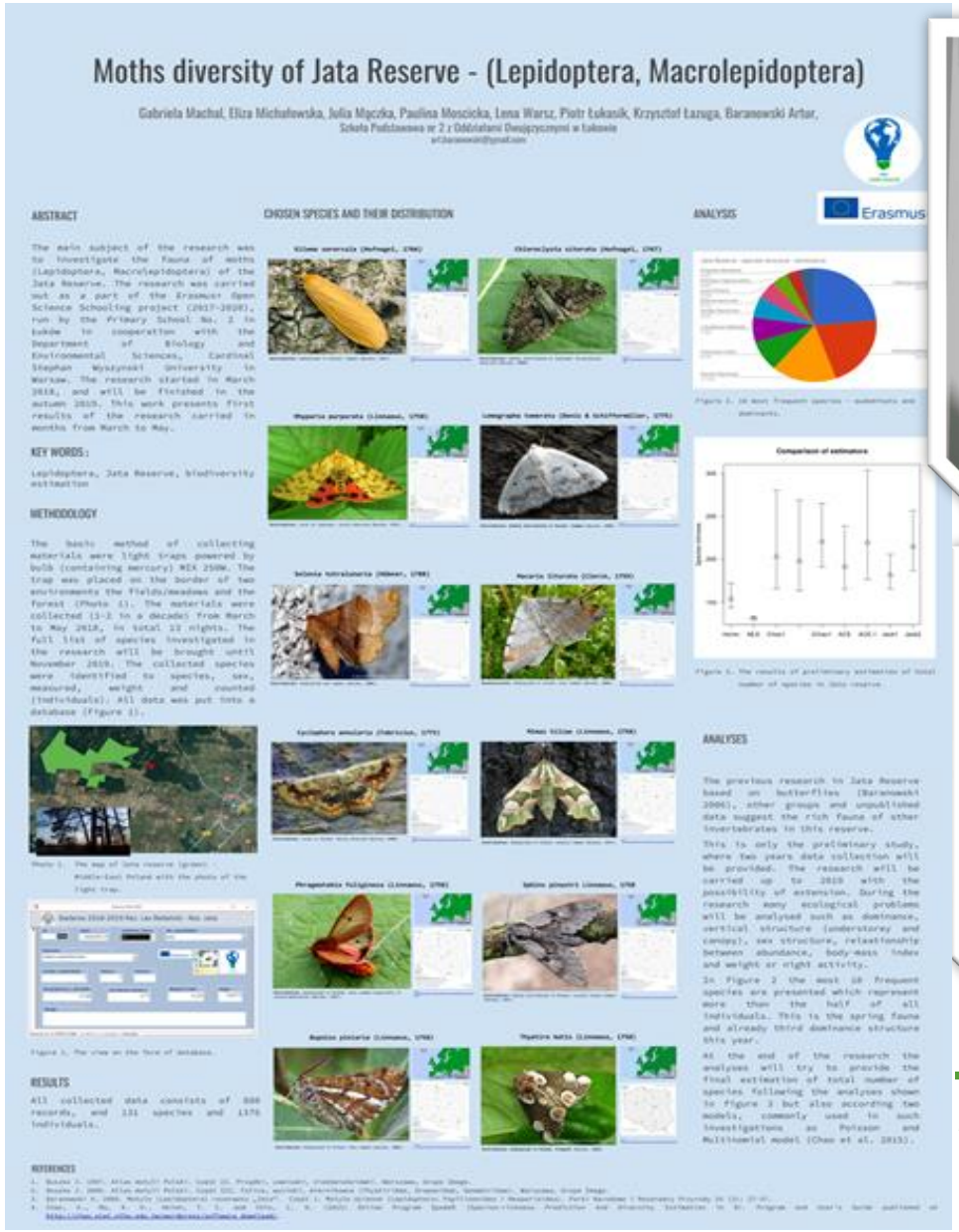
Students visited the Nature Reserve Jata, which is about 12 kms from Łukow town, to collect field data about moths by using standard light traps. The light traps consisted of light bulbs 250V MIX and were placed in different sites in the reserve. The moths were collected from March to November in 2018 and 2019, once or twice every 10 days. The students sometimes visited the Nature Reserve at nights to capture moths. They also camped overnight or spent weekends dedicated to moth-catching as a part of their immersive mission. They were accompanied by the lead teacher (consent was formally obtained from the parents and the students before they join the project missions).

Student team overnight camping expedition to Jata Reserve as part of their immersive mission

Student team moth trapping field work at Jata Reserve

After the field work was completed, the student team met on Saturdays at the school ground, where they identified the moths' species and learnt their Latin names. This information was then recorded in a special database. The first set of results drawn from this immersive mission was showcased as both a poster and an oral presentation during the national conference dedicated to students Biopotencjal 2018, organised by Cardinal Stefan Wyszynski University in Warsaw. The students presented a poster showing the beginning of discovering biodiversity of Lepidoptera in Jata Reserve and a speech in the same which was well received by the scientific community present.

Student team working on their project. The results were presented in a poster at Biopotential 2018.



Moths diversity of Jata Reserve - (Lepidoptera, Macrolepidoptera)

Gabriela Machal, Eliza Michałowska, Julia Mgcińka, Paulina Moscicka, Lena Warsz, Piotr Łukasik, Krzysztof Łazuga, Baranowski Artur,
Szkoła Podstawowa nr 2 z Oddziałami Dwujęzycznymi w Łukowie

ABSTRACT

The main subject of the research was to investigate the fauna of moths (Lepidoptera, Macrolepidoptera) of the Jata Reserve. The research was carried out as a part of the Erasmus+ Open Science Schooling project (2017-2018), run by the Primary School No. 2 in Łuków in cooperation with the Department of Biology and Environmental Sciences, Cardinal Stephan Wyszyński University in Warsaw. The research started in March 2018, and will be finished in the autumn 2019. This work presents first results of the research carried in months from March to May.

KEY WORDS:

Lepidoptera, Jata Reserve, biodiversity estimation

METHODOLOGY

The basic method of collecting materials were light traps powered by bulb (containing mercury) MIX 250W. The trap was placed on the border of two environments the fields/meadows and the forest (Photo 1). The materials were collected (1-2 in a decade) from March to May 2018, in total 12 nights. The full list of species investigated in the research will be brought until November 2019. The collected species were identified to species, sex, measured, weight and counted (individuals). All data was put into a database (Figure 1).

CHOSEN SPECIES AND THEIR DISTRIBUTION

ANALYSIS

ANALYSES

The previous research in Jata Reserve based on butterflies (Baranowski 2006), other groups and unpublished data suggest the rich fauna of other invertebrates in this reserve.

This is only the preliminary study, where two years data collection will be provided. The research will be carried up to 2019 with the possibility of extension. During the research many ecological problems will be analysed such as dominance, vertical structure (understorey and canopy), sex structure, relationship between abundance, body-mass index and weight or night activity.

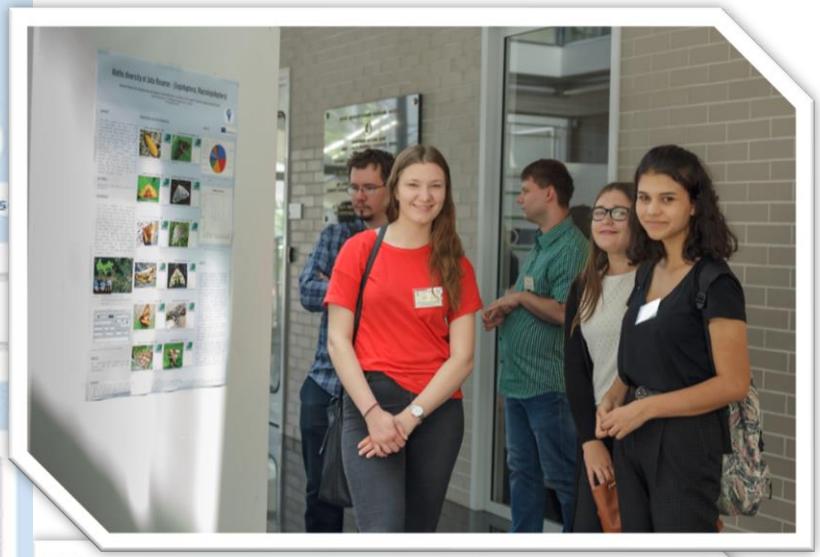
In Figure 2 the most 10 frequent species are presented which represent more than the half of all individuals. This is the spring fauna and already third dominance structure this year.

At the end of the research the analyses will try to provide the final estimation of total number of species following the analyses shown in Figure 3 but also according two models, commonly used in such investigations as Poisson and Multinomial model (Chao et al. 2013).

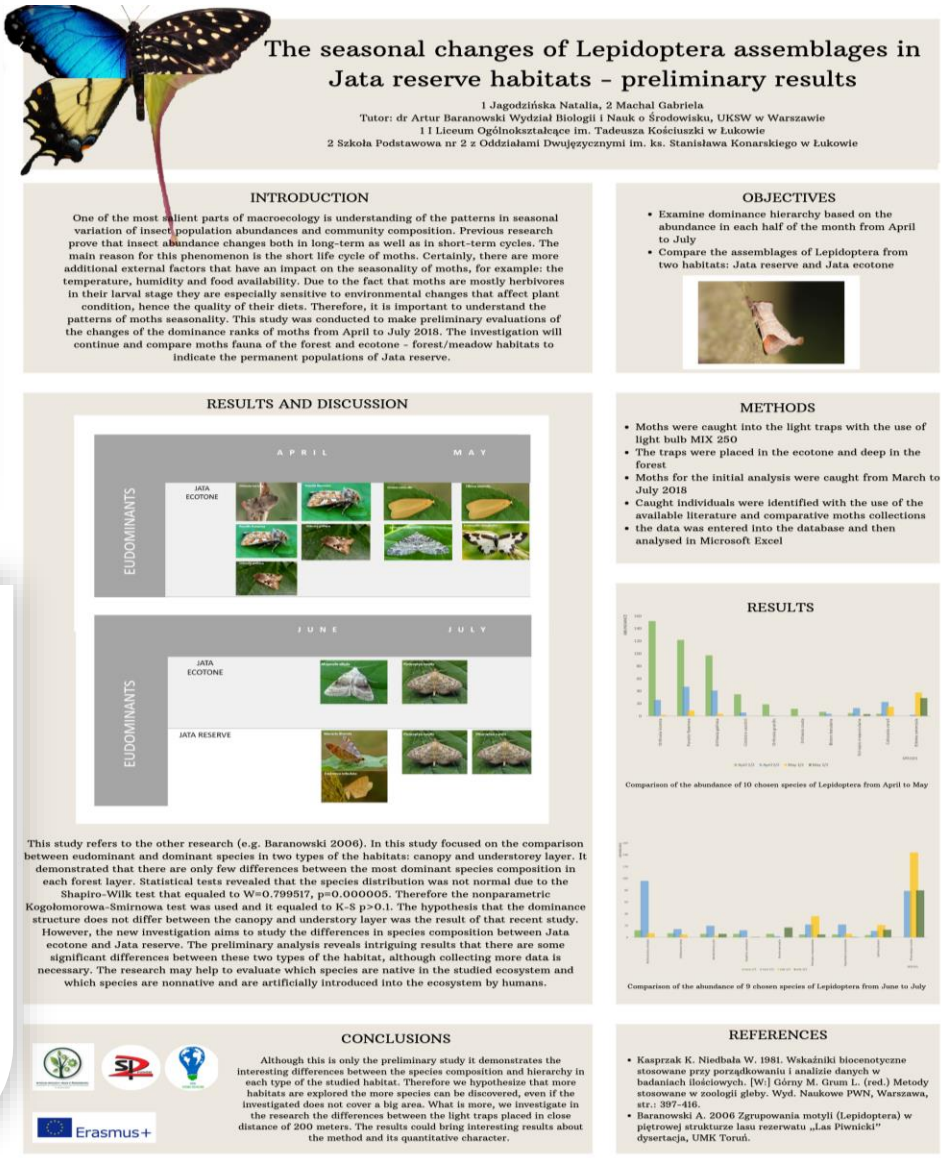
RESULTS

All collected data consists of 888 records, and 131 species and 1176 individuals.

REFERENCES



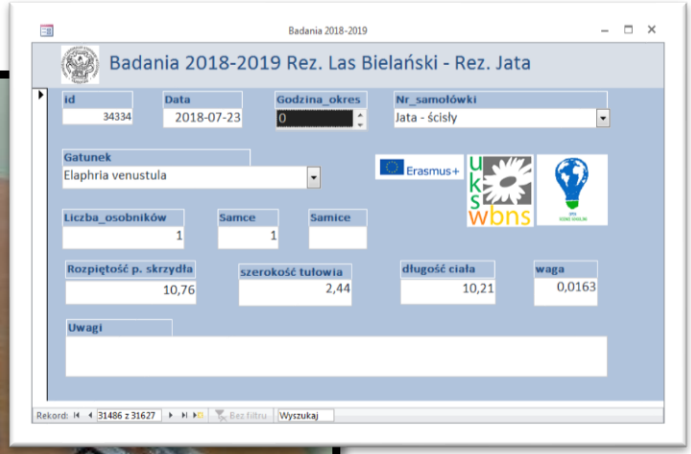
Student team presenting their scientific research results at a local conference in Warsaw (2018)



Student team presenting their scientific research results at a local conference in Warsaw (2019)

IMMERSIVE MISSION 2: THE RELATION BETWEEN BODY MASS, BODY MASS INDEX AND ABUNDANCE – IN FIELD RESEARCH OF MOTHS (LEPIDOPTERA)

This immersive mission harnessed the same procedure as the first mission, however the teachers state that subject here was a bit more sophisticated and intended to be more ambitious for the student teams. During the field research and the meetings, the student team engaged in camping, catching and observing other animals, taking photographs and video recording of the surrounding. After collecting moths from the set traps at the Reserve, the students met on Saturdays, identified the moth species, measured them, weighed them on scales and determined the gender of each captured moth. Similar to the previous mission, all the data on the moths including their Latin names, were recorded in a special database.

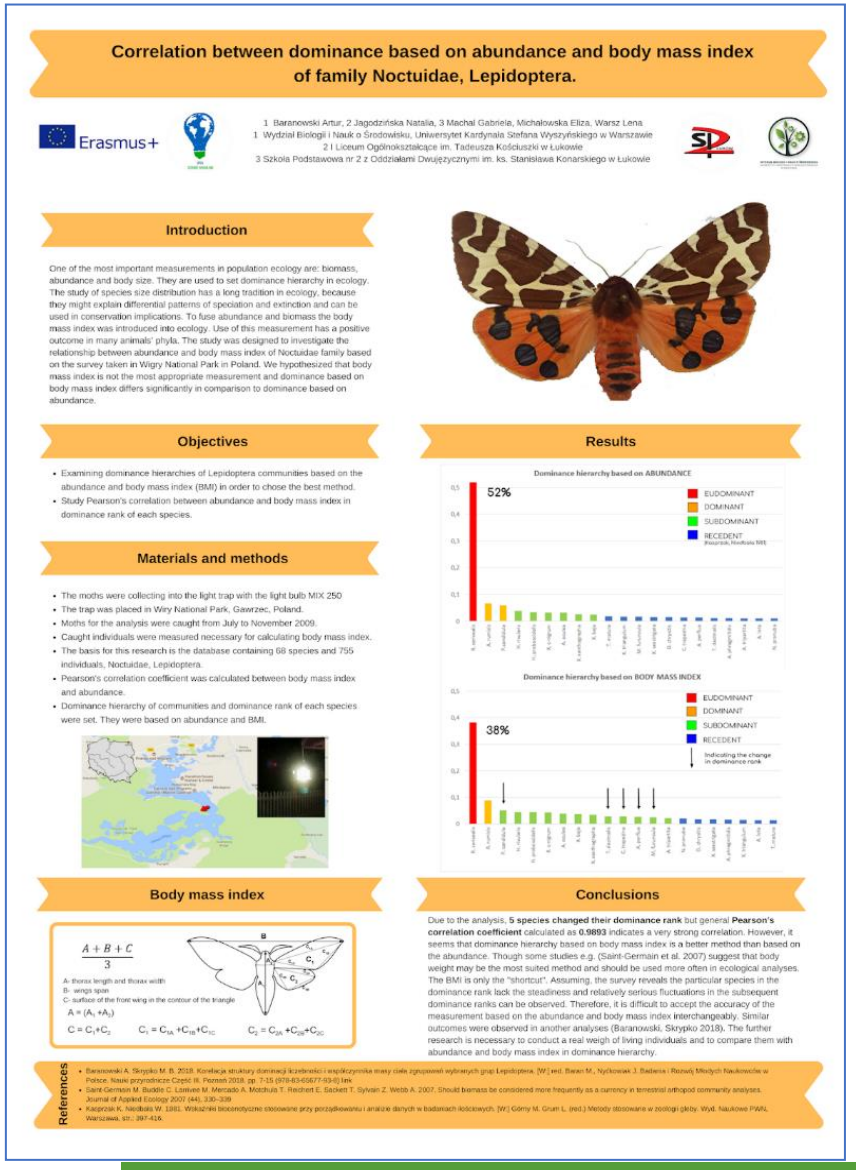


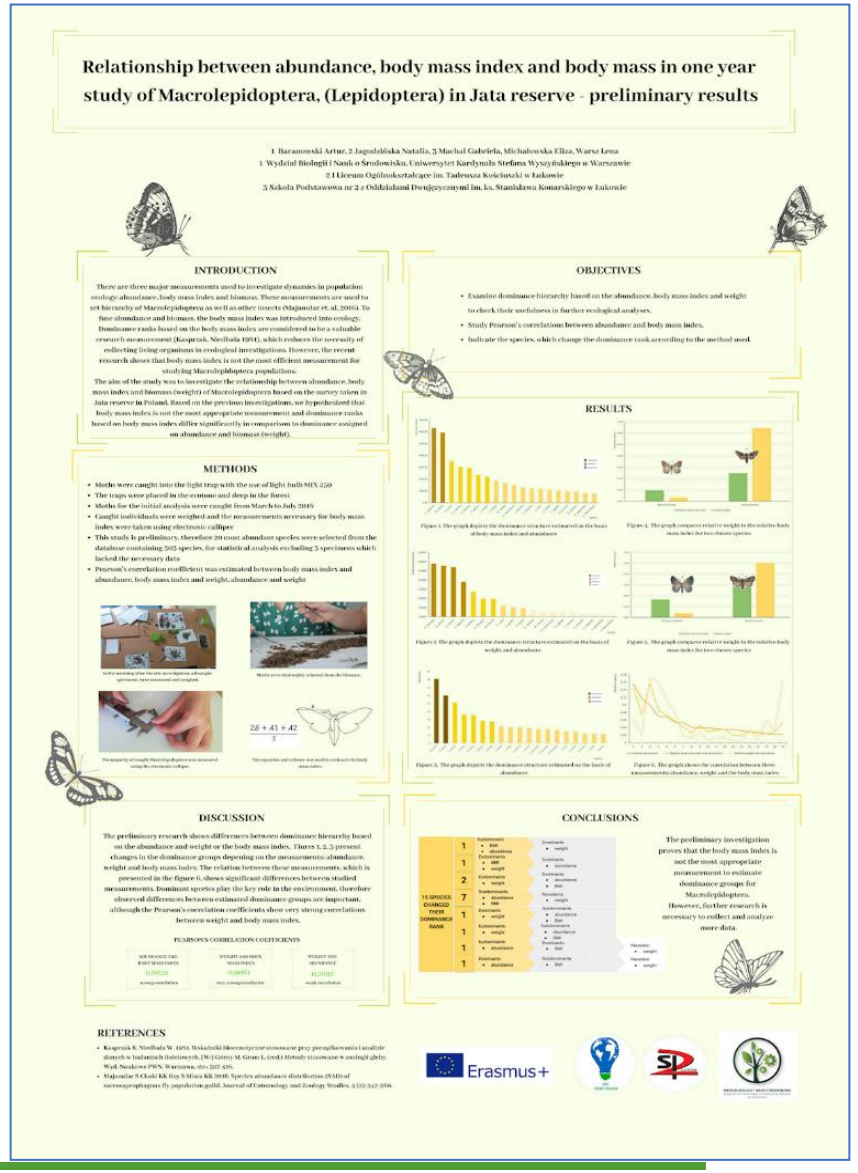
Student team moth categorisation activity

From top-left clockwise: a moth getting closer to the trap, school research, moth weighing and data recording, moth measuring

.

With the results drawn from **the relation between body mass, body mass index and abundance – in field research of moths (Lepidoptera),** the student team prepared an oral presentation and two posters showing the relation between these three factors during at the scientific conference in Warsaw (2019) and also, in Lublin.





Student team posters of their scientific research results at a local conference in Warsaw and Lubin (2019).

IMMERSIVE MISSION 3: GIVE 5 TO A BUTTERFLY!

This immersive mission was based on the outcomes created during the previous two missions. Built on the knowledge gained on moths and butterflies, their biology, ecology, morphology and conservation matters, **the student teams wanted to create and showcase an attractive science activity during the popular science event – Biologists' Night 2019**. This vision materialised on 11th January 2019, in the form of a workshop called ***"Give 5 to a butterfly".*** The aim of the workshop was to make the butterflies and moths an interesting topic for teenagers. The students also wanted to present the entomologist's everyday practice and how to conduct field research in the real world.

The student team arranged it so that participants of the workshop could identify species of moth by themselves, prepare the microscopic slides of insects' bodies and investigate their anatomy and morphology in order to have a hands-on experience with entomology science.

Before the workshop the OSS students prepared showcases with moths, practiced microscopic slides preparation, prepared the presentation about moth's biology and ecology. The outcomes of the Biologists' Night 2019 are also available as a Prezi presentation.

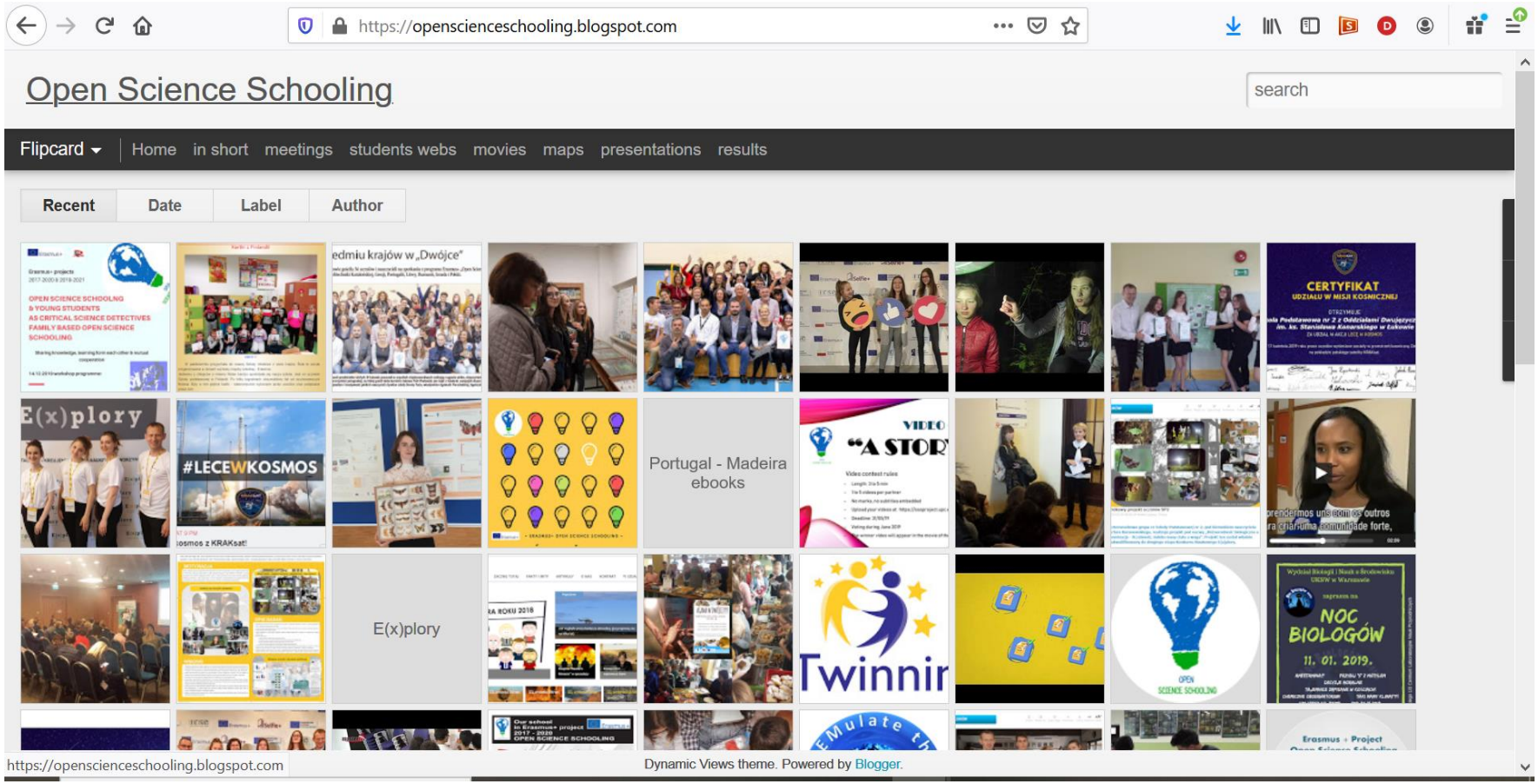
Workshop participant engaging in hands-on science with student team during the Biologist's Night 2019 event.

Hands-on workshop preparations Biologists' Night 2019.
(Left) Butterflies showcases. (Right) Microscopic slides

Student team Prezi presentation
(click on the image)

DOCUMENTATION

The school teams at Primary School No. 2 with Bilingual Classes in Łuków have made a comprehensive and extensive documentation of their activities and experiences in OSS project. This is accentuated by the creation of an OSS blog: http://openscienceschooling.blogspot.com/ which has served as the repertoire of information on all their Science related missions.

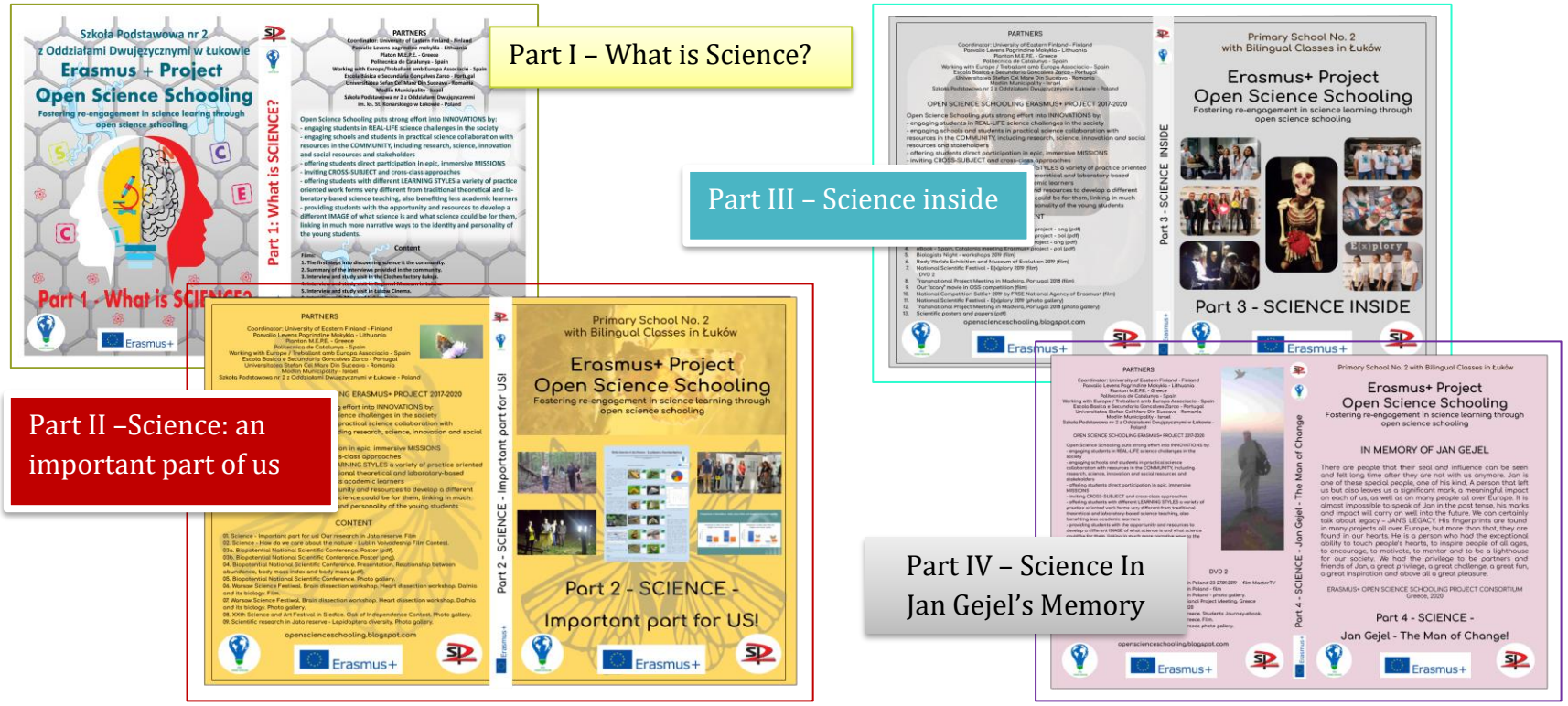


School team in Poland extensive documentation of their project activities. Click on the image to visit the site.

Each tab is embedded with all the activities undertaken by the students during their OSS journey, along with dates of the activities, the pictures, PowerPoint presentations and final consolidated results section. The students also were encouraged to keep a record of their teams' activities in a blog format that is also accessible through the documentation site.

In order to make contributions to the blog, the students took part in the ICT workshops, where they learnt to use many digital tools to create and maintain their own web pages for their journey documentation.

The team also documented their activities through a series of DVDs published in their native language and in English



Treasure hunt in the forest. Click the pic to watch the video!

Furthermore, the teams also documented their work through videomaking. One of the immersive missions of Team Poland was focused on researching the biodiversity of moths in their local nature park, Jata Reserve. During the field research for the mission the students made visits to the forest at nights and set up light traps to capture the moths. They wanted to showcase their field work for the research in their video in an entertaining way. Therefore, they planned to add suspense/horror elements to their video.

"So, to show our journey in the project we needed to involve our real scientific research. But to show only the research is not very attractive, so we add a bit of scary to our story"

Treasure hunt in the forest

The students mark that they took over the complete planning process of the video making. They mutually collaborated in plot creation and envisioning the end result. The choice of actors for the video was also carefully implemented with multiple "auditions" among themselves. Although not all the participating students of the project would make it to the field visits or record videos, the whole team is said to have had a positive attitude towards the video idea.

"We the students were only involved in the planning of the plot, the scenes, the dialogues and the characters.

"...while practicing we found out who could speak or play a particular scene."

"...not all students could come this day to the field research and make the film recording. But the whole team showed a very positive attitude towards our idea and final result."

Team Poland invested in a handheld digital camera from the project's funding. Since they were making field visits at night, they wanted to make sure that the quality of the video recording was good enough. They used Filmora software for editing the video footage. The students state that since they could not install the software on all the school computers, the video editing was done by the teacher in charge on his computer.

"This program was installed on the teacher's computer."

"We do not have at school good computers to install the program for film editing unfortunately. So it was impossible to provide the workshop for us and then we could not take part in editing."

Regarding the teachers' involvement in the video making activities, the students mark that they received as much help they needed. While they created the storyline and the plan, the teacher recorded and edited the video.

Reflecting on the challenges they faced, the students state that, developing the idea for video compiling among the plethora of ideas was difficult since they wanted to tell their story in an interesting way. However, working together as a team with multiple age groups was rewarding and they were able to overcome the challenge and enjoyed the process of video making. This, according to them, was their new learning.

"We think that doing things together is always rewarding and to choose the best idea is the hardest part of the task."

"Yes, doing things together is always fun and enjoyable."

Putting forth the one thing they would like to do differently next time if they have an opportunity, the student state,

"...we would like to be able to edit such films by ourselves."

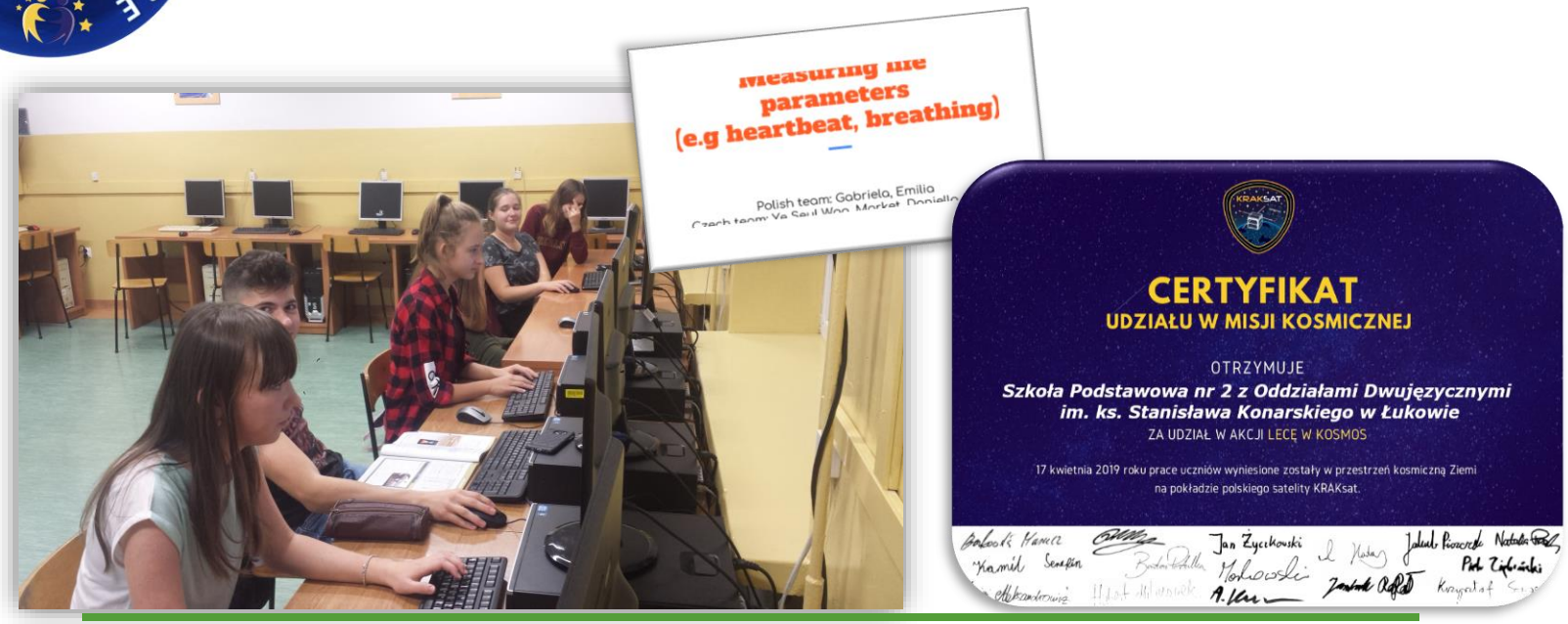
SHARING

The student teams in Poland engaged in several types of sharing activities, locally and internationally. These activities ranged from networking with the scientific community to participation in local completions. Sharing was an important activity for the student teams as they understood that this could open for them interesting doors for collaboration with international peers. Below is a summary of the sharing activities that the student teams embarked on during their OSS journey.

eTWINNING PROJECTS

***"The art of science and the science of art"* ZOOM; STEMulate the SPACE**

The student teams commend that, *"Our idea for engaging into science is to take part in eTwinning project with the Czech Republic partner. The project title is ZOOM - what means ZOO and Maths. We want to use Maths as a tool to better understand Biology and especially Zoology ;). We have set the project during the eTwinners meeting in Armenia, May 2018."*



The logo 'STEMulate the SPACE' was sent into space on the KRAKsat Polish satellite (certificate above)

SELFIE+ NATIONAL COMPETITION

The students took part in the Erasmus+ National Selfie+ Competition under the category "Your project in one shot" on and won the first place. The picture depicts a surgery simulation, ***"Operacja – Open Science Schooling"***. During the activity of taking selfies for the competition, they mark that, "we were trying to feel like a scientist". The students and the teachers were ecstatic.

Erasmus+ National Selfie+ Competition
in category "Your project in one shot"

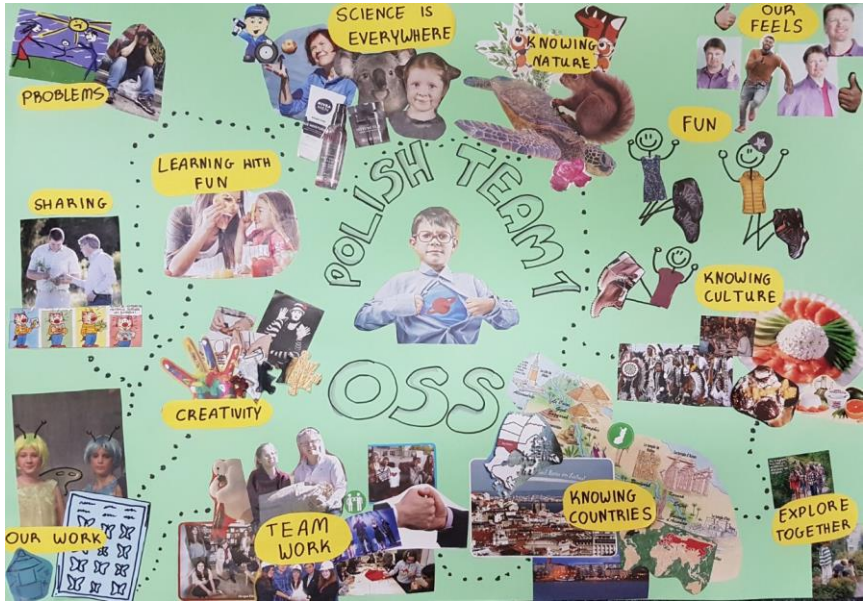
Student teams' poster at E(x)plory. Click any image to watch the video!

OTHER LOCAL AND INTERNATIONAL SHARING ACTIVITIES

The student teams' activities and results products were showcased in school community through five posters presented at conferences and workshops and their findings were also published in scientific magazines. Students have engaged in writing articles on school's web page, Facebook and in their OSS blog documentation page. Furthermore, the student teams participated in the **E(x)plory Regional Competition in Summer 2019**. Regarding the experience the team commented:

"Being here in Regional E(x)plory Competition in Podzamcze town was extremely challenging, exhausting but also exciting. We got a future experience which shaped our science thinking and problem-solving abilities. By having a chance to explore other teams' findings we got enormous knowledge what students in our age do experiment and create solutions for economy and society. I hope we will come back again here!"

The students were also very active sharing their work with the local community and society through a local television channel, **Master TV**[1]**,** on local radio station **Catholic Radio Podlasie**, **local newspaper Wspólnota**. Furthermore, student teams also used online media channels like **podlasie24.pl** as well as the official project's webpage to share their work and progress with the international community. They also shared their OSS journey at the Mobility Event held at Łukow in September 2019, in the form of a collage. As a part of the Video contest, of the project, the student teams presented a short video which depicts their work during the immersive mission activities at Jata Nature Reserve. https://youtu.be/plmwtrqasdm

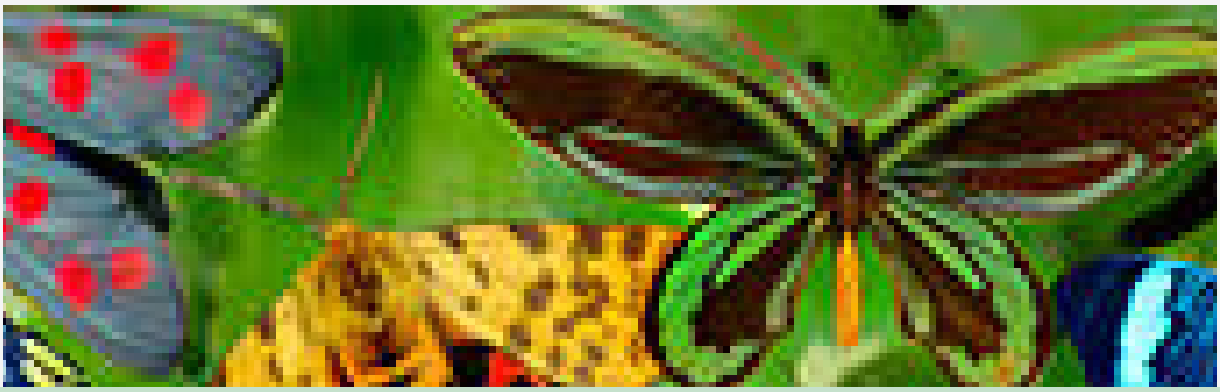


Student teams' collages representing their OSS journey in retrospect

[1] Link to the videos presented in the local master TV: https://www.youtube.com/watch?v=g3-nnmFabxc&feature=emb_logo

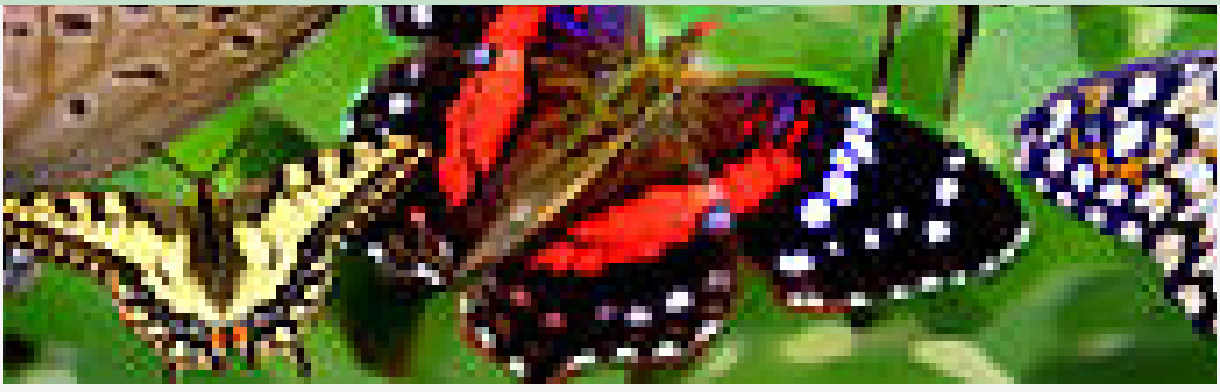
STUDENT TEAMS' VOICES – JOURNEY DESCRIPTION IN POLISH

OPEN SCIENCE SCHOOLING



Bioróżnorodność Rezerwatu Jata

2017-2020



...ale co to jest różnorodność?

Różnorodność biologiczna to zróżnicowanie życia na wszelkich poziomach jego organizacji.

Zainteresowaliśmy się tym, ponieważ nasza szkoła w ramach projektu Erasmus+ Open Science Schooling poszukiwała nauki w lokalnym środowisku. W okolicznym rezerwacie Jata zaczęły się badania nad różnorodnością motyli nocnych prowadzone przez UKSW w Warszawie. Zafascynowała nas jak duża różnorodność jest w wśród nich, rozmiary, kolory, waga i inne.

NASZ ZESPÓŁ:

JULKA MĄCZKA

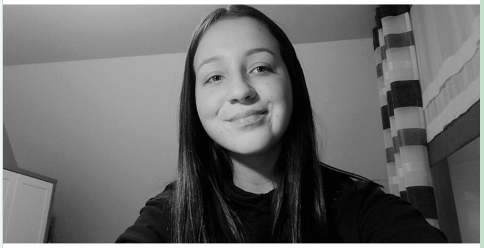
Myślałam, że w projekcie OSS będziemy uczyli się nowych ciekawych i inspirujących rzeczy i nie myliłam się. Projekt OSS nauczył mnie systematyczności, ciężkiej pracy, koleżeństwa i miłości do przyrody. Nasza grupa stałą się jedną wielką rodziną. Braliśmy czynny udział w warsztatach na uczelni i jeździliśmy do rezerwatu Jata.

KRZYSZTOF ŁAZUGA

Na początku projektu nie do końca wiedziałem czego się spodziewać podczas OSS. Okazało się że projekt jest bardzo ciekawy i wnosi sporo do życia poprzez możliwość zrozumienia wielu zagadnień. W planach mamy zrealizowanie wystawy odnośnie naszego projektu w lokalnym muzeum.Byłem odpowiedzialny za różne rzeczy w różnych fazach projektu. Parę razy miałem okazję być liderem grupy co wymagało sporego zaangażowania. Najbardziej podobała mi się część praktyczna projektu, przez którą mogłem doświadczyć działania nauki w życiu codziennym i miałem wiele okazji do integracji z grupą. Najmilsze wspomnienia mam również wyjazdów do rezerwatu Jata.Podczas projektu nauczyłem się korzystać z różnych platform internetowych dzięki czemu wiele rzeczy okazało się łatwiejszych do zrobienia przez co zmieniłem podejście do wielu spraw bo po prostu okazało się łatwiejsze. Ten projekt to nauka.

PAULINA MOŚCICKA

Na początku byłam pewna, że to nie dla mnie i szybko się poddam, ale bardzo się myliłam. Projekt zapewnił mi wiele różnorodnych zadań. Zajmowałam się wieloma rzeczami i we wszystkie starałam się zaangażować, a im więcej czasu na nie poświęcałam tym bardziej satysfakcjonujący był efekt końcowy. Udało mi się nawiązać długotrwałe przyjaźnie i zyskałam kilka fantastycznych wspomnień. Nauczyłam się mnóstwa rzeczy i poznałam fascynujących, pełnych pasji ludzi. Najbardziej podobało mi się zróżnicowanie zagadnień nad którymi pracowałam. Wielokrotnie coś na pozór nudnego okazywał się fascynujące. Dzięki projektowi czuję się dużo swobodniej pracując w chmurze, nauczyłam się też korzystać z wielu platform internetowych. Spojrzałam z innej perspektywy na tematy które zdawały się niczym już mnie nie zaskoczyć. Zyskałam też więcej śmiałości i pewności siebie. Dzięki OSS na nowo obudziłam w sobie ciekawość świata i chęć do nauki. To doświadczenie było jedyną w swoim rodzaju..



GABRIELA OSTOJSKA

Na początku projektu nie wiedziałam czy oby na pewno chcę wziąć w nim udział, ponieważ miałam co do tego obawy, że będzie w nim dużo pracy i nie podołam. Jak się później okazało był on jedynie przyjemnością. Dzięki projektowi nauczyłam się dokładności w wykonywanych przez siebie pracach oraz pracy w grupie. Poznałam bardzo ciekawych ludzi i zdobyłam nowych przyjaciół, z którymi mogłam dzielić swoje zainteresowania. Dzięki mojemu udziałowi w projekcie nauczyłam się korzystania także z różnorodnych platform internetowych, które się bardzo przydają w szkole czy życiu codziennym. Projekt ten był niesamowitym doświadczeniem, najbardziej podobała mi się współpraca z osobami z wielu innych państw. Dzięki OSS stałam się osobą bardziej pewną siebie i poznałam wiele nowych metod nauki.

OLA MISIAK

! Na początku nie byłam przekonana co do wzięcia udziału w projekcie. Myślałam, że to nie dla mnie jednak się myliłam. Projekt nauczył mnie cierpliwości, dokładności oraz przede wszystkim pracy w grupie. Nawiązałam wiele przyjaźni i poznałam wiele nowych i ciekawych rzeczy. Dzięki projek towi nauczyłam się również korzystania z różnych platform internetowych, co jest bardzo przydatne w nauce i szkole. Braliśmy udział w różnych wyjazdach na uczelnię oraz wyjazdów do rezerwatu Jata. Najbardziej mi się podobała współpraca z osobami z innych krajów, gdzie rozwinęłam swoj język angielski. Przez projekt stałam się bardziej pewna siebie. Dzięki OSS poznałam bardziej interesujące metody nauki, przez co chętniej chodzę do szkoły.

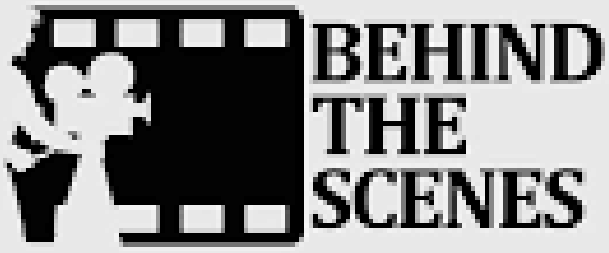
GABRIELA MACHAL

Na początku projektu sama nie wiedziałam, czego dokładnie mogę się spodziewać, myślałam, że będzie dużo pracy. Była to sama przyjemność, poznałam wspaniałych ludzi, z którymi mogłam dzielić się moją pasją. Dowiedziałam się wielu interesujących rzeczy, prowadziłam warsztaty, odkrywałam różne zagadnienia nauki, byłam odpowiedzialna jako lider zespołu podczas spotkania w Polsce. Projekt OSS był dla mnie niesamowitym doświadczeniem. Nauczyłam się pracy w grupie, przełamałam swoją barierę językową, stałam się bardziej otwartą osobą. jest to idealna propozycja dla młodych, ambitnych ludzi, którzy chcą potem stać się jeszcze mądrzejszymi osobami.

Rezerwat Jata

-leśny rezerwat przyrody znajdujący się na terenie gminy Łuków w województwie lubleskim. Został utworzony w 1933 roku, co czyni go jednym z najstarszych rezerwatów w Polsce.

...a jak to wszystko wyglądało?



Pierwszy etap badań w rezerwacie

20.06.2018

Rozstawiliśmy samołówki (urządzenie do łapania zwierząt), a potem czekaliśmy przy ognisku do rana i zbieraliśmy zebrane łowy motyli. Złapaliśmy nawet gatunek, który jest bardzo rzadki w Polsce.

Jata część druga

28,06.2018

Po drugim biwaku, podczas którego również łapaliśmy motyle, następnego dnia byliśmy w szkole, by je wszystkie zmierzyć. Ale trochę też pozwiedzaliśmy...

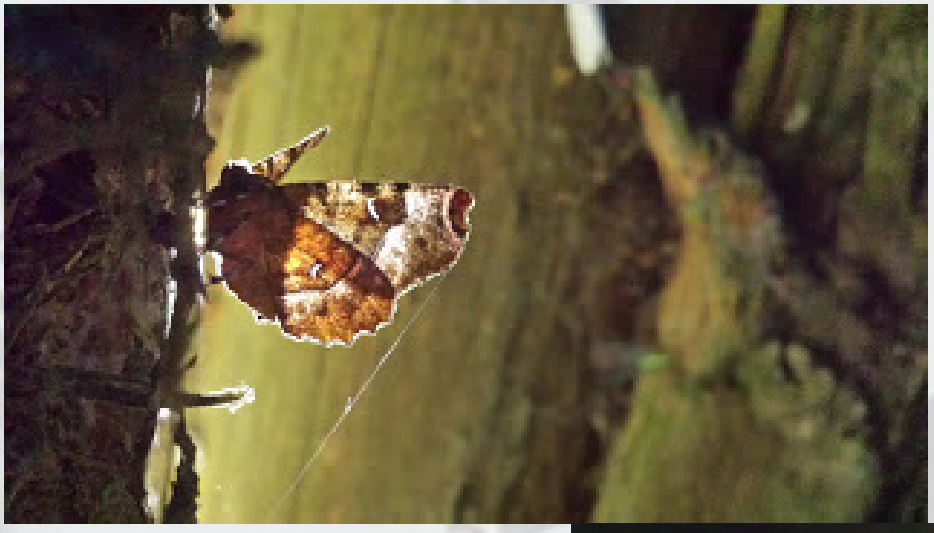
Kolejna wizyta w rezerwacie

6.07.2018

A oto co zebraliśmy...

Dalsze badania...

23.07.2018



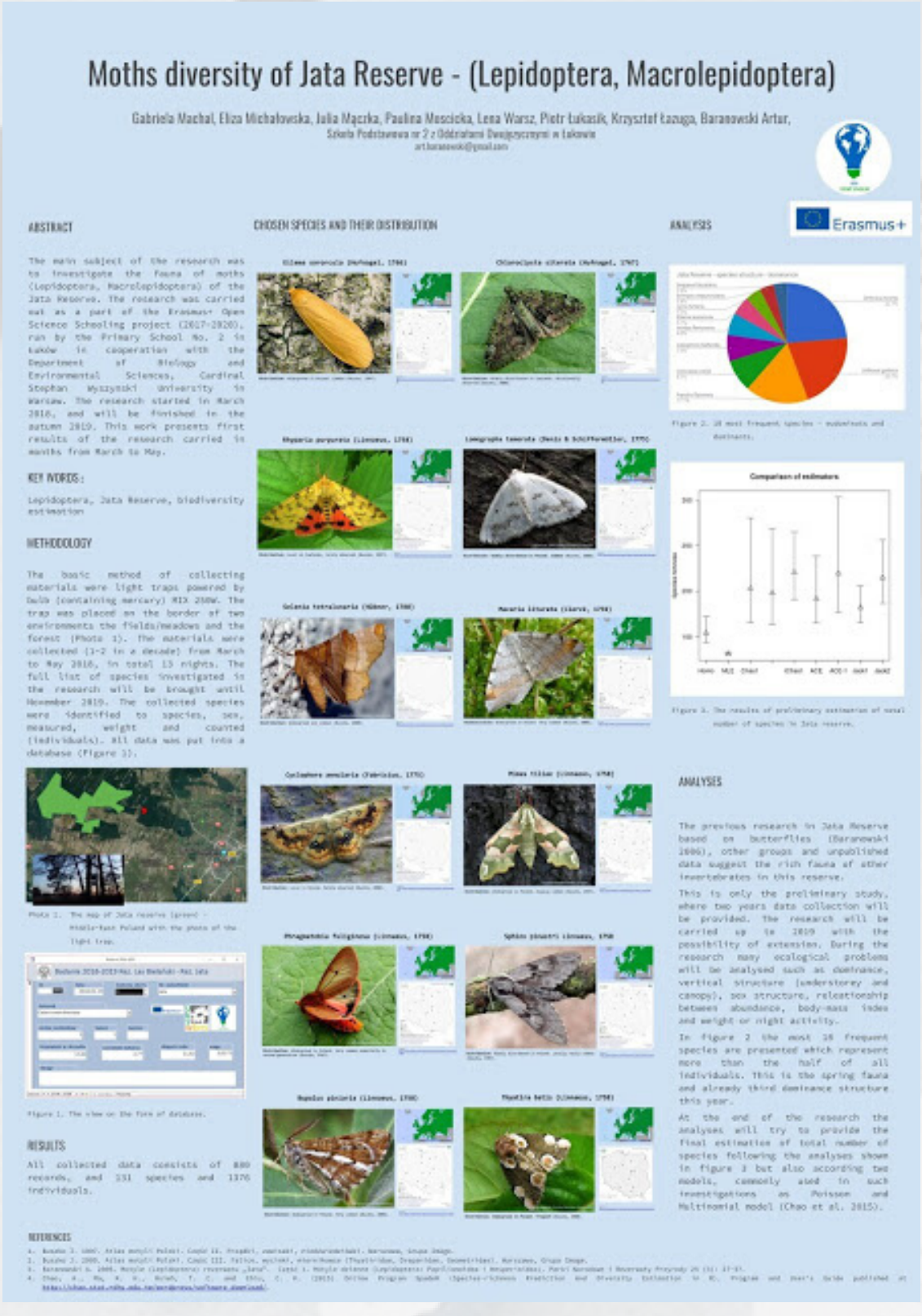
Wspólna zabawa i nauka

6.08.2018

Zakończenie wakacji z motylami

26.08.2018

Biopotencjał 2018 - wstępne wyniki badań



Moths diversity of Jata Reserve - (Lepidoptera, Macrolepidoptera)

Gabriela Machał, Eliza Michałowska, Julia Mączka, Paulina Mościcka, Lena Warsz, Piotr Łukasik, Krzysztof Łazuga, Baranowski Artur,
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Erasmus+

ABSTRACT

The main subject of the research was to investigate the fauna of moths (Lepidoptera, Macrolepidoptera) of the Jata Reserve. The research was carried out as a part of the Erasmus+ Open Science Schooling project (2017-2020), run by the Primary School No. 2 in Łuków in cooperation with the Department of Biology and Environmental Sciences, Cardinal Stephan Wyszyński University in Warsaw. The research started in March 2018, and will be finished in the autumn 2019. This work presents first results of the research carried in months from March to May.

KEY WORDS:

Lepidoptera, Jata Reserve, biodiversity estimation

METHODOLOGY

The basic method of collecting materials were light traps powered by 8w1b (containing mercury) MIX 250W. The trap was placed on the border of two environments the fields/meadows and the forest (Photo 1). The materials were collected (1-2 in a decade) from March to May 2018, in total 15 nights. The full list of species investigated in the research will be brought until November 2019. The collected species were identified to species, sex, measured, weight and counted (individuals). All data was put into a database (Figure 1).

Photo 1. The map of Jata reserve (green) - middle-east Poland with the photo of the light trap.

Figure 1. The view on the form of database.

RESULTS

All collected data consists of 880 records, and 151 species and 1376 individuals.

CHOSEN SPECIES AND THEIR DISTRIBUTION

ANALYSES

Figure 2. 10 most frequent species - eudominants and dominants.

Figure 3. The results of preliminary estimation of total number of species in Jata reserve.

ANALYSES

The previous research in Jata Reserve based on butterflies (Baranowski 1986), other groups and unpublished data suggest the rich fauna of other invertebrates in this reserve.

This is only the preliminary study, where two years data collection will be provided. The research will be carried up to 2019 with the possibility of extension. During the research many ecological problems will be analysed such as dominance, vertical structure (understorey and canopy), sex structure, relationship between abundance, body-mass index and weight or night activity.

In figure 2 the most 10 frequent species are presented which represent more than the half of all individuals. This is the spring fauna and already third dominance structure this year.

At the end of the research the analyses will try to provide the final estimation of total number of species following the analyses shown in figure 3 but also according two models, commonly used in such investigations as Poissom and Multinomial model (Chao et al. 2015).

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Byliśmy w lokalnych mediach

ŁUKÓW

Drukuj Wyślij do Zgłoś błąd Archiwum Cofnij Rozmiar Tekstu

Łuków: uczniowie „Dwójki" poznawali nocne motyle

2018-09-12 13:11:23 Artykuł czytany *54* razy

Uczniowie ze Szkoły Podstawowej nr 2 w Łukowie, którzy biorą udział w projekcie Erasmus+ Open Science Schooling, mieli okazję poznać świat nocnych motyli. Pod opieką nauczyciela Artura Baranowskiego brali udział w nocnych odłowach i badaniach. Efekty swojej pracy przedstawią niedługo partnerom projektu podczas spotkania w Portugalii.

Nocowali w Jacie i łowili ćmy

Podczas wakacji młodzież ze Szkoły Podstawowej nr 2 w Łukowie prowadziła intensywne badania fauny motyli nocnych tzw. ciem w rezerwacie Jata.

Badania odbywały się w ramach realizacji projektu Erasmus+ Open Science Schooling wraz z partnerami z Hiszpanii, Portugalii, Izraela, Finlandii, Grecji i Rumunii.

Biwaki w Jacie

W projekt zaangażowali się uczniowie: Paulina Mościcka, Julia Mączka, Natalia Jagodzińska, Dorotka Piros, Gabriela Machal, Krzysztof Łazuga oraz nauczyciele: Agnieszka Czerska-Pawlak, Dariusz Nicał oraz koordynator projektu Artur Baranowski. Młodzież biwakowała w pobliżu rezerwatu, poznawała różne gatunki owadów, przyrodę - torfowiska, łęgi i bagna.

Na konferencji

- Wstępne wyniki badań różnorodności gatunkowej rezerwatu młodzież naszej szkoły miała już szansę przedstawić podczas Ogólnopolskiej Konferencji Naukowej Biopotencjał 2018 odbywającej się na Wydziale Biologii i Nauk o Środowisku, Uniwersytetu Kardynała Stefana Wyszyńskiego w Warszawie, która odbyła się 8 czerwca 2018 r. Współautorami plakatu byli uczniowie: Gabriela Machal, Eliza Michałowska, Julia Mączka, Paulina Mościcka, Lena Wasz, Piotr Łukasik, Krzysztof Łazuga. Podczas konferencji absolwentka szkoły Natalia Jagodzińska przedstawiła prezentację w języku angielskim, otrzymując od gremium naukowego wyróżnienie – mówi Artur Baranowski.

- Przed nami liczne jesienno-zimowe spotkania, na których będziemy analizować uzyskane dane i przygotowywać się do kolejnych wystąpień konferencyjnych, ale także publikacyjnych. Z naszymi wynikami prac podzieliliśmy się również z naszymi partnerami podczas wyjazdu do Portugalii w dniach 7-11 listopada 2018 r. – dodaje Baranowski.

Młodzi naukowcy brali udział w wielu jedno i dwudniowych biwakach w pobliżu rezerwatu, co było doskonałą okazją do poznania owadów o dziennej i nocnej aktywności.

Podczas nocnych odłowów niemałą atrakcją były obserwacje setek, latających w nocy świetlików! Był również czas na integrację zespołu Erasmusa przy wieczornym ognisku.

Podziękowania dla Nadleśniczego

- Kierujemy ogromne podziękowania dla Pana Nadleśniczego Grzegorza Usa, za dużą otwartość i pomoc w prowadzonym projekcie – mówi Artur Baranowski.

mo

Uczniowie poznali metodologię badań terenowych aktywnie, biorąc w nich udział, ale także podczas zajęć w szkole, gdzie nauczyli się rozpoznawać wiele gatunków ciem i preparować owady, przygotowując gabloty z motylami.

Absolwentka szkoły, Natalia Jagodzińska przedstawiła prezentację w języku angielskim, otrzymując od gremium naukowego Uniwersytetu Kardynała Stefana Wyszyńskiego w Warszawie wyróżnienie.

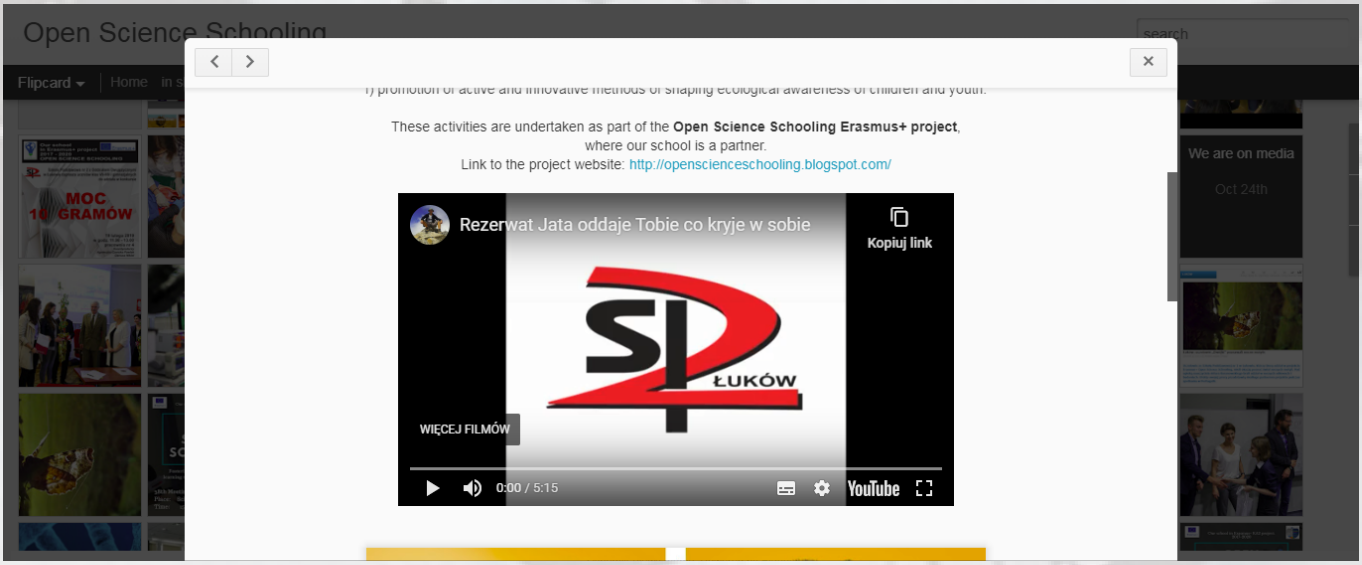
Wydział Biologii i Nauk o Środowisku UKSW

Published by Artur Baranowski [?] · 14 mins ·

Konferencja Biopotencjał to dla wielu młodych naukowców okazja aby przyjrzeć się nauce z bliska i podzielić swoją pasją.
Młodzież Szkoły Podstawowej nr 2 z Oddziałami Dwujęzycznymi oraz I Liceum Ogólnokształcącego im. T. Kościuszki w Łukowie, miała właśnie taką okazję pokazując bardzo ciekawy plakat o wstępnym rozpoznaniu motyli w rezerwacie Jata oraz prezentując referat w języku angielskim o zależnościach między ideksem masy ciała, masą ciała i liczebnością.
O ich badaniac... See More

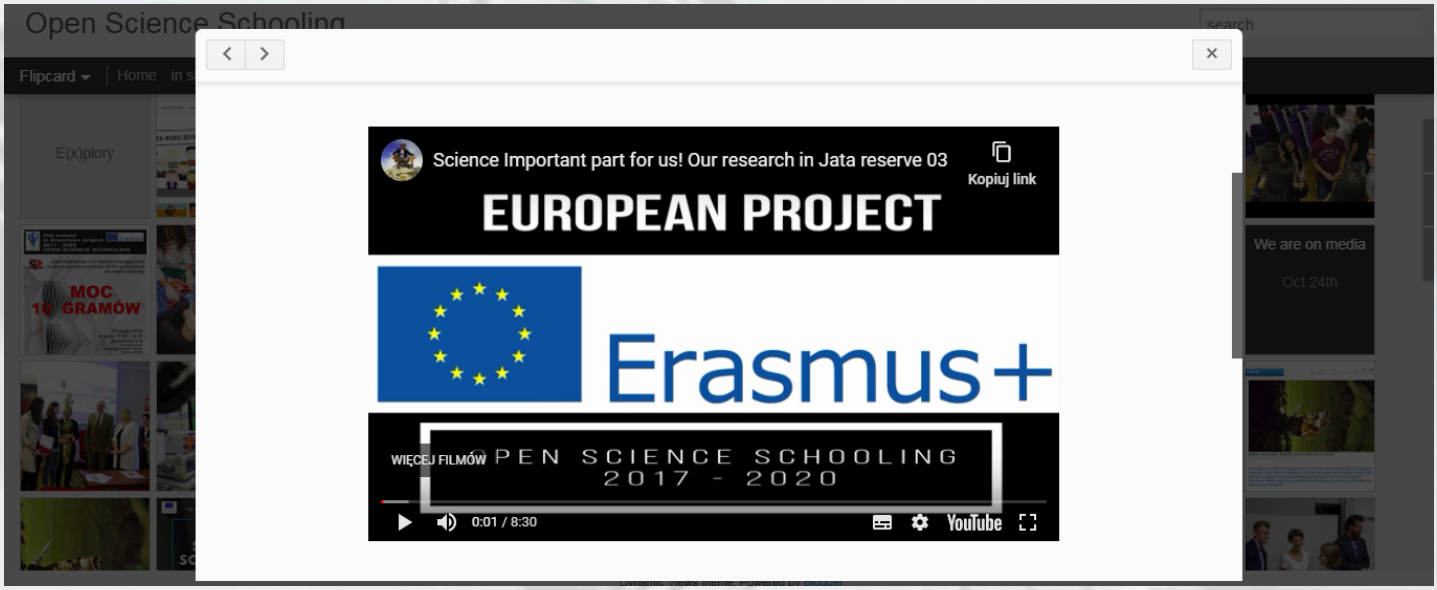

Nocowali w Jacie i łowili ćmy

Krótki film przedstawiający czym się zajmowaliśmy



https://www.youtube.com/watch?v=6gE4v1pZwEg&feature=youtu.be

Film w całej okazałości



https://youtu.be/BQaiDqFC-SE

Przybij "5" z motylem - Noc Biologów

link do prezentacji:
https://prezi.com/qgnnlz88p8-5/przybij-quot5quot-z-motylem/?utm_campaign=share&utm_medium=copy

Plakat na E(x)plory

E(x)plory

MECENAS: LOTOS

Różnorodność biologiczna a dominacja
- liczebność, indeks masy ciała a waga

Autorzy pracy:
Natalia Jagodzińska, Gabriela Machal, Eliza Michałowska, Lena Warsz

Szkoły:
Szkoła Podstawowa z Oddziałami Dwujęzycznymi nr 2 w Łukowie, I Liceum Ogólnokształcące im. T. Kościuszki w Łukowie

Opiekun naukowy:
dr Artur Baranowski

Główne badania dotyczą motyli większych rezerwatu Jata prowadzonych w 2018 roku. W sumie zebrano 48 prób przy użyciu samołówki świetlnej, a w tym 4863 osobników i 293 gatunki motyli z 12 rodzin Lepidoptera. Wszystkie osobniki oznaczano, mierzono i ważono. Badania służą głównie do oceny wiarygodności i poprawności wyznaczania klas dominacji ze względu na liczebność, indeks masy ciała oraz wagę ciała. Innym aspektem jest ocena stanu lokalnej bioróżnorodności. Badania weryfikują postawioną hipotezę, iż wyznaczone średnie wartości wagi ciała są najprecyzyjniejszym sposobem oceny dominacji zgrupowań motyli. Przeprowadzone analizy ujawniły istniejące zmiany w składzie gatunkowym między wszystkimi klasami dominacji, a różnice te były istotne.

MOTYWACJA

Nasza szkoła w ramach projektu Erasmus+ Open Science Schooling poszukuje nauki w lokalnej społeczności. W okolicznym rezerwacie Jata właśnie ruszyły badania prowadzone przez UKSW w Warszawie. Z chęcią dołączyliśmy do projektu badającego motyle nocne, a owady zadziwiły nas swą różnorodnością. Zgłębiając literaturę przedmiotu, a także uczestnicząc w innych badaniach, zainspirowaliśmy się aspektem dominacji gatunkowej oraz analizą ekologiczną w wymiarze, który w Polsce nie był jeszcze podejmowany.

obiekt badań - badania terenowe - laboratorium - baza danych

Grafika wykonana przez autorów projektu

Dzielimy się naszymi rezultatami

Grafika wykonana przez autorów projektu

OPIS BADAŃ

- Badania były prowadzone od marca do listopada 2018 w jednym z najstarszych rezerwatów w Polsce - rezerwat Jata (powstał w 1933 r.) i będą one kontynuowane w 2019 roku.
- W celu dokonania wstępnych pomiarów i analiz, przez 9 miesięcy motyle nocne były łowione przy użyciu samołówek świetlnych z żarówką rtęciowo-żarową 250W typu MIX.
- Odłowy prowadzono w różnych typach środowisk, zarówno wewnątrz rezerwatu jak i w ekotonie tj. na granicy lasu i otwartych wilgotnych łąk.
- Zebrane osobniki były:
  1) liczone a także identyfikowane do gatunku oraz płci,
  2) mierzone z użyciem suwmiarki elektronicznej celem wyznaczenia indeksu masy ciała, a pomiarom podlegały rozpiętość skrzydeł oraz długość i szerokość tułowia,
  3) ważone na wadze analitycznej z dokładnością do dziesięciotysięcznej grama.
- Utworzona baza danych pozwoliła na przeprowadzenie analiz korelacji dominacji fauny motyli większych opartych o liczebność, indeks masy ciała oraz wagę, w 5 klasach dominacji: eudominanci, dominanci, subdominanci, recedenci i subrecedenci.
- Analizom poddano również dane z innych badań. Przygotowana przez nas praca „Korelacja struktury dominacji liczebności i współczynnika masy ciała na podstawie rodziny miernikowców (Geometridae, Lepidoptera) została przyjęta do druku w monografii.

WNIOSKI

- Wstępnie przeprowadzone analizy sugerują, iż nie można uznać przyjętych wskaźników dominacji wyznaczanych na podstawie liczebności czy indeksu masy ciała za precyzyjne. Wskazuje na to istnienie istotnych różnic gatunkowych w każdym z trzech sposobów wyznaczania klas dominacji opartych na liczebności, indeksie masy ciała i masie ciała.
- Zmiana klasy dominacji ze względu na przyjęty wskaźnik to zmiana zasadnicza. W związku z tym ze względu na istniejące różnice najbardziej wiarygodny sposób wyznaczania klas dominacji powinien być oparty o masę ciała.
- Rezerwat Jata stanowi regionalne refugium bogate pod względem różnorodności gatunkowej.
- Wcześniejsze nasze badania wskazują również, iż wyznaczenie hierarchii gatunkowej na podstawie liczebności bądź indeksu masy ciała mają wiele jakościowych różnic, co ogranicza ich użyteczność i nie daje precyzyjnych podstaw służących opisaniu podstawowych relacji ekologicznych.
- Konieczne jest jednak przeprowadzenie dalszych badań, aby uchwycić stałe i powtarzalne relacje na dużej próbie, na kilku powierzchniach i w różnych latach oraz wyznaczyć faktyczne średnie gatunkowe wartości masy ciała, co pozwoli na przyjęcie wniosków o charakterze ogólnym.
- Badania te, dzięki analizom porównawczym z innymi badaniami pozwolą na postawienie nowych hipotez jeszcze nie stawianych w literaturze przedmiotu.

Wstępne wnioski i pierwsze publikacje

Grafika wykonana przez autorów projektu

E(x)plory - etap regionalny

7.06.2019

Biopotencjał 2019

Local Hot Spot of moths diversity in Jata Reserve
- (Lepidoptera, Macrolepidoptera) preliminary results

Dominika Piros, Paulina Mosycka, Marta Karwowska, Krzysztof Łazuga, Baranowski Artur,
Szkoła Podstawowa nr 2 z Oddziałami Dwujęzycznymi w Łukowie

ABSTRACT

One of the main goals of the project was to investigate the moths diversity (Lepidoptera, Macrolepidoptera) of Jata reserve. The research was carried out as a part of the Erasmus+ Open Science Schooling project (2017-2020), run by the Primary School No. 2 in Łuków in cooperation with the Department of Biology and Environmental Sciences, Cardinal Stephan Wyszyński University in Warsaw. The research started in March 2018, and will be finished in the autumn 2019. This work presents first results of the research carried in from March to July. The presented poster shows the most interesting species which were observed in the reserve. Their rare and local distribution character indicates that Jata reserve is a local or even regional biodiversity hotspot.

KEY WORDS:

faunistics, biodiversity estimation, hot spot.

INTRODUCTION & METHODOLOGY

The biodiversity research is still a very important subject for many scientists. First of all, because nowadays we can observe the rapid decrease of biodiversity in the world and the diversity is considered as a crucial value for society and education. Secondly, it is in the agenda of many countries and it is seen as a key feature and value to be protected for further generations. Therefore understanding the biodiversity dynamics and monitoring it became the goal in our project, especially in the light of local and regional biodiversity what is going to be analysed at the end of the project.

The basic method of collecting materials were light traps powered by both (containing mercury) MTK 250W. The trap was placed on the border of two environments: the fields/meadows and the forest (Photo 1) and inside of the forest. The materials were collected 1-2 in a decade from March to July 2018, in total 45 samples in 20 (nights). The full list of species investigated in the research will be brought until November 2019. The collected species were identified to species, sex, measured, weighted and counted (individuals). All data was put into a database (Figure 1).

RARE SPECIES AND THEIR DISTRIBUTION IN POLAND

All collected data consists of 4248 records, and 319 species and 7275 individuals.

The presented species are shown together with their distribution (maps), rarity character and pictures.

ANALYSES

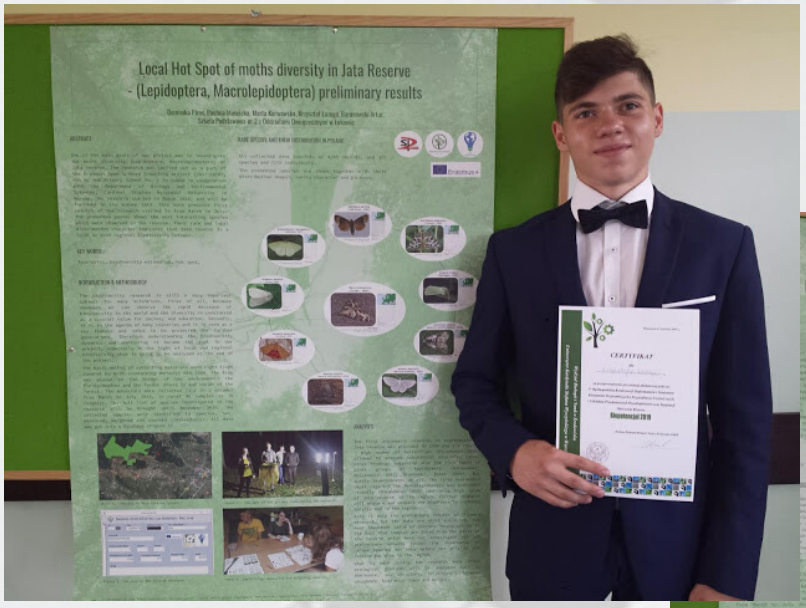
The first systematic research on Lepidoptera in Jata reserve was practised in 1938 and its results - high number of butterflies (Baranowski 2006) allowed to presume substantial diversity there. Other findings suggested also the rich fauna of other groups of Lepidoptera (Baranowski, Kołtowski 2002; Baranowski, Banar 2004), but subtle invertebrates at all. The first systematic paper regarded the Macrolepidoptera was published recently (Baranowski 2019) confirming high value of Jata reserve in the region. Further research will measure and compare the biodiversity richness locally and in the region.

This is only the preliminary results of 1-years research, but the data are still collected. The most important value of current investigation is the fact that samples are taken from the part of the reserve which were not investigate yet and preliminary results reveal the occurrence of unique species not know before not only in the reserve but also in the region.

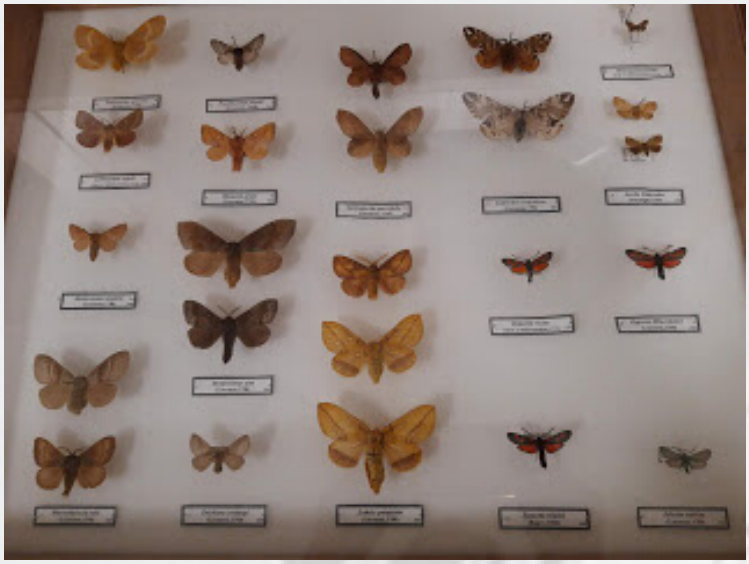
What is more during the research many other ecological processes will be analysed such as dominance, gen structure, relationship between abundance, body mass index and weight.

REFERENCES

I my z naszym plakatem



21 Festiwal Nauki i Sztuki w Siedlcach



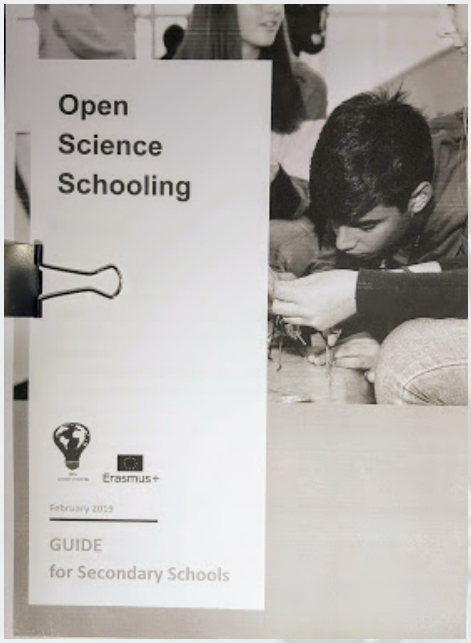
Noc Biologów jako Multipier Event - 10.01.2020

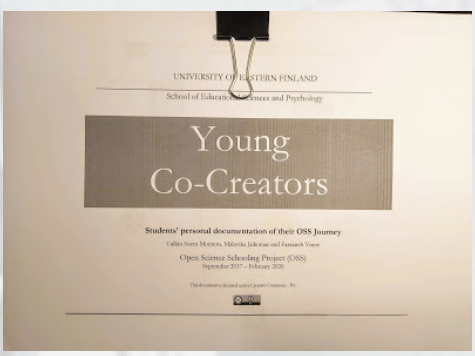
Noc Biologów jako Multipier Event - 10.01.2020

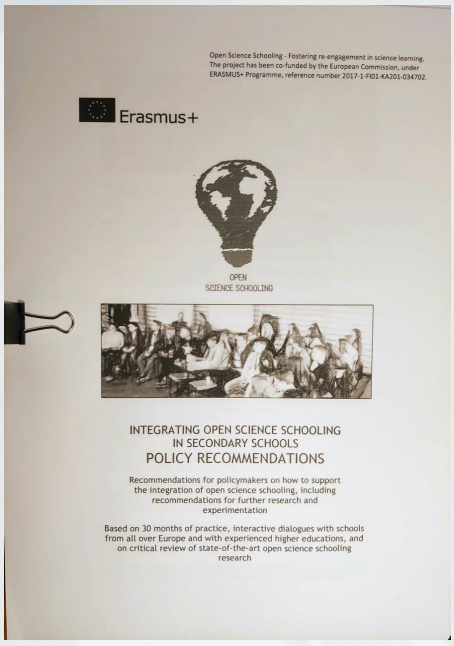
10 stycznia 2020 roku nasza grupa uczestniczyła w laboratoriach, eksperymentach i wykładach organizowanych w ramach ogólnopolskiej akcji Noc Biologów przez Wydział Biologii i Nauk o Środowisku Uniwersytetu Kardynała Stefana Wyszyńskiego w Warszawie.

Wraz z nauczycielami zaprezentowaliśmy uczestnikom Nocy Biologów efekty podsumowujące nasz dwuipółletni projekt Open Science Schooling (2017-2020) programu Erasmus+ *openscienceschooling.blogspot.com* m.in. w formie wystawy motyli rezerwatu Jata, wraz z 5 plakatami i trzema publikacjami przedstawiającymi wyniki naszych prac.

Dodatkowo w rozmowach z licznie przybyłymi nauczycielami i uczniami zaprezentowaliśmy przewodnik wprowadzający do metodyki nauczania metodą open science schooling "OSS - Guide for Secondary Schools", dokument przedstawiający nasze indywidualne doświadczenia "Young Co-Creators" wraz z filmem oraz propozycje rozwiązań prawnych integrujących metodę OSS w system szkolny "Policy Recommendation".







Rezultaty

Zbadaliśmy lokalną bioróżnorodność jednego z najstarszych rezerwatów w Polsce, rezerwacie Jata, na podstawie wybranych grup motyli (Lepidoptera). Pozwala nam to na porównanie bogactwa tego terenu na tle innych przyrodniczych obszarów w kraju.

Warto też zaznaczyć jakie korzyści dał nam sam projekt - Open Science Schooing. Nauczyliśmy się pracy w grupach, komunikacji, współpracy, cierpliwości. Poznaliśmy również wspaniałych ludzi, z którymi mogliśmy dzielić swoje pasje. Projekt otworzył nam oczy na nowe możliwości, zaczęliśmy inaczej postrzegać naukę.

Poradnik projektowy

Realizując podobne projekty należy pamiętać o:

- współpracy
- docenianiu i braniu pod uwagę opinii innych
- stawianiu sobie nowych celów oraz dążeniu do ich realizacji
- pogłębianiu swojej wiedzy i rozwijaniu zainteresowań

OPEN SCIENCE SCHOOLING ERASMUS+ 2017-2019

OCTOBER 2020

LICZEBNOŚĆ, INDEKS MASY CIAŁA I WAGA

- A WIĘC, CZY WZÓR ZAWIERAJĄCY WYMIARY CIAŁA POZWOLI ZASTĄPIĆ POMIARY WAGI MOTYLI NOCNYCH?

PRZYGOTOWAŁY:

MARTA KARWOWSKA, NATALIA JAGODZIŃSKA, DOMINIKA PIROS,MAGDALENA, SIERPIEŃ, EMILIA MACHNIKOWSKA, MAGDALENA CISIAK

BOHATERKI PROJEKTU

NATALIA JAGODZIŃSKA

"DZIĘKI PRACY W PROJEKCIE ZYSKAŁAM "WIĘKSZĄ PEWNOŚĆ SIEBIE, A PRZEDE WSZYSTKIM WIARĘ W TO, ŻE MARZENIE O BYCIU NAUKOWCEM JEST REALNE I JUŻ ZACZĘŁO SIĘ SPEŁNIAĆ"

MARTA KARWOWSKA

"NIESAMOWITE PRZEŻYCIE PRZEPEŁNIONE NOWYMI DOŚWIADCZENIAMI I OSIĄGANYMI SUKCESAMI, CZYLI EFEKTAMI CIĘŻKIEJ PRACY."

DOMINIKA PIROS

"MOŻLIWOŚĆ ROZWIJANIA WŁASNYCH MOŻLIWOŚCI PRZEZ NAUKĘ NIETYPOWYMI SPOSOBAMI I ZDOBYWANIEM NOWYCH DOŚWIADCZEŃ"

MAGDALENA SIERPIEŃ

"BARDZO CIEKAWE DOŚWIADCZENIE I SZKODA ŻE TO JUŻ KONIEC"

EMILIA MACHNIKOWSKA

"WSPANIAŁE DOŚWIADCZENIE I NOWE ZNAJOMOŚCI."

MAGDALENA CISIAK

"ZAINTERESOWAŁAM SIĘ MOTYLAMI, ICH ZACHOWANIEM ORAZ ŻYCIEM W ŚRODOWISKU NATURALNYM"

Na początek kilka pojęć...

INDEKS MASY CIAŁA

ODPOWIEDNIK WAGI WYZNACZANY NA PODSTAWIE WZORU Z SZEROKOŚCI TUŁOWIA, DŁUGOŚCI TUŁOWIA I ROZPIĘTOŚCI SKRZYDEŁ MOTYLA

LICZEBNOŚĆ

LICZBA OSOBNIKÓW DANEGO GATUNKU

BIOMASA

ILOŚĆ MATERII ORGANICZNEJ W OSOBNIKU WYRAŻONA W GRAMACH

ZMIERZYĆ, ZWAŻYĆ I CO DALEJ?

Celem naszego projektu było zbadanie zależności pomiędzy indeksem masy ciała motyli a ich wagą i liczebnością. Dzięki temu mogłyśmy zebrać dane niezbędne do sprawdzenia czy indeks masy ciała może być traktowany jako zamiennik wagi motyli nocnych.

W okolicznym rezerwacie Jata właśnie ruszyły badania prowadzone przez UKSW w Warszawie. Z chęcią dołączyliśmy do projektu badającego motyle nocne; owady zadziwiły nas swą różnorodnością. Zgłębiając literaturę przedmiotu, a także uczestnicząc w badaniach, zainspirowaliśmy się aspektem dominacji gatunkowej oraz analizą ekologiczną w wymiarze, który w Polsce nie był jeszcze podejmowany.

PROJEKTOWE DOŚWIADCZENIA I WSPOMNIENIA

CZEGO SIĘ NAUCZYŁYŚMY?

PROJEKT BYŁ DLA NAS NIEZWYKLE CENNYM ORAZ INSPIRUJĄCYM DOŚWIADCZENIEM, SZCZEGÓLNIE DZIĘKI WIELU UMIEJĘTNOŚCIOM, KTÓRE NABYŁYŚMY. PRACA W GRUPIE NAUCZYŁA NAS WSPÓŁPRACY ORAZ RACJONALNEGO PODZIAŁU OBOWIĄZKÓW, DZIĘKI CZEMU DEADLINE NIE BYŁ NAM JUŻ TAK STRASZNY. PONADTO WIELE PUBLICZNYCH WYSTĄPIEŃ NA SPOTKANIACH PROJEKTOWYCH, POZWOLIŁO NAM NA ZDOBYCIE WIĘKSZEJ PEWNOŚCI SIEBIE ORAZ JEDNEJ Z NAJWAŻNIEJSZYCH ZDOLNOŚCI W RELACJACH MIĘDZYLUDZKICH, A MIANOWICIE - AKTYWNEGO SŁUCHANIA. CO WIĘCEJ, ROZWINĘŁYŚMY SWOJE ZDOLNOŚCI JĘZYKOWE I TERAZ Z PRZYJEMNOŚCIĄ ROZMAWIAMY ZE ZNAJOMYMI PO ANGIELSKU.

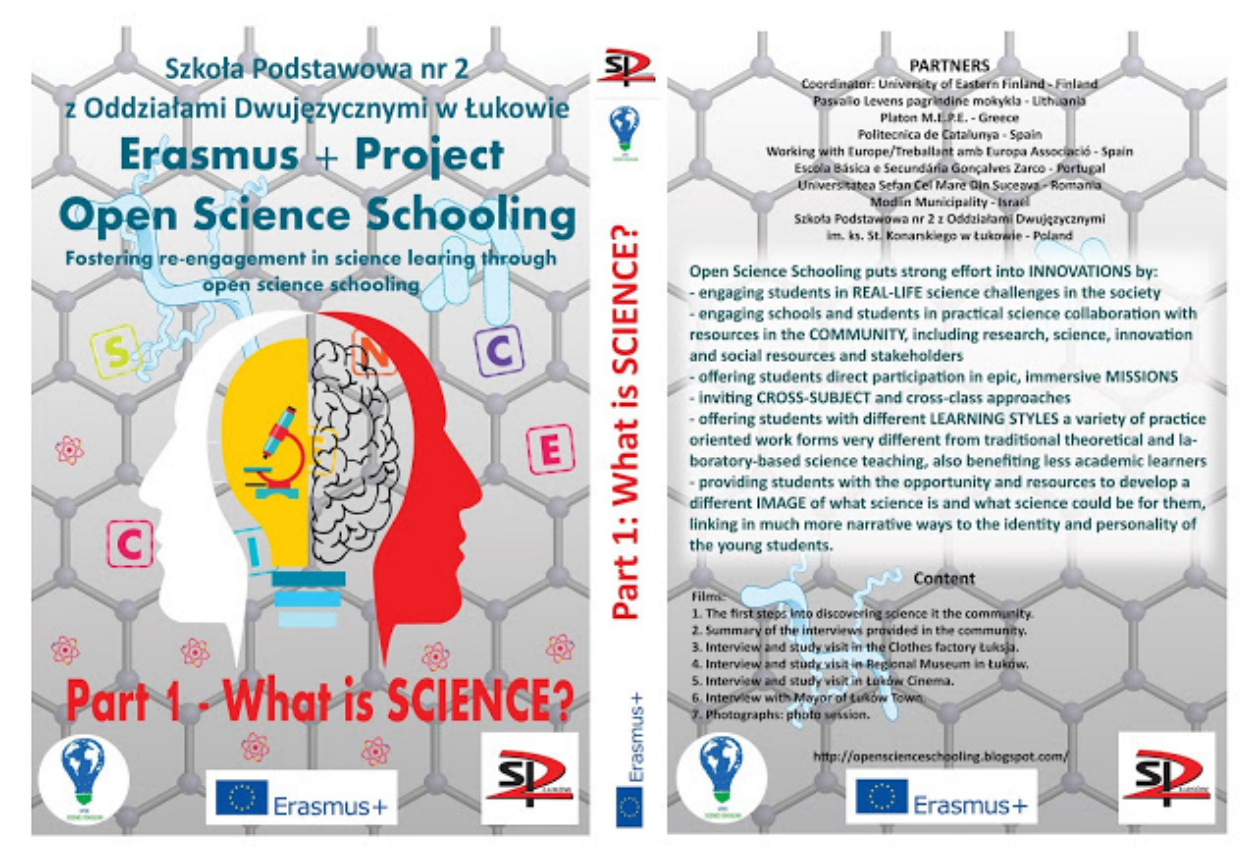
PASJA DO MOTYLI

PRACUJĄC NAD TEMATEM ZALEZNOŚCI MIĘDZY INDEKSEM MASY CIAŁA A WAGĄ MOTYLI NOCNYCH, WZBOGACIŁYŚMY NASZĄ WIEDZĘ DOTYCZĄCĄ EKOLOGII ORAZ LOKALNEGO REZERWATU JATA. STWORZYŁYŚMY 2 PLAKATY NA KONFERENCJE, ABY PRZEDSTAWIĆ WYNIKI NASZYCH BADAŃ, KTÓRE POKAZAŁY ŻE INDEKS MASY CIAŁA MOTYLI NOCNYCH NIE JEST IDEALNYM ZAMIENNIKIEM ICH WAGI. DAŁO NAM TO TAKŻE OKAZJĘ DO DYSKUSJI Z INNYMI NAUKOWCAMI I POZANANIA ICH OPINNI NA TEMAT NASZEGO BADANIA.

TRENING CZYNI MISTRZA - NASZE PROJEKTOWE ZADANIA

UWIELBIAMY WYZWANIA, KTÓRYCH Z PEWNOŚCIĄ NIE BRAKOWAŁO W PROJEKCIE. BYŁYŚMY ZAANGAŻOWANE W TWORZENIE PLAKATÓW ORAZ PREZENTACJI, KTÓRE NASTĘPNIE PRZEDSTAWIAŁYŚMY PODCZAS SPOTKAŃ A TAKŻE KONFERENCJI NAUKOWYCH. BYŁO TO DOSKONAŁĄ OKAZJĄ DO DZIELENIA SIĘ SWOJĄ PASJĄ Z UCZESTNIKAMI TYCH WYDARZEŃ ORAZ ZAWIERANIA NOWYCH ZNAJOMOŚCI, Z KTÓRCH ZNACZNA CZĘŚĆ TRWA DO DZIŚ!

NASZĄ PRZYGODĘ DOKUMENTOWALIŚMY W FORMIE FILMÓW DVD KTÓRYMI DZIELILIŚMY SIĘ Z NASZYMI PARTERAMI



NAJPIĘKNIEJSZE MOMENTY

JESTEŚMY DUMNE Z TYCH PIĘKNYCH CHWIL, KTÓRE MIAŁYŚMY PRZYJEMNOŚĆ WSPÓŁTWORZYĆ

NAJBARDZIEJ PODOBAŁO MI SIĘ GOSZCZENIE W POLSCE GRUP PROJEKTOWYCH Z INNYCH KRAJÓW. NIESAMOWITE BYŁO POZNANIE OSÓB PRACUJĄCYCH NAD TYM SAMYM PROJEKTEM. MOGLIŚMY PODZIELIĆ SIĘ SWOIMI DOŚWIADCZENIAMI I PRZEDE WSZYSTKIM POSŁUGIWALIŚMY SIĘ PRZY TYM JĘZYKIEM ANGIELSKIM. DAŁO NAM TO SZANSĘ DO ROZWOJU POD RÓŻNYMI ASPEKTAMI - MARTA

WSPÓŁPRACA Z UCZNIAMI Z INNYCH KRAJÓW W RÓŻNORODNYCH ZADANIACH, W KTÓRYCH POJAWIŁO SIĘ WIELE WYZWAŃ ALE OSIĄGNIĘCIE POSTAWIONEGO CELU DAWAŁO WIELKĄ SATYSFAKCJE.- DOMINIKA

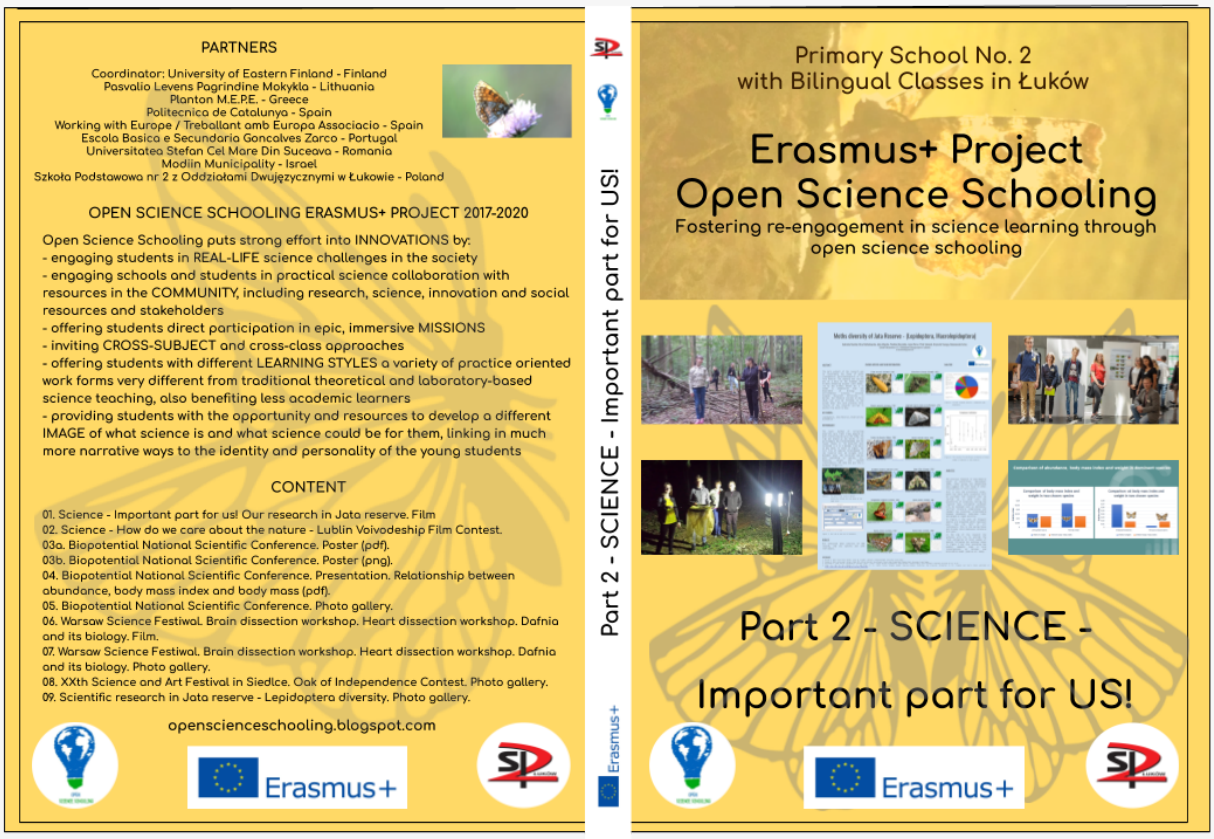
MILE WSPOMINAM CZAS GOSZCZENIA W POLSCE UCZESTNIKÓW PROJEKTU ZA ZAGRANICY. BARDZO PODOBAŁO MI SIĘ RÓWNIEŻ PRZYGOTOWYWANIE GABLOT Z MOTYLAMI. - MAGDA

WYDAJĘ MI SIĘ ŻE NAJWIĘKSZA RADOŚĆ SPRAWIAŁO MI POZNAWANIE NOWYCH OSÓB.NAJMILSZE WSPOMNIENIE Z PROJEKTU TO: PRACA W GRUPACH PRZY RÓŻNYCH ZADANIACH ZAWSZE BYŁO ŚMIESZNIE I NIGDY SIĘ NIE NUDZIŁAM. - MAGDA

WSZYSTKIE CZĘŚCI PROJEKTU BYŁY RÓWNIE INSPIRUJĄCE, NAJBARDZIEJ DUMNA BYŁAM Z PRACY Z GRUPĄ PODCZAS NOCY BIOLOGÓW, WYMAGAŁO TO OD NAS BARDZO DUŻO ODWAGI I PRACY, A ZAINTERESOWANIE MŁODZIEŻY PREZENTOWANYM PRZEZ NAS TEMATEM BYŁO NAJPIĘKNIEJSZĄ NAGRODĄ. - NATALIA

NAJBARDZIEJ PODOBAŁA MI SIĘ INTEGRACJA W RÓŻNYCH ZADANIACH Z UCZESTNIKAMI Z INNYCH KRAJÓW. - EMILKA

NASZĄ PRZYGODĘ DOKUMENTOWALIŚMY W FORMIE FILMÓW DVD KTÓRYMI DZIELILIŚMY SIĘ Z NASZYMI PARTERAMI



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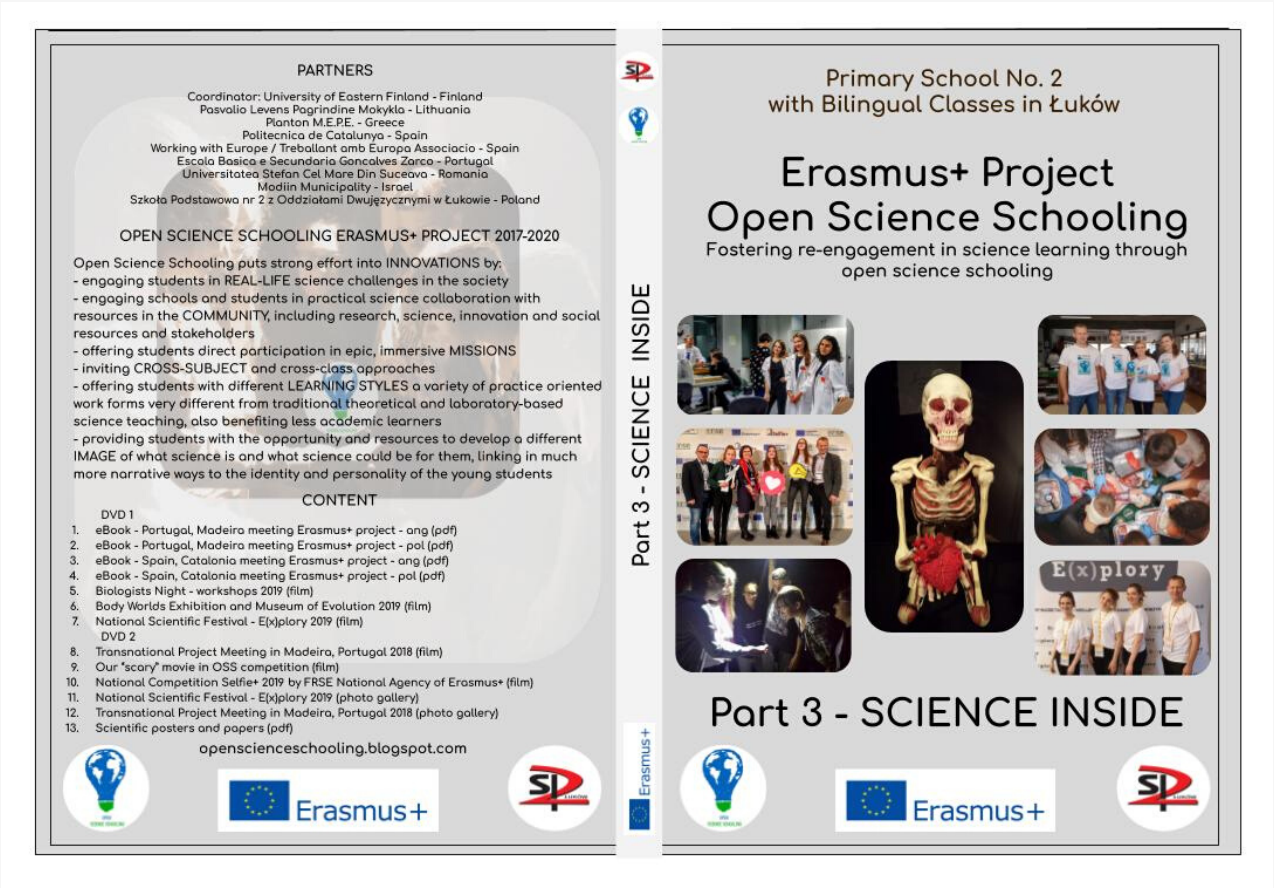

C.D.N.

CZĘŚĆ 4 JUŻ WKRÓTCE NA ZAKOŃCZENIE PROJEKTU :)

Dzięki naszej pasji i kreatywności zdobyliśmy I miejsce w konkursie selfie+ 2019!!!


Selfie+
DYPLOM
dla
Szkoły Podstawowej
z Oddziałami Dwujęzycznymi nr 2
im. ks. Stanisława Konarskiego w Łukowie
za zajęcie I miejsca w kategorii
Twój projekt w jednym ujęciu
w konkursie Selfie+
Erasmus+ Edukacja szkolna
za pracę „Operacja – Open Science Schooling"
dr Paweł Poszytek
dyrektor generalny Fundacji Rozwoju Systemu Edukacji,
Narodowej Agencji Programu Erasmus+
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oraz zdobyliśmy świetną nagrodę!

A nasze logo projektu eTwiningowego let's STEMulate the Space zostało wyniesione w przestrzeń kosmiczną!

... na pokładzie polskiej satelity KRAK-SAT o czym głośno mówiono w mediach :)

ŁUKÓW

Drukuj Wyślij do Zgłoś błąd Archiwum Cofnij Rozmiar Tekstu

Cząstka łukowskiej „Dwójki" w przestrzeni kosmicznej

2019-06-24 07:51:42 Artykuł czytany *75* razy

Zdjęcie wykonane przez uczniów Szkoły Podstawowej nr 2 w Łukowie, którzy biorą udział w międzynarodowym projekcie eTwinning "Let's STEMulate the Space", znalazło się w przestrzeni kosmicznej. Jak to możliwe? Wyjaśnia nam to ich nauczyciel, Artur Baranowski.

Jesteśmy dumni z naszych publikacji i plakatów !

Badania i Rozwój Młodych Naukowców w Polsce 2019
Materiały konferencyjne – wiosna
Część pierwsza - Lublin

Correlation between dominance based on abundance and body mass index of family Noctuidae, Lepidoptera.

Baranowski Artur [1], Jagodzińska Natalia [2], Machal Gabriela [3], Warsz Lena [3], Michałowska Eliza [3] Baranowska Beata

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[2] I Liceum Ogólnokształcące im. Tadeusza Kościuszki w Łukowie
[3] Szkoła Podstawowa nr 2 z Oddziałami Dwujęzycznymi im. ks. Stanisława Konarskiego w Łukowie

Key words: dominance hierarchy, body mass index, population ecology, Wigierski National Park,

Abstract
Understanding the importance of relation between abundance, biomass and biodiversity is one of the most intriguing problems in ecology. Previous investigations reflected by mathematically created body mass index equations, highlighted the problem of the accuracy of this measurement in estimating the patterns of species distributions and dominance hierarchy. The aim of this research is to analyse the relation between body mass index and abundance and test this accuracy in estimating the dominance ranks. The field research was provided near Wigierski National Park from July to November 2009. The specimens were caught using the light-trap with 250 MIX light bulb. In total of 18 samples 755 individuals, 68 species of Noctuidae family (Lepidoptera) were indicated. Body mass index was calculated by measuring individual's dimensions. The research revealed some significant differences in dominance hierarchy based on abundance and body mass index, thus these two indices cannot be used interchangeably.

1. Introduction

The estimation of arthropod biomass is often important in studies of terrestrial ecosystem structure and function what enables many reasonable and accurate predictions of biological phenomena. To estimate the biomass and weight of particular individuals, the body size parameters are in use. One of the least understood aspects of animal development – the determination of body size – is currently the subject of intense scrutiny (Parker and Johnston 2006). Predicting biomass by measuring the size of the body is a common method used in variety groups of animals (e.g.: Deichmann 2008; Radtke and Williamson 2005). It is also the most important life history character of organisms, yet little is known of the physiological mechanisms that regulate body size and the variation in it (Davidowitz et al. 2003; Chown and Gaston 2010). Many researches and global ecological conclusions are based on the size of organisms what enables better understanding the processes taking place in ecosystems (Biedermann 2003). Another issue in this matter is the body condition of animals what has

Poznań
kwiecień 2019

Relationship between abundance, body mass index and body mass in one year study of Macrolepidoptera, (Lepidoptera) in Jata reserve - preliminary results.

Baranowski Artur [1], Jagodzińska Natalia [2], Machal Gabriela [3] Baranowska Beata

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Key words: dominance hierarchy, body mass index, abundance, insect weight, population ecology,

Abstract
One of the most interesting issues in ecology is the comprehension of the biomass dynamics between different systematic groups. In order to investigate it, different measurements were used like abundance, body mass index and weight. Previous approaches to this problem revealed that the mathematical equation of the body size is not the most appropriate reflection of the weight of the individual, so the real biomass, although some researchers suggested such correlation. This paper reveals also that, body mass index is not the most adequate metric to set dominance hierarchy, especially in Lepidoptera investigations. This study aims to analyze the relation between abundance, body mass index and weigh in dominance ranks to assess the accuracy of abundance and body mass index in ecological analysis. The preliminary field research was conducted in Jata Reserve in Poland from March to August 2018. The specimens were caught using the light-trap with 250 MIX light bulb. Overall, 5803 individuals belonging to 303 species of Lepidoptera were collected. To determine the body mass index all specimens were measured but also weighed. Analysis of the abundance, BMI and weight correlation in dominance ranks showed up significant differences that occur in the dominance hierarchy. This indicates that body mass index is not the most relevant measurement of weight in studies of Lepidoptera.

1. Introduction

The understanding the biodiversity dynamics in the context of biomass of different taxonomic groups and relationship between them, is one of the fundamental assignments in population ecology. In recent years, researchers have studied the graphical patterns of species abundance distributions (known in literature as SADs) in order to assess the species richness

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BIOPOTENCJAŁ 2018

Jesteśmy dumni z naszych publikacji i plakatów !

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Correlation between dominance based on abundance and body mass index of family Noctuidae, Lepidoptera.

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Introduction

One of the most important measurements in population ecology are: biomass, abundance and body size. They are used to set dominance hierarchy in ecology. The study of species size distribution has a long tradition in ecology, because they might explain differential patterns of speciation and extinction and can be used in conservation implications. To fuse abundance and biomass the body mass index was introduced into ecology. Use of this measurement has a positive outcome in many animals' phyla. The study was designed to investigate the relationship between abundance and body mass index of Noctuidae family based on the survey taken in Wigry National Park in Poland. We hypothesized that body mass index is not the most appropriate measurement and dominance based on body mass index differs significantly in comparison to dominance based on abundance.

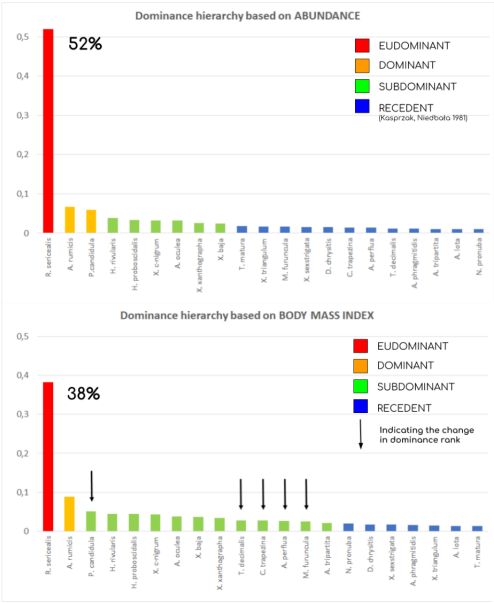
Objectives

- Examining dominance hierarchies of Lepidoptera communities based on the abundance and body mass index (BMI) in order to chose the best method.
- Study Pearson's correlation between abundance and body mass index in dominance rank of each species.

Materials and methods

- The moths were collecting into the light trap with the light bulb MIX 250
- The trap was placed in Wiry National Park, Gawrzec, Poland.
- Moths for the analysis were caught from July to November 2009.
- Caught individuals were measured necessary for calculating body mass index.
- The basis for this research is the database containing 68 species and 755 individuals, Noctuidae, Lepidoptera.
- Pearson's correlation coefficient was calculated between body mass index and abundance.
- Dominance hierarchy of communities and dominance rank of each species were set. They were based on abundance and BMI.

Results



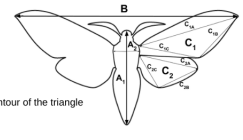
Body mass index

$$\frac{A+B+C}{3}$$

A- thorax length and thorax width
B- wings span
C- surface of the front wing in the contour of the triangle

$A = (A_1 + A_2)$

$C = C_1 + C_2$ $\quad C_1 = C_{1A} + C_{1B} + C_{1C}$ $\quad C_2 = C_{2A} + C_{2B} + C_{2C}$



Conclusions

Due to the analysis, **5 species changed their dominance rank** but general **Pearson's correlation coefficient** calculated as **0.9893** indicates a very strong correlation. However, it seems that dominance hierarchy based on body mass index is a better method than based on the abundance. Though some studies e.g. (Saint-Germain et al. 2007) suggest that body weight may be the most suited method and should be used more often in ecological analyses. The BMI is only the "shortcut". Assuming, the survey reveals the particular species in the dominance rank lack the steadiness and relatively serious fluctuations in the subsequent dominance ranks can be observed. Therefore, it is difficult to accept the accuracy of the measurement based on the abundance and body mass index interchangeably. Similar outcomes were observed in another analyses (Baranowski, Skrypko 2018). The further research is necessary to conduct a real weigh of living individuals and to compare them with abundance and body mass index in dominance hierarchy.

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Relationship between abundance, body mass index and body mass in one year study of Macrolepidoptera, (Lepidoptera) in Jata reserve - preliminary results

1 Baranowski Artur, 2 Jagodzińska Natalia, 3 Machal Gabriela, Michałowska Eliza, Warsz Lena
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3 Szkoła Podstawowa nr 2 z Oddziałami Dwujęzycznymi im. ks. Stanisława Konarskiego w Łukowie

INTRODUCTION

There are three major measurements used to investigate dynamics in population ecology: abundance, body mass index and biomass. These measurements are used to set hierarchy of Macrolepidoptera as well as other insects (Majumdar et. al. 2016). To fuse abundance and biomass, the body mass index was introduced into ecology. Dominance ranks based on the body mass index are considered to be a valuable research measurement (Kasprzak, Niedbała 1981), which reduces the necessity of collecting living organisms in ecological investigations. However, the recent research shows that body mass index is not the most efficient measurement for studying Macrolepidoptera populations.

The aim of the study was to investigate the relationship between abundance, body mass index and biomass (weight) of Macrolepidoptera based on the survey taken in Jata reserve in Poland. Based on the previous investigations, we hypothesized that body mass index is not the most appropriate measurement and dominance ranks based on body mass index differ significantly in comparison to dominance assigned on abundance and biomass (weight).

OBJECTIVES

- Examine dominance hierarchy based on the abundance, body mass index and weight to check their usefulness in further ecological analyses.
- Study Pearson's correlations between abundance and body mass index.
- Indicate the species, which change the dominance rank according to the method used.

METHODS

- Moths were caught into the light trap with the use of light bulb MIX 250
- The traps were placed in the ecotone and deep in the forest
- Moths for the initial analysis were caught from March to July 2018
- Caught individuals were weighed and the measurements necessary for body mass index were taken using electronic calliper
- This study is preliminary, therefore 20 most abundant species were selected from the database containing 303 species, for statistical analysis excluding 3 specimens which lacked the necessary data
- Pearson's correlation coefficient was estimated between body mass index and abundance, body mass index and weight, abundance and weight

In the morning after the site investigation, all caught specimens were measured and weighed.

Moths were thoroughly selected from the biomass.

The majority of caught Macrolepidoptera was measured using the electronic calliper.

$$\frac{2B + A1 + A2}{3}$$

The equation and scheme was used to estimate the body mass index.

RESULTS

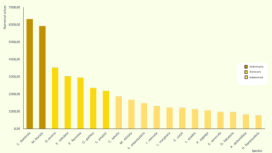


Figure 1. The graph depicts the dominance structure estimated on the basis of body mass index and abundance

Figure 4. The graph compares relative weight to the relative body mass index for two chosen species

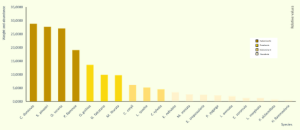


Figure 2. The graph depicts the dominance structure estimated on the basis of weight and abundance

Figure 5. The graph compares relative weight to the relative body mass index for two chosen species

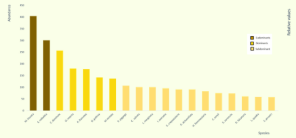


Figure 3. The graph depicts the dominance structure estimated on the basis of abundance

Figure 6. The graph shows the correlation between three measurements: abundance, weight and the body mass index

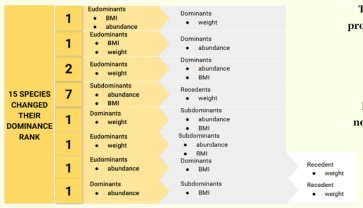
DISCUSSION

The preliminary research shows differences between dominance hierarchy based on the abundance and weight or the body mass index. Figures 1, 2, 3 present changes in the dominance groups depening on the measuements: abundance, weight and body mass index. The relation between these measurements, which is presented in the figure 6, shows significant differences between studied measurements. Dominant species play the key role in the environment, therefore observed differences between estimated dominance groups are important, although the Pearson's correlation coefficients show very strong correlations between weight and body mass index.

PEARSON'S CORRELATION COEFFICIENTS

ABUNDANCE AND BODY MASS INDEX	WEIGHT AND BODY MASS INDEX	WEIGHT AND ABUNDANCE
0,5629	0,9061	0,2692
strong correlation	very strong correlation	weak correlation

CONCLUSIONS



The preliminary investigation proves that the body mass index is not the most appropriate measurement to estimate dominance groups for Macrolepidoptera. However, further research is necessary to collect and analyze more data.

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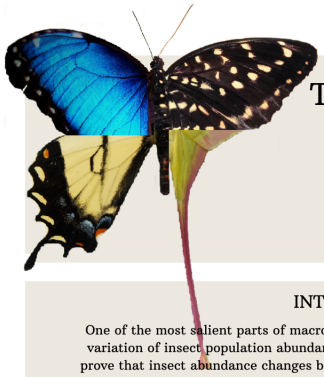

The seasonal changes of Lepidoptera assemblages in Jata reserve habitats - preliminary results

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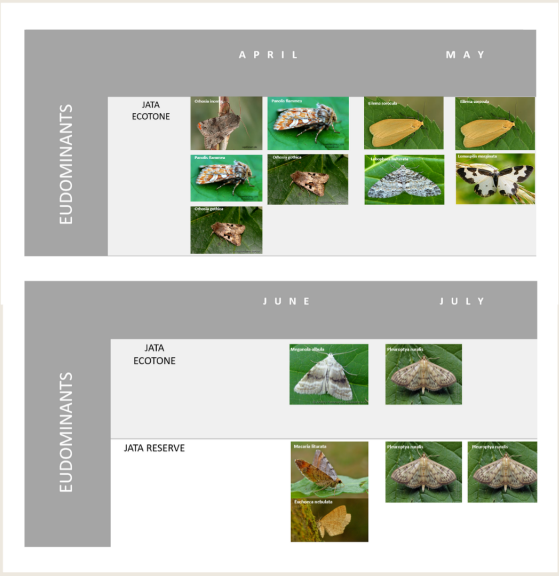
INTRODUCTION

One of the most salient parts of macroecology is understanding of the patterns in seasonal variation of insect population abundances and community composition. Previous research prove that insect abundance changes both in long-term as well as in short-term cycles. The main reason for this phenomenon is the short life cycle of moths. Certainly, there are more additional external factors that have an impact on the seasonality of moths, for example: the temperature, humidity and food availability. Due to the fact that moths are mostly herbivores in their larval stage they are especially sensitive to environmental changes that affect plant condition, hence the quality of their diets. Therefore, it is important to understand the patterns of moths seasonality. This study was conducted to make preliminary evaluations of the changes of the dominance ranks of moths from April to July 2018. The investigation will continue and compare moths fauna of the forest and ecotone - forest/meadow habitats to indicate the permanent populations of Jata reserve.

OBJECTIVES

- Examine dominance hierarchy based on the abundance in each half of the month from April to July
- Compare the assemblages of Lepidoptera from two habitats: Jata reserve and Jata ecotone

RESULTS AND DISCUSSION

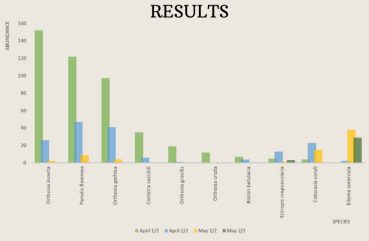


This study refers to the other research (e.g. Baranowski 2006). In this study focused on the comparison between eudominant and dominant species in two types of the habitats: canopy and understorey layer. It demonstrated that there are only few differences between the most dominant species composition in each forest layer. Statistical tests revealed that the species distribution was not normal due to the Shapiro-Wilk test that equaled to W=0.799517, p=0.000005. Therefore the nonparametric Kogołomorowa-Smirnowa test was used and it equaled to K-S p>0.1. The hypothesis that the dominance structure does not differ between the canopy and understory layer was the result of that recent study. However, the new investigation aims to study the differences in species composition between Jata ecotone and Jata reserve. The preliminary analysis reveals intriguing results that there are some significant differences between these two types of the habitat, although collecting more data is necessary. The research may help to evaluate which species are native in the studied ecosystem and which species are nonnative and are artificially introduced into the ecosystem by humans.

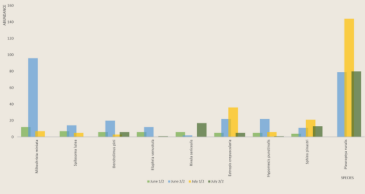
METHODS

- Moths were caught into the light traps with the use of light bulb MIX 250
- The traps were placed in the ecotone and deep in the forest
- Moths for the initial analysis were caught from March to July 2018
- Caught individuals were identified with the use of the available literature and comparative moths collections
- the data was entered into the database and then analysed in Microsoft Excel

RESULTS



Comparison of the abundance of 10 chosen species of Lepidoptera from April to May



Comparison of the abundance of 9 chosen species of Lepidoptera from June to July

CONCLUSIONS

Although this is only the preliminary study it demonstrates the interesting differences between the species composition and hierarchy in each type of the studied habitat. Therefore we hypothesize that more habitats are explored the more species can be discovered, even if the investigated does not cover a big area. What is more, we investigate in the research the differences between the light traps placed in close distance of 200 meters. The results could bring interesting results about the method and its quantitative character.

Erasmus+

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- Baranowski A. 2006 Zgrupowania motyli (Lepidoptera) w piętrowej strukturze lasu rezerwatu „Las Piwnicki" dysertacja, UMK Toruń.

ABY ZREALIZOWAĆ PODOBNY PROJEKT NALEŻY:

- WSPÓŁPRACOWAĆ Z INNYMI
- BYĆ WYTRWAŁYM
- BYĆ OTWARTYM NA NOWE POMYSŁY I DOŚWIADCZENIA
- DĄŻYĆ DO INTEGRACJI GRUPY
- MYŚLEĆ KREATYWNIE
- MIEĆ DYSTANS DO SIEBIE
- BYĆ GOTOWYM NA KOMPROMIS
- W WYBORZE TEMATU KIEROWAĆ SIĘ ZAINTERESOANIAMI INNYCH UCZESTNIKÓW

TO BYŁ CZAS PEŁEN WYZWAŃ I SATYSFAKCJI Z ICH PRZEZWYCIĘŻANIA, A PRZEDE WSZYSTKIM OKRES PEŁEN PRZYJAŹNI I WSPÓŁPRACY

OPEN SCIENCE SCHOOLING
NSTUDENTS' JOUNEY

SCHOOL TEAM MADEIRA PORTUGAL

ESCOLA BÄSICA E SECUNDÁRIA
GONÇALVES ZARCO

PORTUGAL

ESCOLA BÁSICA E SECUNDÁRIA GONÇALVES ZARCO, MADEIRA, PORTUGAL is a public secondary school situated in the urban area of Madeira. The city has an approximate population of 111,892 inhabitants. The number of students over 12 years of age studying at the school is 1108. The school follows the traditional method of teaching, however there are projects that explore other teaching methods. These projects encompass several classes from different years. Examples of projects: Cooperative Learning; Class + (project work); Currently with changes at the national level, the school begins to develop teaching based on curriculum flexibility.

Escola Básica Secundária Gonçalves Zarco

The school team consisted of four teachers and eleven students who volunteered to participate in the Open Science Schooling Project, 8 students were 10th graders and 3 students were 9th graders. The project related activities were conducted approximately 2 hours per week after school hours and schedule according to students' availability. They activities were developed in several places like school, institutions, companies, etc. Two groups of 5 and 6 students were formed and encouraged to come up with new ideas for their OSS mission in the local community. All the students were from the same class.

Portugal school team during the TPM III, 2018, Mdeira, Portugal

Problem Identification and Contextualisation

Understanding science was the first stage of the students' OSS journey. In this regard, the students were given the chance to decide freely on what immersive mission they would like to work on. They actively took part in group discussions among themselves and with the teachers, keenly contemplating and understanding the different aspects of the project.

What is Science?

Personal perspectives (representative answers)

WHERE CAN WE FIND SCIENCE?

PERSONAL PERSPECTIVES (REPRESENTATIVE ANSWERS)

"Everywhere and in everyone, we are surrounded by it."

"Everywhere, as everything's made of science. In the past, science was a way of understanding things less approximate from reality whereas today we have more resources and knowledge about what happens around us."

"Although created by humans, science can be applied and therefore found on Nature and almost anything, since everything around us is target of scientific work in order to explore find the truth in it."

"We can find science literally everywhere and every place in the Universe. Scientific laws can be applied and used in our daily life as well as in transcendental realities."

WHAT IS SCIENCE IN THE PAST AND WHAT IS IT NOW?

PERSONAL PERSPECTIVES (REPRESENTATIVE ANSWERS)

"Obviously science and the way we perceive the world has changed throughout times. Due to technological progress it has certainly evolved for better. It is more accessible than has ever been."

"I think the idea is the same but with the pass off the years the materials got better and that helped in new discoveries."

"In the past science wasn't as specific as it is today. What we take for granted today could have been one of the greatest achievements in the past."

"Science used to have certain limitations in the past (Religion, for example) and that stays until now. However, these limitations are not about futile things but instead relevant things like ethics and morals (Human Cloning, for instance)."

"Without science our life wouldn't make sense and we couldn't explain the phenomena that happen in the world."

WHY IS SCIENCE IMPORTANT?

PERSONAL PERSPECTIVES (REPRESENTATIVE ANSWERS)

"People usually take for granted daily life things without putting much thought into it. Things like vaccines, televisions and internet are a result of needs that we human created with time. This requires tireless work from various teams of researchers around the world and unfortunately this effort is not recognised enough. Without Science we wouldn't live as much as we do, we wouldn't have the comforting things we have and so on."

"Science does play a very vital role in everyone's life. For those who are fortunate enough it improves their life."

"Science makes us look at everything on a different way, and give us the knowledge we need to know to discover even more things."

"It's important because it gives us knowledge about things that we don't know and even thing that we already understand."

"With science we can discover new things like cures for grave diseases."

WHAT ARE THE BENEFITS OF SCIENCE?

PERSONAL PERSPECTIVES (REPRESENTATIVE ANSWERS)

Science Benefits

"We have learned to live better with science and without it that would have been impossible."

"Know more about us and everything that is around. Development in every area of knowledge that will prove beneficial in the present and in the future."

"Science has given us so much such as vaccines, longer lifespan and better health conditions. With this our lifestyle is way more comfortable and pleasant."

"Get to know a little bit better how the things had become and how they work."

How would the world look like without science?

Personal perspectives (representative answers)

- → *" Well, we would still exist but we couldn't have come to understand somethings that have lead us to progress in terms of civilization. The world would be a chaos of ignorance and everyone would be afraid of the unknown just like centuries and Millennium ago."*
- → *" I think it would be mess because, science is the answer for almost everything."*
- → *" The world would be in some disarray for sure. Also the thought of ignorance would be harmful to everyone."*
- → *" The world wouldn't be like we know it, we probably never would evolve."*
- → *" The world would be a chaos, honestly it's impossible to imagine our society without science as it plays an important role in our lives."*

Contextualising science in their community was the next step in which, the students contacted various companies, institutions and specialists trying to explore and expand their ideas. Arrangements like schedules, place to perform and materials were made with the specialists who accepted the challenge and were eager to cooperate with the students.

Heliograph

The biggest strength that facilitated students' crusade was the networking with eminent experts, specialists and professionals in the field of renewable energy resources of the veteran specialist engineer who imparted a comprehensive knowledge on the said topic.

The presence and dynamism of the Engineer José Carlos Magro was important in the development of the project. The students became aware of their surroundings by making field visits to understand the geographical and climatic situations of their island.

Student team's investigation on renewable energy sources, clockwise: Dr Vitor Prior (Portuguese Institute of Sea and Weather); wind generator; Rng. Carlos Magro (expert in renewable energies); a Solar Oven

KNOWLEDGE AND COMPETENCES ACQUISITION

After discussions and interviews with experts in the community, student teams decided to look at issues related to renewable energy sources in their local environment. For their immersive missions, student teams chose two activities to work on: learning about the usage of renewable energy sources and their practical applications and identifying which renewable energy solutions are suitable for their school grounds. The topics chosen aimed to tackle economic issues in their school as students noticed that their school outdoor and indoor spaces could be improved but there was a lack of budget for this.

IMMERSIVE MISSION 1: PRACTICAL USE OF RENEWABLE ENERGY AND ITS POSSIBLE APPLICATIONS IN SCHOOL

Under this immersive mission, the student teams were planning and building **a dryer of fruits and aromatic herbs that uses solar radiation.** Engineer Carlos Magro and Professor Damasceno (professor of technological education) were the experts assisting the students with their work and progress. In order to achieve their goal, the student teams collected the information and learned about the following topics:

- → the best angle of inclination in order to optimise solar radiation capture,
- → the best materials to use to build the device (within the possibilities of the school and the reuse of some materials), and
- → the operation of the entire structure.

Student teams working together with teachers and other experts in the construction of the device.

IMMERSIVE MISSION 2: RENEWABLE ENERGY SOLUTIONS FOR THE SCHOOL GROUND IN MADEIRA

This immersive mission was carried out in 3 phases. In the 1st Phase, students investigate the existing renewable energies. In the 2nd Phase the renewable energies that could be explored on the Madeira island and in particular in the school was selected. After the data collection in the 3rd Phase, the team will select one (or several) device(s) to install in the school using renewable energies, and in the final 4th Phase, students will set up the selected device at the school. During the 1st phase the students carried out an exploratory field trip to the local energy supplier. This exploratory field trip helped students:

- → to learn the different energy infrastructures of existing renewable energies
- → to know the importance of the courses of water-taken to the mini hydro power stations
- → to learn the importance of the hidden precipitation in the supply of the soils and consequently of the mini hydric ones
- → to recognize the importance of studying wind and radiation
- → to know the advantages and disadvantages of photovoltaic and wind systems
- → to familiarise with other small applications of solar energy (solar radiation) such as solar cookers (roasting sweet potatoes)

Student teams during their field trip to understand renewable energies

Completing this mission, the student teams came to the conclusion that of the two renewable sources of energy that have been successful on their island, Madeira, Portugal, namely wind energy and solar energy, only solar energy has the potential to be explored in their school. The geographical location of the school does not have sufficient wind values (speed and consistency) to justify the bet. On the other hand, the values collected, related with solar energy (radiation energy per unit of time and area in Funchal), justify its use. With this conclusion held by the school board, contacts are being made to install solar panels in the school.

DOCUMENTATION

Student teams made their OSS journey documentation mainly through pictures and videos that were used for the project's video contest.

Team's immersive missions focussed on identifying suitable renewable energy solutions that can be utilised in the schools thereby tackling the economic situation of the school due to high energy bills. The students noticed that their school's premises both outdoors and indoors, had spaces that could be utilised for the purpose, however, there is a lack of budget. In their quest of finding the suitable renewable energy solutions, the students explored the solar, wind and hydro energy with the help of field experts. This entire journey is depicted in their video, which they aimed to make it as entertaining as possible.

Video Competition winner – click any image to watch the video!

"We thought that we needed to tell our journey in OSS and so we did a video about our project in renewable energies. We thought a little more fun was essential to make it more interesting and captivating."

"We just thought of the situation going on in our school in Madeira and tried to recreate it in our video".

With the plot/ storyline of the video in hand, the students engaged themselves in the planning of the presentation. They worked as a team, brainstorming, discussing multiple ideas, listening to each other's opinions and perspectives, dividing the tasks equally among themselves and finalizing the sequence. Working as a team according to them, facilitated in easier, faster and smoother functioning of the video-making project, since they all were comfortable and co-operative with each other.

"We started with ideas, the order of them and then what little jokes to put between them. Everyone gave an opinion and helped building the video."

"We created some characters and divided playing roles. Again, everyone was involved in the brainstorming process."

"Working as a team made things a lot easier and quicker."

"…everyone was co-operative, and did their tasks just fine"

Any conflicts of interest and opinions were sorted out through deeper discussions. The initial footage for their video compilation was captured through both smartphone camera and a handheld camera and later edited and compiled using editing tools from IOS and Windows. They claim that some of them in their groups already knew how to work with the technology, however, when needed, their teachers helped them familiarize with the technology part of the video making.

"Some of us knew how to edit very well."

"We didn't need training because we had help from our teachers."

With regards to teachers' involvement in their work, the students are happy that they received all the help they needed from the teachers as and when it was required in different stages of the video-making process.

"Actually, a lot, they really helped us with the ideas, material and specially, editing the video"

The students did face a couple of challenges during the planning process, however, teamwork and collaboration among themselves made the process easy.

"Putting ideas together and bringing them to life was the hardest."

"The planning was the harder part, but I think that as we were working as a team, it got easier to do it."

Despite all the challenges, the students contend that they enjoyed the process of video-making and they wouldn't change anything about this experience.

> *"I wouldn't change anything about it because, for a first time doing this type of activity, I found it very fun and a good way to learn about the concept we are working."*

The student team's short video called "An Adventure in Renewable Energy" was shot in a creative way as a silent movie which captivated the audience's attention and resulted in winning the first place in the OSS Project Video Contest.

Click the image above to access the video or follow this link https://youtu.be/jHuxEXP8t88

Furthermore, the students also made a video of their experience during the Mobility in Poland, 2019 – click the image below to access it!

SHARING

To promote the OSS project in Madeira, a TV reportage was made in a Portuguese channel which can be found in the link below.
https://www.rtp.pt/madeira/sociedade/escola-goncalves-zarco-acolhe-projeto-europeu-na-area-das-ciencias_23464

Furthermore, the student teams participated in the celebration of **Erasmus Day 2019** at the school. The activity was attended by all Erasmus projects that are taking place in our school, as well as other guests. Among the guests were the Director of Youth Services, the Secretariat of Education of the Autonomous Region of Madeira and the Theater Group "Metaphor".

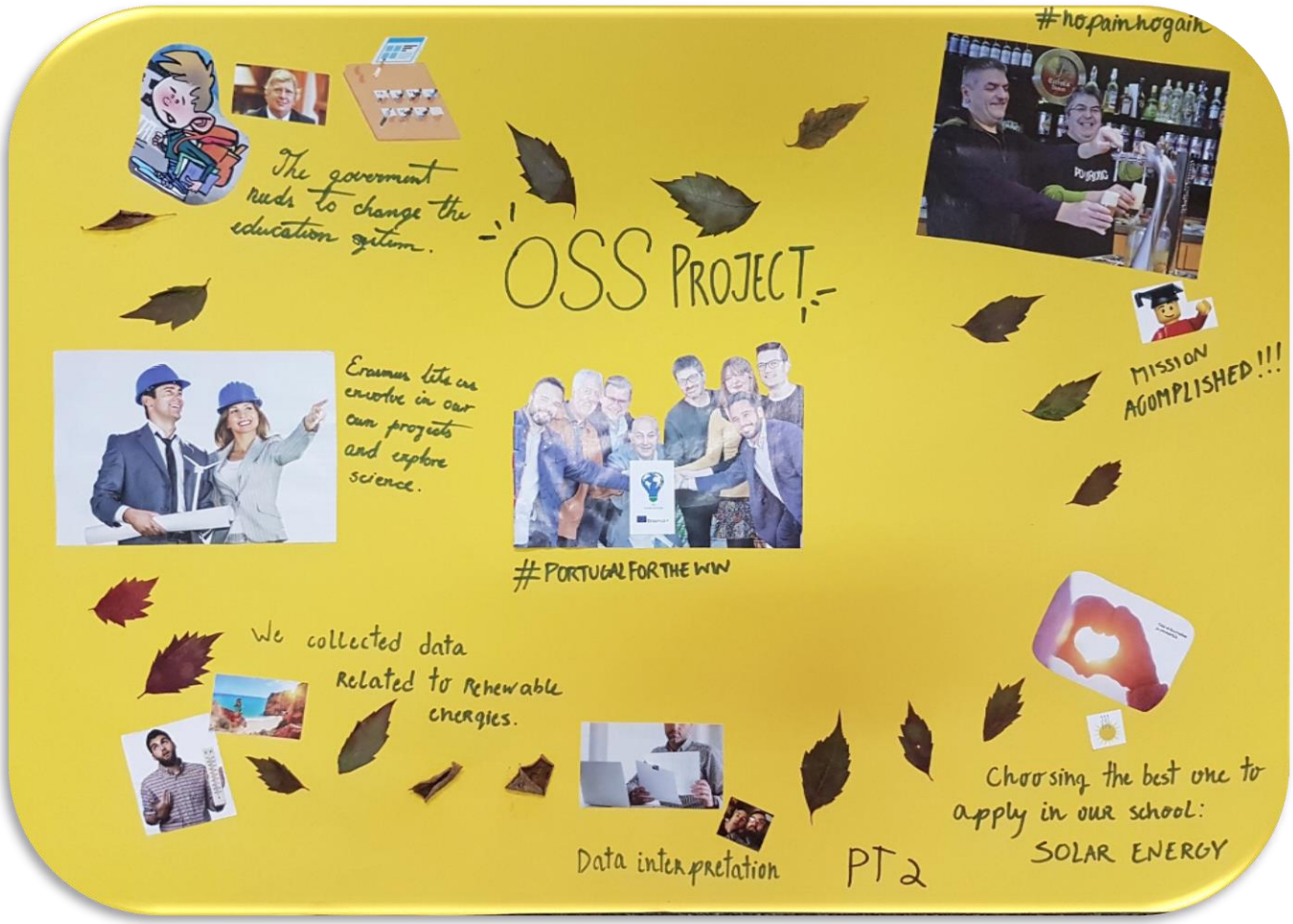
Student teams participating in the Erasmus Day 2019 event in Madeira

In addition, the student teams' activities were published in several local newspapers. Follow the images below to access the articles in Portuguese.

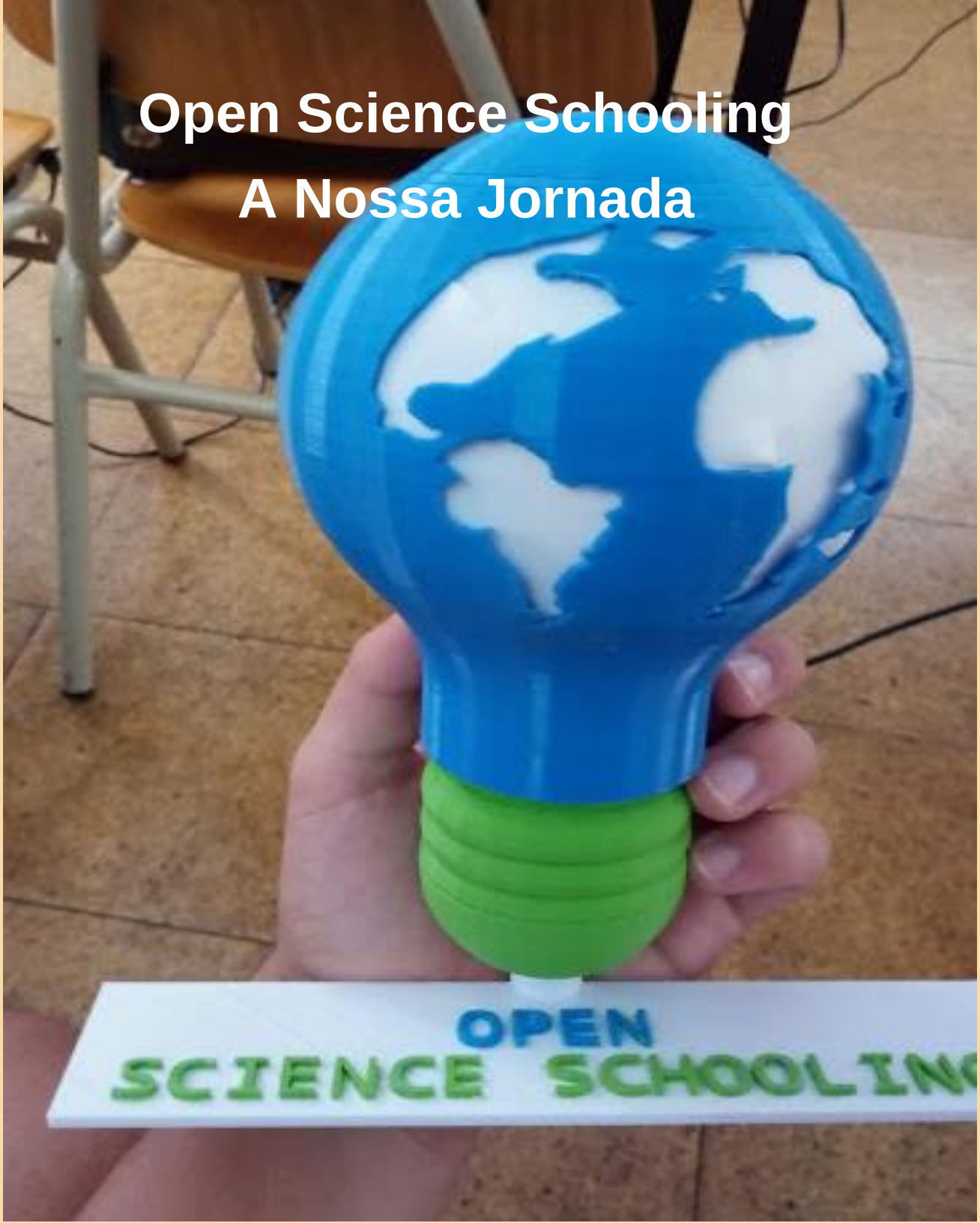
Newspaper's coverage of the school team activities – click on each image to access the article!

STUDENT TEAMS' VOICES – JOURNEY DESCRIPTION IN PORTUGUESE

Students' collage was prepared during the Mobility Event in Poland so that they can tell their stories through pictures as shown below: The student teams narration of their journey in their native language is given here.



Open Science Schooling
A Nossa Jornada



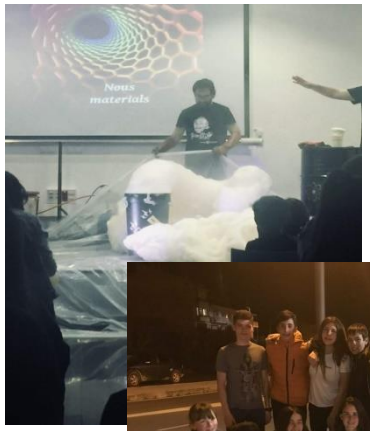
A nossa história no OSS

O Open Science Schooling é um projeto que foi proposto à turma 9º3 e 8º4. Na altura os alunos que faziam parte do projeto eram João Cunha, Francisco Pereira, Rodrigo Alves, Diego Alastre, Leonor Caires, Sofia Abreu, Letícia Carlota, Catarina e Carolina. Com o passar dos anos alguns dos membros saíram e novos entraram. Neste momento os membros envolvidos fazem todos parte da turma 11º1.

Este projeto tem uma iniciativa muito pertinente: "Tornar a Ciência mais interessante, através de uma aprendizagem mais aberta à experiência". Deste modo, nós temos a oportunidade de aprender com o auxílio de pessoas diretamente ligadas ao tópico que pretendemos estudar. Logicamente, este projeto visa uma aprendizagem fora da escola e que permite compreender que a ciência está em todo o lado.

O tema do projeto que foi escolhido foram as Energias Renováveis. De várias possíveis escolhas optámos por esta, pois é bastante atual e que faz todo o sentido discutir dado o enquadramento geográfico e climatérico da Escola. Assim através de visitas e recolha de dados tentámos chegar a um consenso visando encontrar a melhor e mais eficiente energia que possa ser aplicada na escola.

Realizámos várias visitas de estudo para recolher dados e falar sobre o assunto das Energias Renováveis com especialistas que trabalham nessa área e fazem investigação. Com isto ficámos a perceber melhor sobre as várias opções que tínhamos. Tivemos que organizar a informação e apresentá-la, posteriormente, aos professores, chegando assim a uma conclusão acerca da melhor energia a ser aplicada na Escola. Era claramente a Energia Solar. Para aproveitá-la construímos um secador de frutos e ervas que utiliza radiação solar para desidratar plantas e frutos.



A primeira mobilidade que ocorreu foi à Catalunha, Espanha. Os espanhóis foram bastante acolhedores desde o início proporcionado um ambiente confortável entre todos. Houve um grande equilíbrio entre o trabalho a ser feito e tempo livre. Os Workshops na Universidade de Engenharia envolvendo Informática e Ciências Laboratoriais foram extremamente interessantes. O espectáculo da Ciência Divertida relacionado com a Química foi também divertido. A Gastronomia foi também um aspeto positivo da viagem.

A segunda mobilidade realizou-se na Madeira, Portugal. Recebemos alunos em nossas casas e foi uma experiencia única. Não só tivemos a oportunidade de interagir mais com os colegas, mas também aprendemos muito sobre outras culturas e demos a conhecer um pouco da nossa. O facto de estar a receber pessoas no nosso país é uma experiencia muito diferente de ir para outro sitio e ser recebido. Ver as várias reações das outras pessoas ao ver as paisagens e as marcas da nossa cultura, faz-nos pensar nos diversos aspetos únicos que uma cultura tem e muitas vezes nem reparamos.

A terceira mobilidade do projeto foi a Lukow, Polónia. Começámos a interagir com os outros colegas logo no primeiro dia e fizemos muitos amigos. As atividades de "quebra-gelo" permitem uma socialização muito mais rápida e foram muito úteis nesta mobilidade. Nos workshops estávamos a debater vários tópicos e gostámos muito de ouvir os que os nossos colegas tinham para mostrar. Estava tudo muito organizado e a mobilidade correu muito bem. Foi indubitavelmente uma experiência única e vamos sempre recordar os vários momentos.

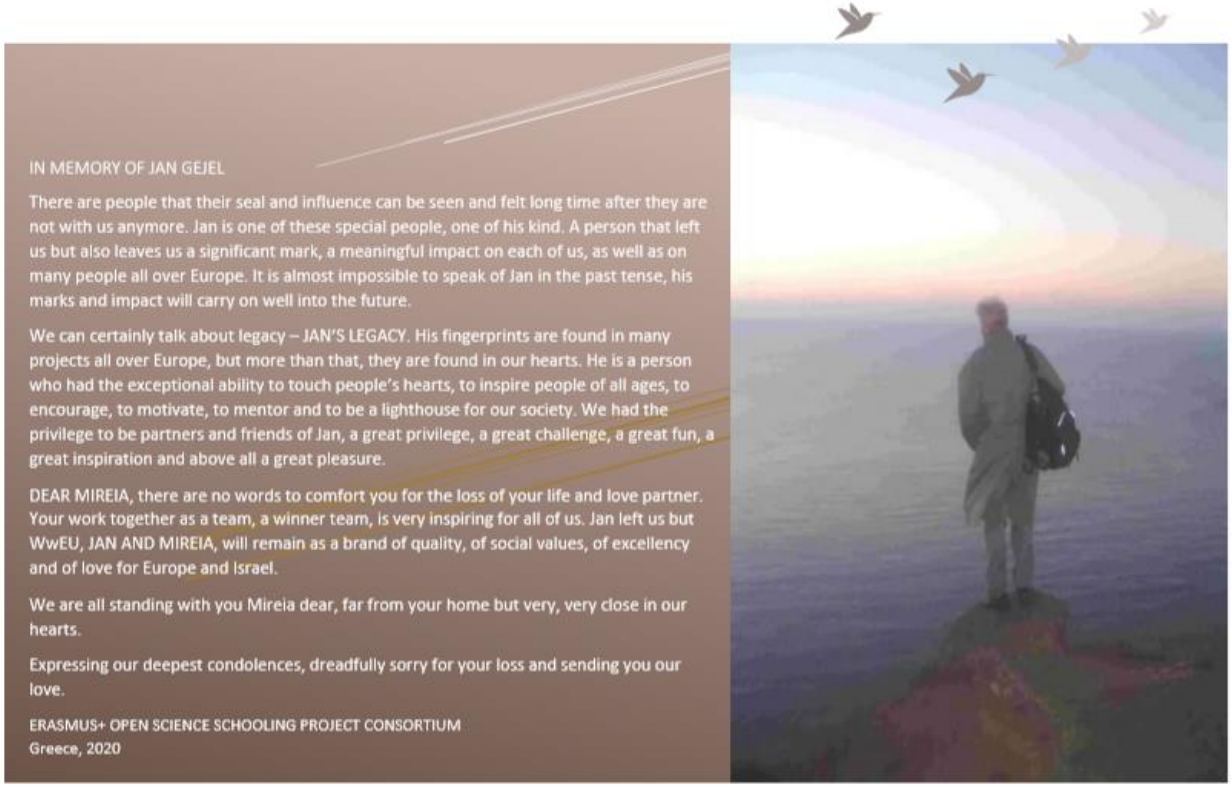
Na mobilidade à Grécia houve um Workshop na sala de robótica, que foi uma experiência muito interessante. Ainda que não tivéssemos trabalhado muito, nós compreendemos muito bem os conceitos de robótica e começámos a ter uma noção de como se programa o robot. Explicaram tudo de forma muito clara e simples, por isso é que foi mais fácil entender como um robot funciona. No entanto, foi complicado começar o trabalho dado que começar um trabalho (que não estamos habituados a fazer) sempre foi um obstáculo para todos. Open Science Schooling ensina-nos a iniciar trabalhos, ou seja, ensina-nos a ter mais iniciativa e é bom saber que este projeto faz a diferença, nesse sentido, na vida de cada um.

Para aqueles que pretendem implementar um novo projeto pelo OSS, recomendamos que tenham uma mente aberta e estejam ou pelo menos tentem estar preparados para novos desafios e obstáculos. É preciso haver motivação e empenho por parte dos membros para estarem prontos a trabalhar e lidar com algumas dificuldades ao longo do projeto. Acima de tudo, uma certa paixão pela Ciência é necessária.

Em conclusão, este projeto foi importante não só a nível do aumento do nosso conhecimento científico mas também a nível cultural. Nós exploramos o nosso conhecimento científico através da pesquisa feita para a execução do trabalho com o fim de o apresentar nas mobilidades e, o cultural através da nossa interação com os parceiros dos diversos países que possuem diferentes tradições e estilos de vida o que nos facilitou a compreensão de culturas que divergem da nossa. Com esta experiência única, retiramos que existe muito mais do que aquilo que sabemos e conhecemos e devemos procurar sempre aumentar os nossos conhecimentos. Podemos dizer que crescemos como pessoas e a nossa visão acerca do mundo e da sociedade mudou.

GOOD OSS PRACTICE!!!

Ao Jan alguém inspirador…



OPEN SCIENCE SCHOOLING
STUDENTS' JOURNEY

SCHOOL TEAM CATALUNYA SPAIN

PERE FONTDEVILA SECONDARY SCHOOL

SPAIN

PERE FONTDEVILA SECONDARY SCHOOL, CATALUNYA, SPAIN, is located in Gironella, a village of 5000 inhabitants near the Llobregat River, 100 km from Barcelona. The school has about 300 students, from 12 to 18, so, they start after Primary school and leave just before University. Our students follow the traditional teaching method and also work on projects, so, we combine different teaching methodologies and try different new activities.

The school team consisted of 4-5 teachers. The number of students involved in the project varied along the period 2017-2019. All the students of 3rd level ESO worked on the project by trying to find and see Science in the nearby surroundings. For the school year 2018-19 the students were working in groups on a main chosen topic, *the forest*, from different scientific points of view: technological, environmental, etc., one hour a week within the school timetable. At the end of the school year, they presented their work.

Student teams at Pere Fontdevila

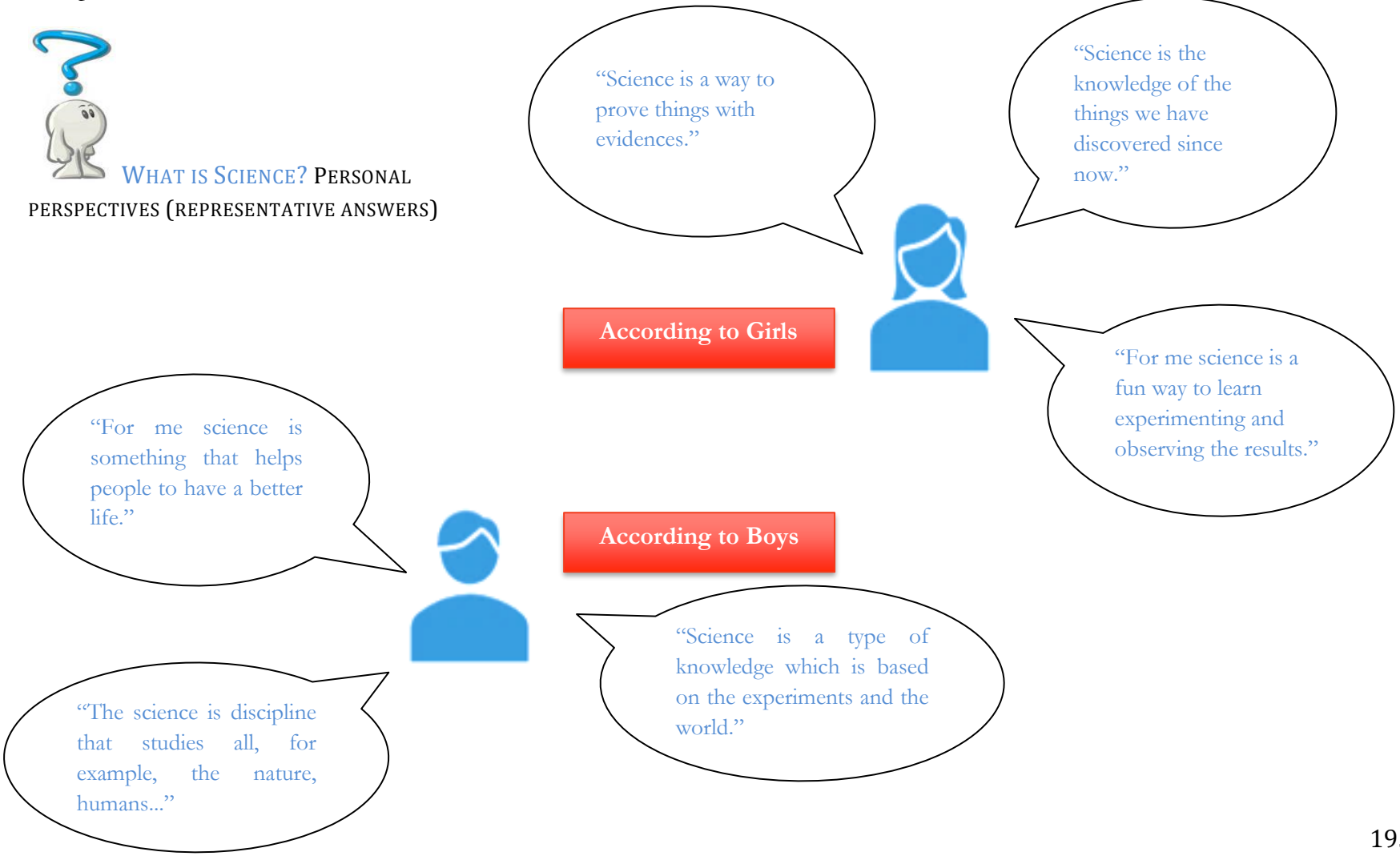
Problem Identification and Contextualisation

Understanding science was the beginning of the journey for the student teams. In this regard, to understand what science is and where science can be found, students made several video clips to demonstrate science around them. They visited various working sites, factories, shops, etc. The videos can be found in the following link

https://openscienceschooling.eu/spain/open-science-schooling-in-gironella/

The student teams investigated the question *Science, Where Are You?* The students visited around 20 different business and industries in the area nearby: Cheesemakers, the Pharmacy, the watch maker, textile industries, a carpenter, a forest area (to learn about the management), a farm, etc., where they could observe, ask and sometimes participate in the local enterprises' activities. From these activities, posters were made summarising all the knowledge that the business shared with the students, with the main goal of realising where science was. Students were organised in different teams; each team was in charge of preparing a video and a PowerPoint presentation on one of the visited enterprises.

WHAT IS SCIENCE? PERSONAL PERSPECTIVES (REPRESENTATIVE ANSWERS)



WHERE CAN WE FIND SCIENCE?

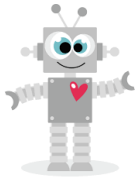
PERSONAL PERSPECTIVES (REPRESENTATIVE ANSWERS)

"We can find science everywhere, everything it's made of science, and a lot of things can only be explained with science."

" Science is everywhere although we can't see it easily."

"We find science in the most part of our environment even in places that we do not relate to."

" Science is everywhere so you can find it everywhere you look."



WHAT IS SCIENCE IN THE PAST AND WHAT IS IT NOW?

PERSONAL PERSPECTIVES (REPRESENTATIVE ANSWERS)

"In my opinion, in the past science was much simpler, without so many complications but it was also functional. Now, science is more complex but in both times it has been fundamental."

"The same thing but now is more developed."

"Firstly, I believe that science has improved a lot. I think so because some years ago the scientists were studying some things (natural phenomena or how technology could improve) and actually, those things which scientists were studying are used every day by us. So, maybe in the past technology was more difficult than now, because now we have more tools to use and investigate than several years ago.

"In the past, science wasn't so developed as it is nowadays, people used to do experiments without any kind of protection, nowadays we know a lot of risks we are exposed to and scientists can protect themselves and try not to be injured doing experiments."

"In the past, science was something that only people with money could use. Nowadays, science is being shared everywhere, so everyone can learn science."

"Science has always been a means of research and the answer to many of the biggest questions."

"Science in the past was simple and everyone believed that science did not explain much, people believed in God but now it's very different and all has a logic scientific answer."

WHY IS SCIENCE IMPORTANT? PERSONAL PERSPECTIVES (REPRESENTATIVE ANSWERS)

"Science is very important for us because we totally depend on it."

"It is important to investigate about all things that happen in the present and things that happened in the past."

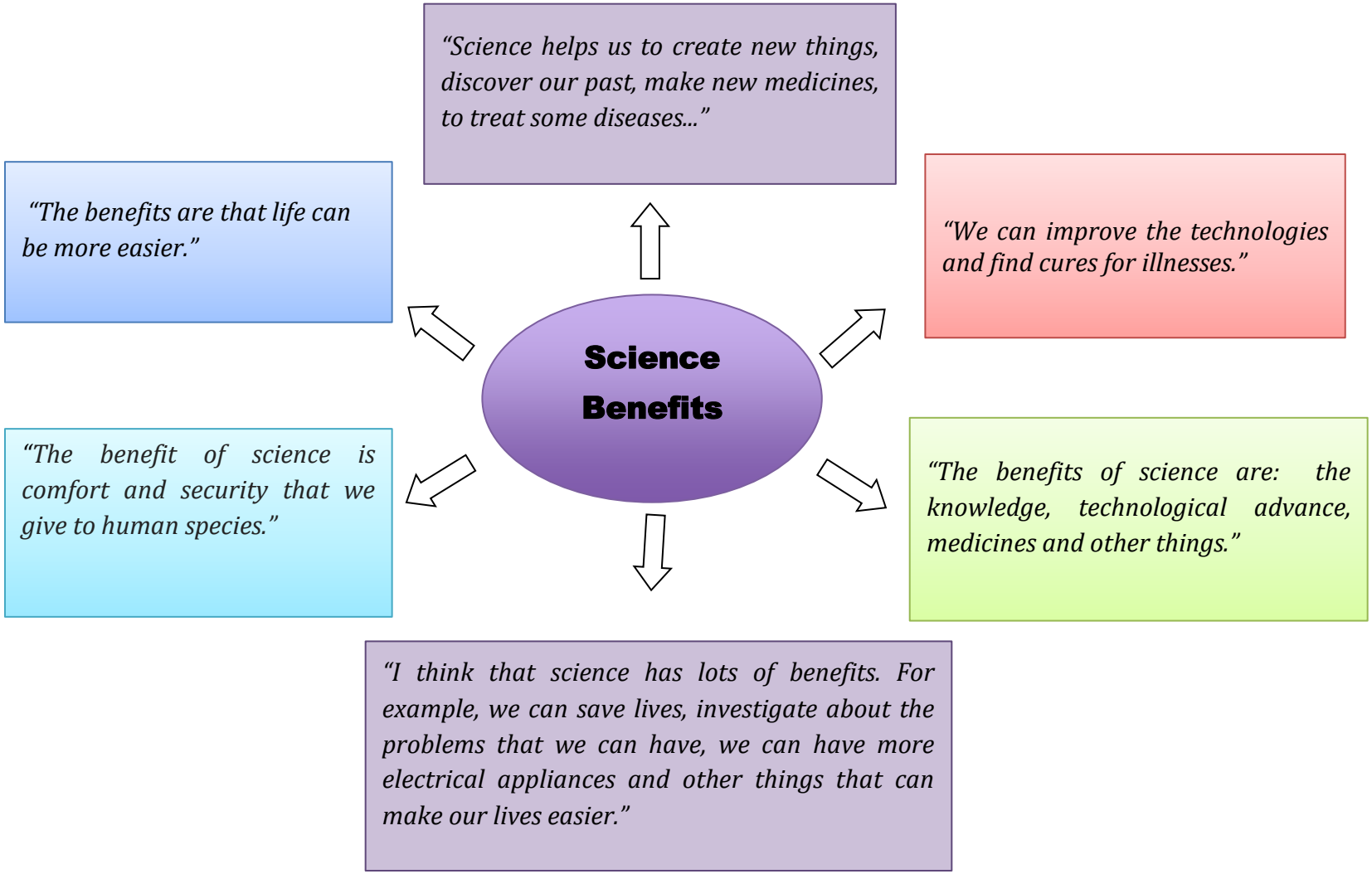
"Science is very important because it helps us to understand the humanity and what surrounds us."

"For me, science is very important because many of the things that I do and that I use in my day to day, science have an important role."

"I am sure that science is very important because it helps us to understand what is surrounding us. Another reason why I that science is important; without it, there would not be medicines, and nowadays medicines are very important for us."

"Science is very important because it studies the health and the problems that we can have for example. Thanks to this we can know about the illnesses and solve some of our problems."

WHAT ARE THE BENEFITS OF SCIENCE? PERSONAL PERSPECTIVES (REPRESENTATIVE ANSWERS)



How would the world look like without science?

Personal perspectives (representative answers)

- → *" We probably wouldn't live for so many years, we couldn't survive a simple cold, and we wouldn't know too many things about humans, and where we come from. Also, we wouldn't have technologies like computers, phones..."*
- → *" A world without science would be all forest and it wouldn't be any type of house or construction."*
- → *" A world without science would be a disaster basically. We wouldn't have anything that we have in our daily lives."*
- → *"I believe that the world without science would not exist since everything starts from it."*
- → *" I believe that the world without science would look as it was at its beginning (it would not be light and electricity, and technology would not be invented yet)."*
- → *" The world without science it would be impossible, because without medicines, vaccines, electricity, technology,... We couldn't survive."*
- → *" I cannot imagine a world without science because we would still be living in the middle ages."*
- → *" It's difficult to imagine."*
- → *" I can't imagine this. Human beings need science for human evolution."*
- → *" The world without science would be like the animal world, guided by instincts and unable to have fore-life privileges of chance"*
- → *" I think, many people would die because of the diseases and we wouldn't have much technology..."*
- → *" The world without science would be difficult because we are used to living in under some circumstances and without science we couldn't have many things we have now, as for example electric appliances, medicines,..."*
- → *" I think that if we didn't have science, we wouldn't have all the technology, medicines and everything that we have nowadays."*
- → *" It would be pointless."*

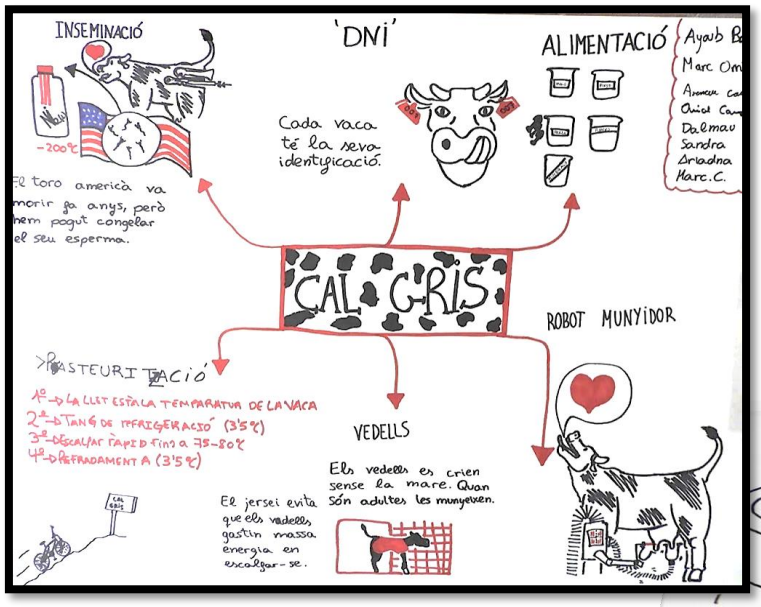
Contextualising Science in their community as the next step of students' OSS journey encouraged students to network and try to get in touch with several enterprises of the local zone, local politicians and administration of the government, and several research centres of Catalonia. Winning the logo contest gave students extra motivation to continue the project.

Several activities were implemented at the local level include:

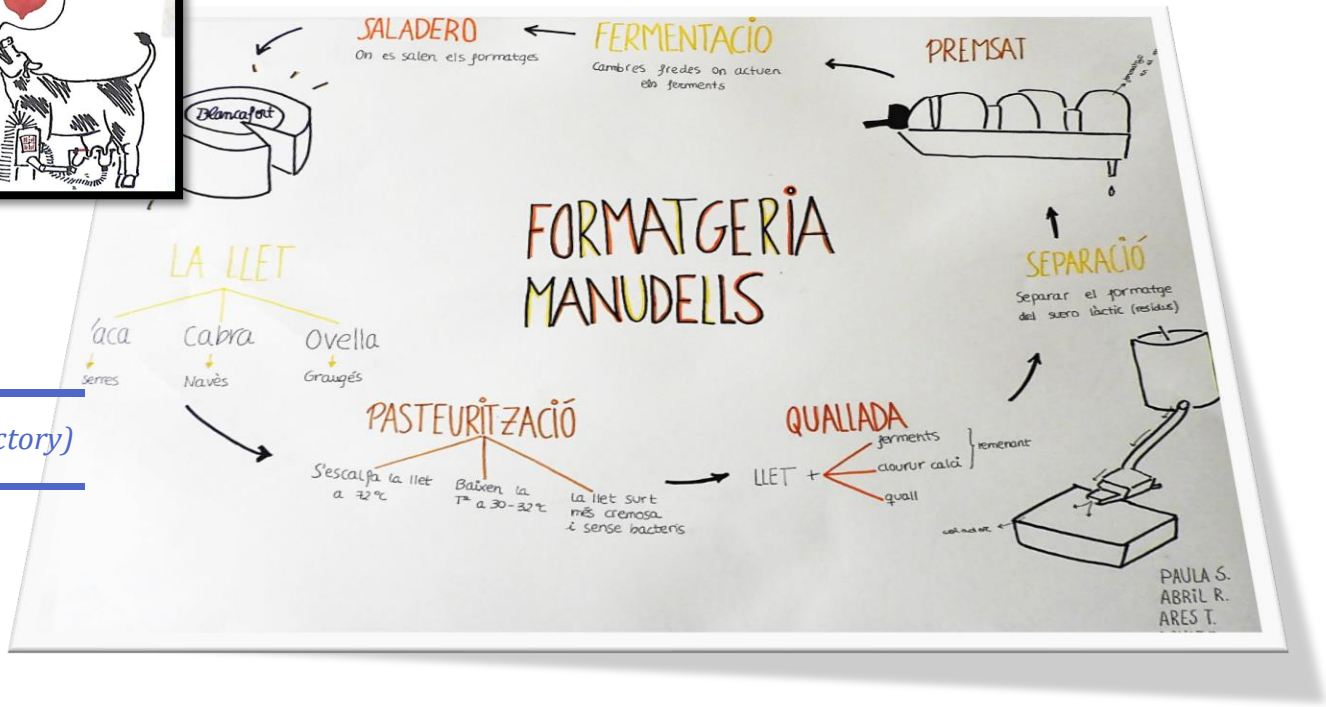
→ Presentation of the project to the students
→ presentation of the project to the families and different stakeholders (enterprises, Politicians and administrative sectors)
→ Preparation of the Manual to make the videos
→ organizing Knowledge Fair 2018
→ Participation to the project SAVEnergy
→ PM in Catalonia (May 2018)
→ Workshop on how to make a video, during the mobility to Catalonia
→ Workshops on Chemistry and robots during the PM in Catalonia
→ Workshop STEAM of the Government (July 2018)
→ Presentation of a paper in HSCI 2018 Congress (July 2018)
→ Design of a LOGO. Our school won the contest, and this encouraged students.
→ Getting in touch with the neighbouring reality:
→ Politicians and administrative sectors
→ Presentation of the project in class
→ Presentation of the project to the families
→ Participation in Science Week in the UPC (seminar)
→ Stall in the Knowledge Fair 2018, explaining the project OSS and presenting experiments
→ Project SAVEnergy: Saving energy at home
→ Workshop on how to make a video, during the mobility to Catalonia
→ Workshops on Chemistry and robots during the PM in Catalonia

→ Activities for a whole week consisting in visiting different enterprises and some organizations of the area near the school where students could find science, as well as workshops on different areas where science is also present (on Photography, the science of colours and art, Series of Fibonacci).

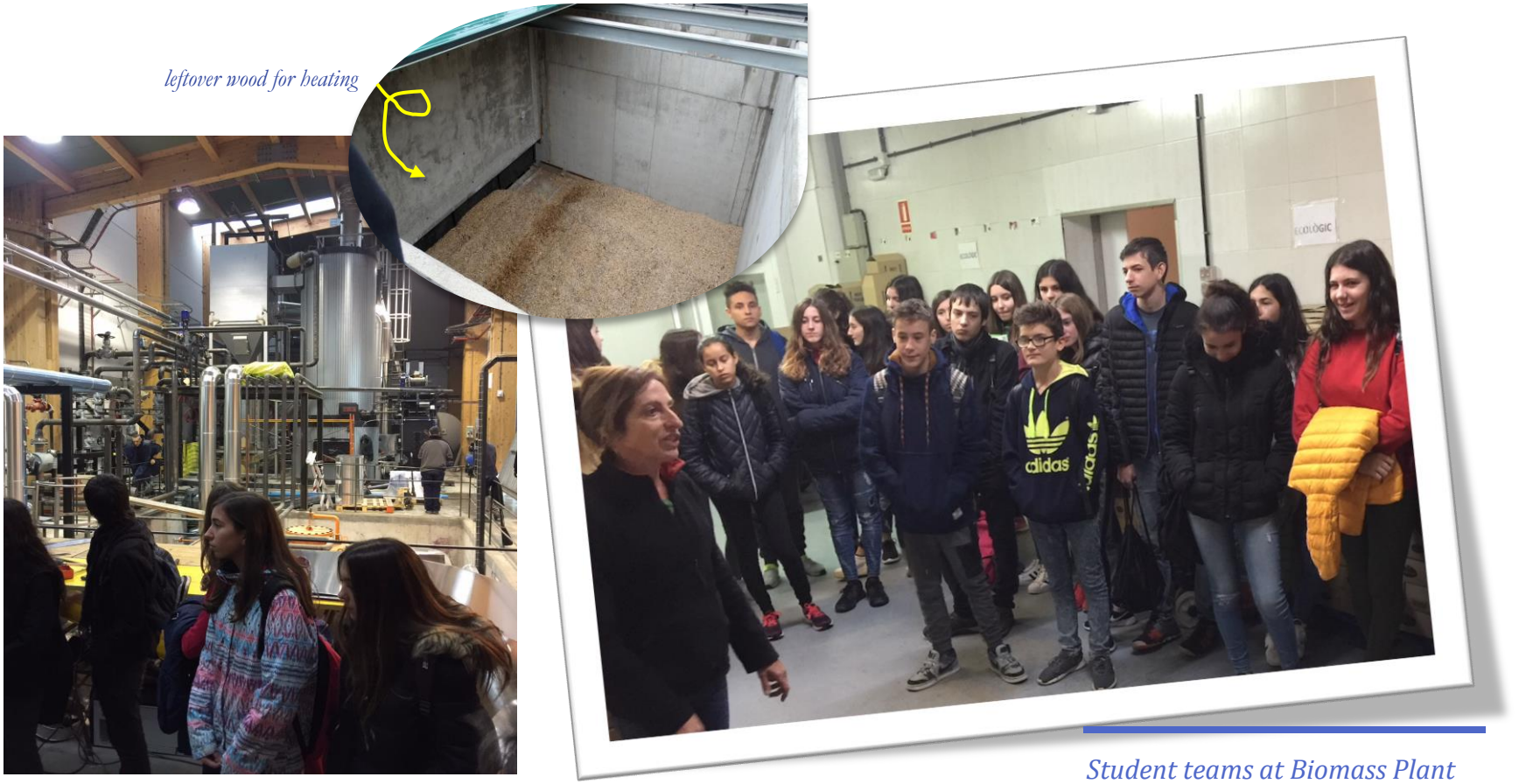
Student teams during a communal activity at Knowledge Fair 2018



"Cheesemakers rely as much on measurements of pH levels and inoculations of specific moulds as they do their own senses of sight, touch, and smell. The cheese-making process follows these steps: acidification, coagulation, separating curds and whey, salting, shaping, and ripening."



Student teams' posters (cheesemakers factory)



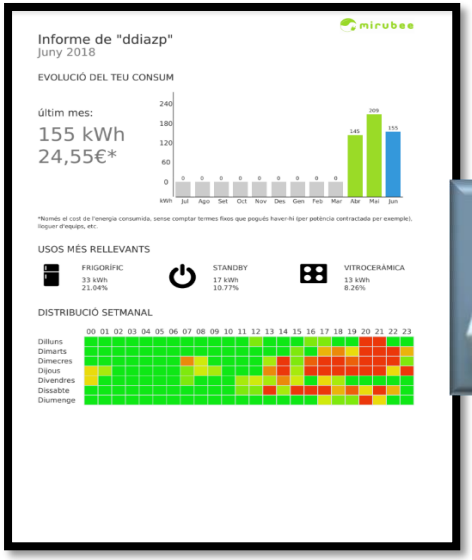
Student teams at Biomass Plant

Catalonia has a big forest surface and Berguedà, the local area where the school is situated, is one the main ones. For this reason, there is now a Biomass plant in Berga which the students went to visit. During the visit, students learnt how this plant deals with the forest management. The main objective of the plant is to get good profit from both the good quality wood that goes to the sawmills and from the less quality wood that is later used to heat local buildings. ***This means that wood that was before only waste, is now used to provide energy to local community for the whole year!***

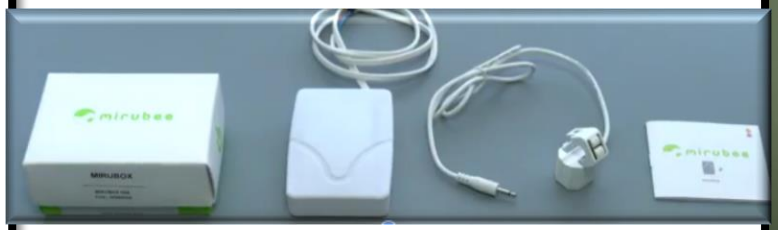
KNOWLEDGE AND COMPETENCES ACQUISITION

IMMERSIVE MISSION: MIRUBEE – UNDERSTANDING DAILY ENERGY CONSUMPTION

After having been involved in the above-mentioned activities, the students concluded that they should **use science to make the world more sustainable.** They understood that they need to be careful about their use of energy and get involved and act, become part of the solution. They decided that only if they are aware of our daily steps, they can understand the importance of their actions. Therefore, some students and their families became volunteers to test a **Mirubee**, which gave them information about their use of energy. This was an interdisciplinary project of Science and Technology to work on energy and its exploitation. The main goal was to make students aware of the importance of using energy in a responsible and sustainable way, so, to become aware of their consumption and how to act so as to save energy. How can this be done? For this mission, students' received assistance from experts at the local Polytechnical University of Catalunya (UPC). Each participating student received a Mirubee appliance lent by UPC to install and use at home for some days. The Mirubee was connected to the general electrical panel and the family could see the real time consumption of energy through a mobile phone application. The results were compared and there was a winner, the family who had spent less energy in their daily life.



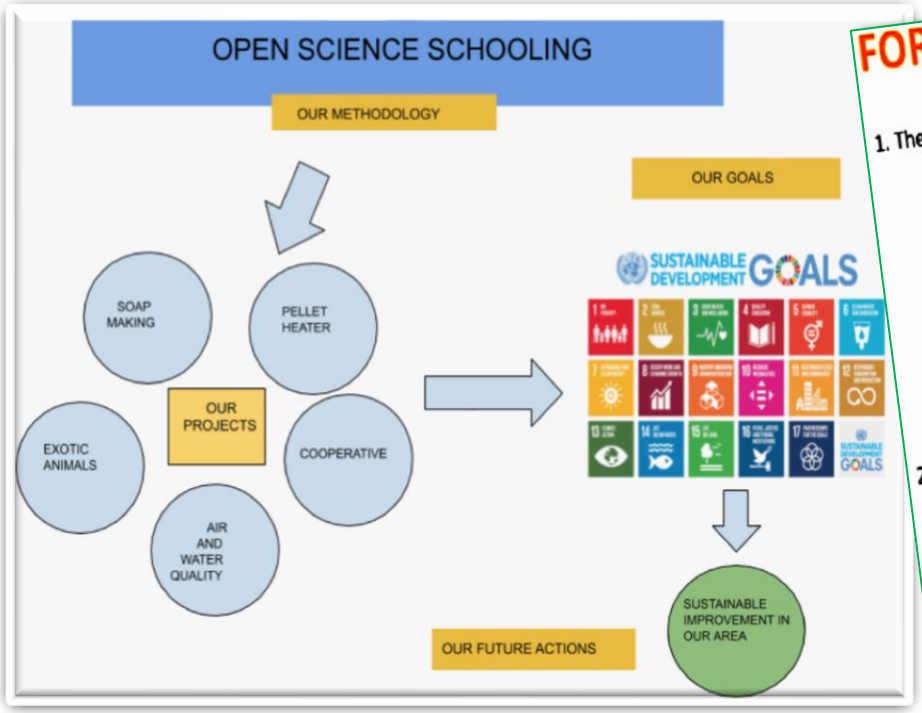
Energy consumption awareness using Mirubee

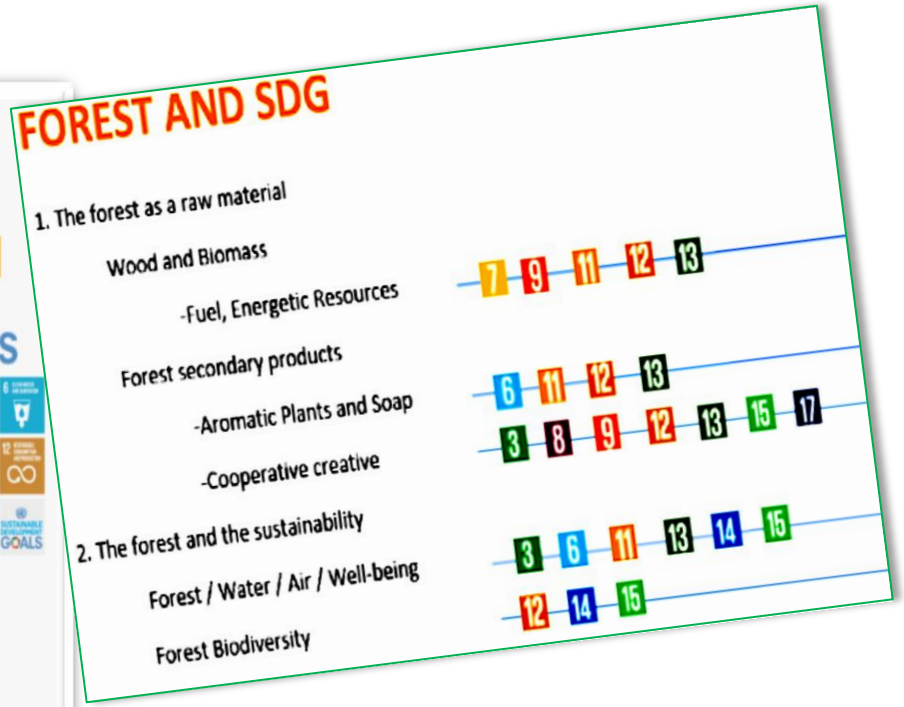


More information: https://sites.google.com/iesperefontdevila.cat/erasmus-oss/activities-2017-18/mirubee

IMMERSIVE MISSION: THE FOREST

Since the students live in the pre-Pyrenees, nature is nearby and the usual activities for the people around are usually related to the natural environment: hiking, fishing, skiing, mushrooms picking, among many other outdoor activities. Since wood is taken out of the forest, many of the chemical products in a pharmacy come from nature, from plants (such as essential oils), we need the forest for animals to grow, and science has developed technology so that humans can obtain the most profit out of this. Because nature is necessary for our health, we need to care about the quality of air and water for the people's and the planet's sustainable future. These missions, therefore, were based on *The Forest* and how the students could make the world more sustainable, with the goal to interact with some of the Sustainable Development Goals of the 2030 Agenda.





Approach to learn about the forest benefits

Task I – Isolation of Essences from Local Plants for Cosmetics Elaboration: Distillation of Essential Oils

The student teams extracted sweet-smelling essential oils from ***Rosmarinus officinalis***, so as to add this perfume to the final soap. We learnt how to do this process in a UPC workshop. The students followed the steps bellow:

1) searching natural materials and home-made recipes to extract natural essences from selected plants

2) building a microscale heater by using copper metal foil, mineral wool and other components

3) extracting the essential oil using steam distillation with microscale heater

4) checking the chemical properties of the distilled product to make sure this was real Rosemary essential oil

5) Elaboration of cosmetics

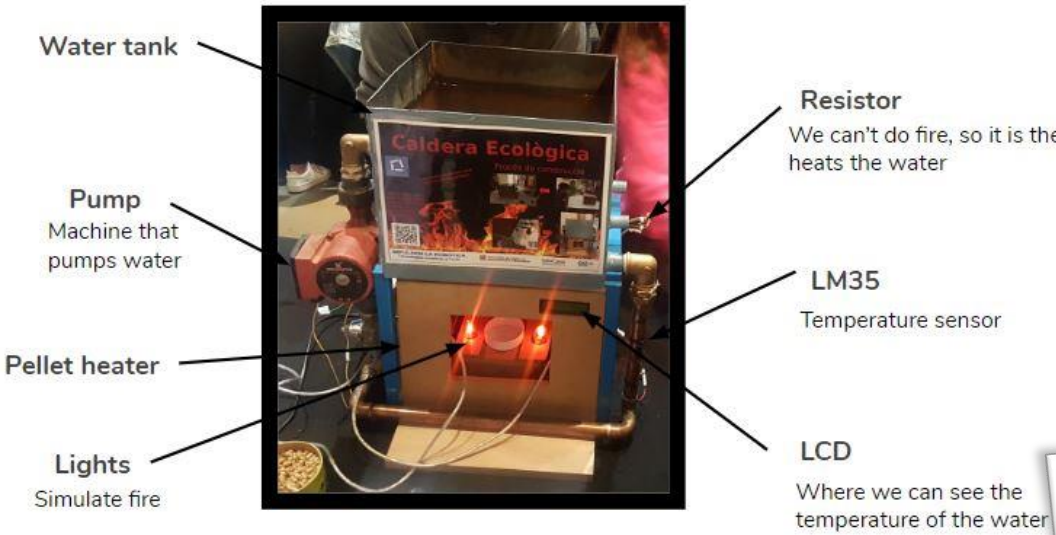
Team mission – The Forest: 5 steps to essential oils

More pics and vids: https://sites.google.com/iesperefontdevila.cat/erasmus-oss/projects-missions/aromatic-plants-and-soap#h.p_O2ZJ_6eKYca0

Microdistillation presentation

https://docs.google.com/presentation/d/1GydKg3I4E4_gNw1PBHOXO2AdHKGQ59aQktDGTwlaHow/edit#slide=id.1-VKeS8BtSrZPMFIjJJdkKppLsatmA5IO

Task 2 - Construction of a Pellet Heater



One of the student teams worked on building the heater with the following features:

- ✓ Made of wood
- ✓ LEDs that simulate fire
- ✓ Automatic entrance of pellet
- ✓ Regulation of air entrance by a fan
- ✓ System controlled by Arduino

Contribution of this work to improve sustainability:

→ Learning from more sustainable technologies (e.g. reduction of greenhouse gas emissions).

→ Learning from the relationship between technology and climate change.

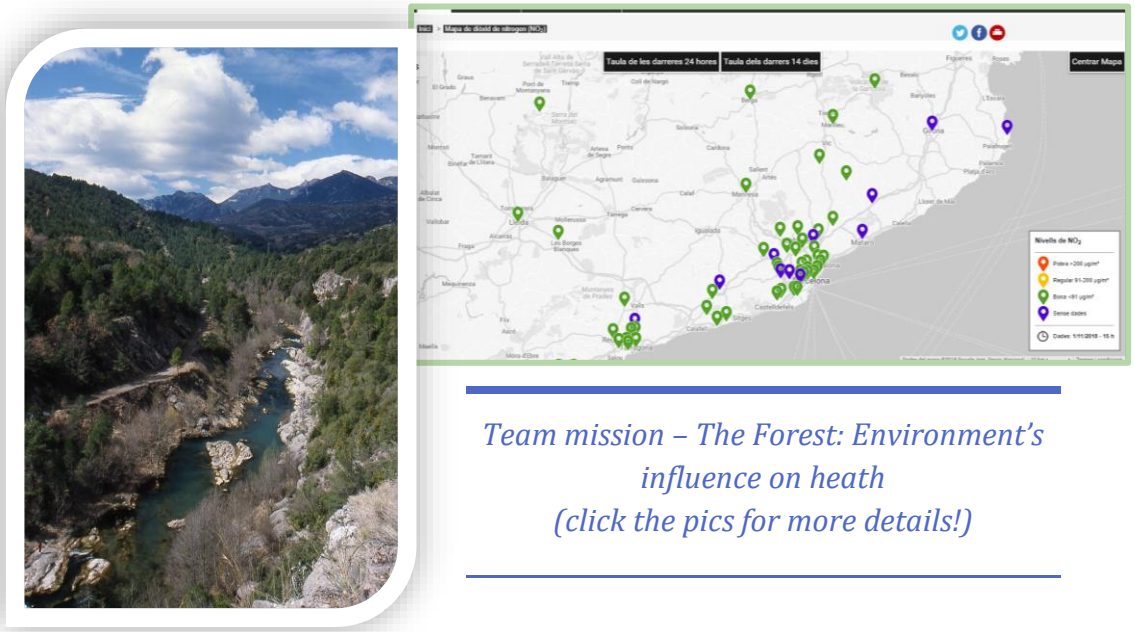
→ Learning from the use on local natural resources for energy production.

Team mission – The Forest: Pellet heater
(click the pic for more details!)

Task 3 - Comparison of Environment and Health in a Small Village (Gironella), a Medium size city (Manresa) and a Big size city (Barcelona)

The students went on fieldwork to check water quality of Llobregat river and in local springs in Gironella. They also compared air quality through time using a local web application (accessible here http://www.gencat.cat/mediamb/qaire/mapes_qualitat_aire_catalunya/mapesqualitatairecatalunya.html)

Furthermore, the student team acquired data on respiratory diseases related to air pollution from city records and made a comparative study of the impact of air allergenics on health as well as the impact of landscape quality on health.



Team mission – The Forest: Environment's influence on heath
(click the pics for more details!)

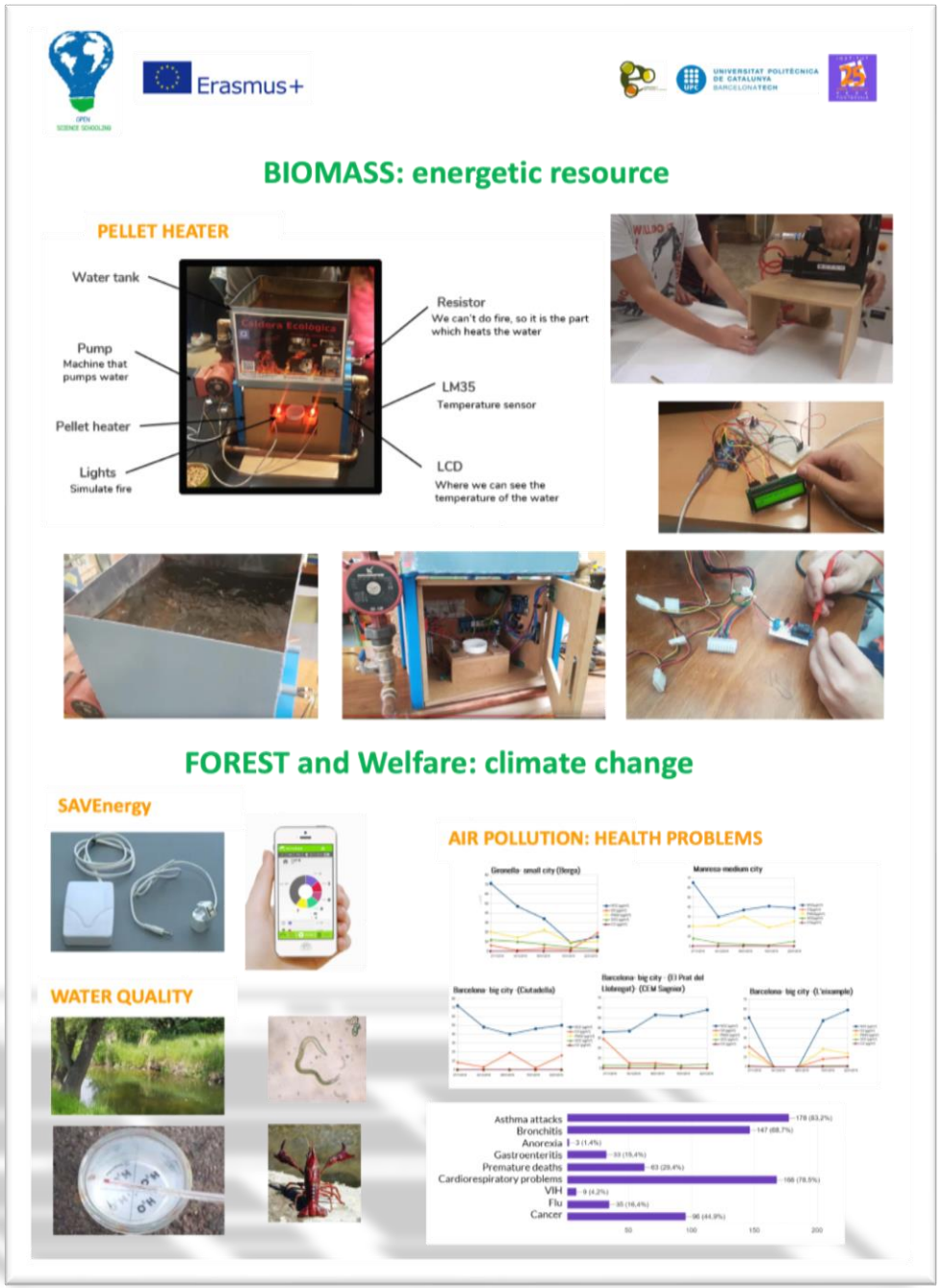
Contribution of this work to improve sustainability

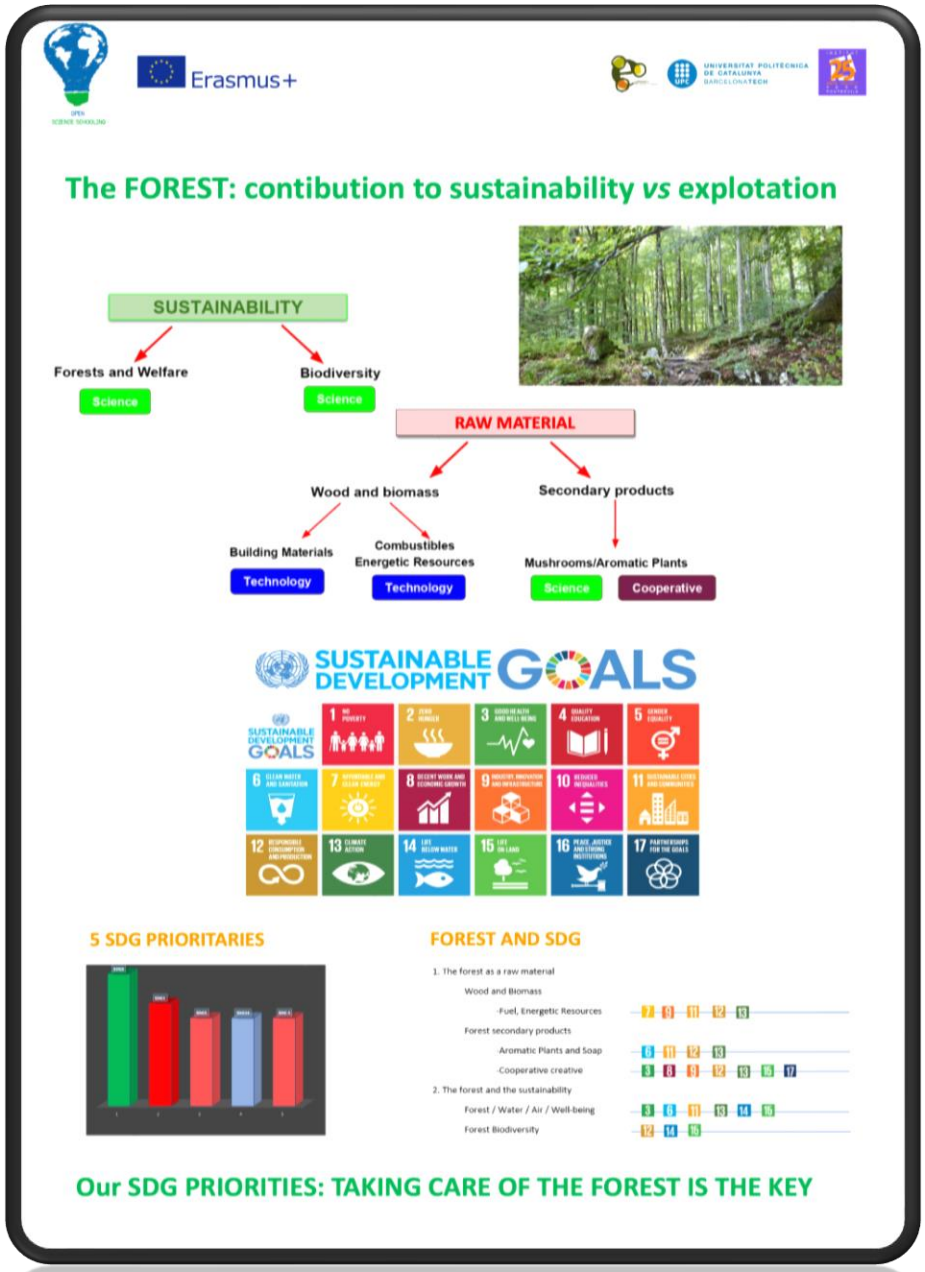
✓ Learning from the impact of polluting substances in water and air quality and health.

✓ Learning from the forests as reservoirs of medicinal and food resources that can contribute to improve health quality.

✓ Becoming aware of the need of forest conservation in order to avoid loss of medicinal and food resources.

Team mission – The Forest
(click the image for more details!)





Team mission – The Forest and its exploitation to improve sustainability

DOCUMENTATION

The student teams relied on video production to document their leaning journey. **Out of three movies made by the students, the video about air and water pollution got the third place in the movie contest.** The student teams' immersive mission comprised three tasks with one common goal, **having more sustainable forests**. "The forest: exploitation and contribution to the sustainability" focused on identifying the key issue in the community to work around the natural resources of the forest to boost Sustainable Development Goals. The use of the forest as raw material and contribution from the forest to the sustainability are the central theme of structuring the activities. The student teams made three videos visualizing the process of their experiments related to forest sustainability and documenting their work.

- **Isolation of Essences from Local Plants: Cosmetics Elaboration**

This video shows the soap making process, where the students explain their experiment and how they did a micro-distillation of rosemary in the lab in order to extract oil essences.

Team task – making natural cosmetics (click the pic to watch the video!)

❖ **Pellet Heater**

In this video, the students show how they build a heater from scratch using wood as combustion. For this, they first visited a plumber and learnt welding, they visited a carpenter, they also had a visit to Biomass Central and UPC (Universitat Politècnica de Catalunya) to learn about the Arduino program and the automatization of the scale model with a university professor.

Team task – building the heater
(click the pic to watch the video!)

❖ **Environment and Health**

This video won the third place in the video contest. As forest was a common topic for all the tasks, the students wanted to study the quality of air and water in the environment nearby and to highlight the importance of having and living in a healthy environment.

Team task – Environment and health
(click the pic to watch the video!)

During the project documentation, the students found cooperation, respecting each other's opinions, and being organised crucial in their progress.

"We had a lot of ideas but we agreed on which ones to use. Then we put in common our ideas and each one of us explained a different project"

"We learned how to record videos with the Filmora Go app and to communicate with the teammates"

" We were organised so it was easy to work as a team"

"The planning process was very organized because all of us were very involved"

Due to individual's involvements in activities, planning process went smoothly and very organised. They used a mobile camera for recording and the only challenge they faced was to find a quiet and suitable place for recording their videos.

"There was a lot of noise so we had to change the recording place"

In most of the process, they did not need the help of the teachers except for editing their videos. The student teams stated that **video making process was really enjoyable and fun**, but they would have better outcomes if they had more time for creating their movies.

"Maybe we would have liked to have more time to have a better result. If we had been told earlier about the video, we would have collected more information and pictures for the final video"

SHARING

The student teams and teachers shared the results of the missions with the local community and family members through the school webpage and through participations in several events.

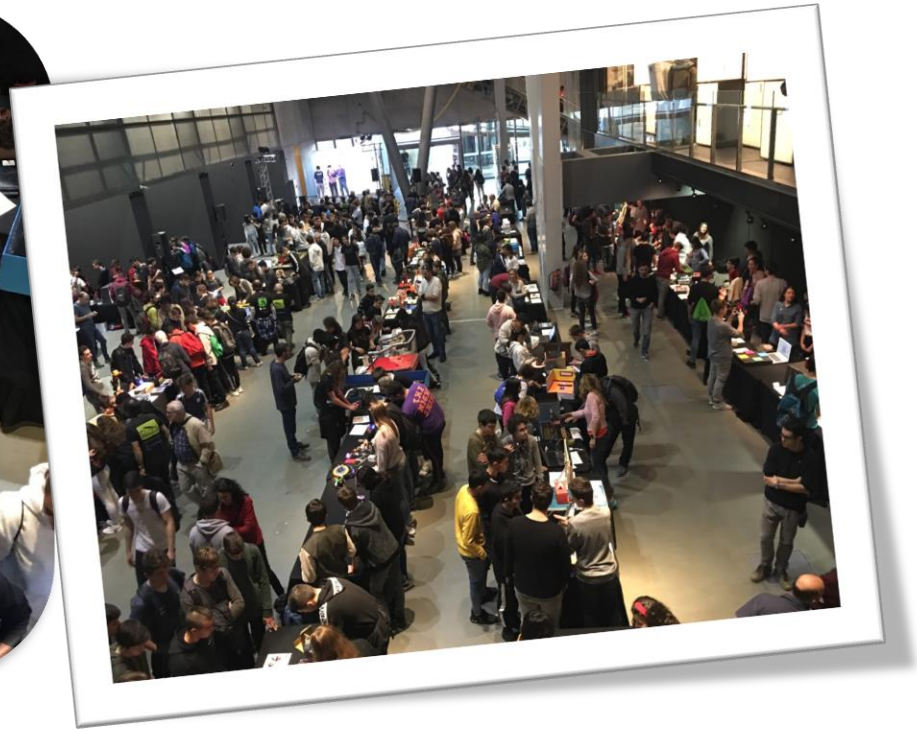
- **The Knowledge Fair, 2019 (Berga, Catalonia)**

The Knowledge Fair is a scientific fair held in Berga every year. It is organized by the Universitat Politècnica de Catalunya (UPC), Manresa Catalonia. The main objective of this fair is to motivate young people to get into scientific and technological vocations by showing them some research projects related to science and technology of the UPC and other research centers. This fair is especially designed for high school students. The Knowledge Fair of the school year 2018-19 was based on the OSS Erasmus Project and the topic was *The Forest and The Sustainable Development Goals*. The student teams showcased the missions results (immersive mission Mirubee and immersive mission The Forest) in this Fair and it was an extraordinary experience, with many visitors from different schools. The final products were also displayed in the primary schools to the young students at the end of the school year 2018-19.

Student teams sharing activities

- **Robotic Fair in Cosmocaixa, Barcelona**

The student teams went to the Technological Fair held in Barcelona, the Robotic Fair, part of the program Impulsem la Robòtica, Tecnologies Creatives a l'Aula (IRTCA2019). In this Fair, different projects made by students are presented, and students have all used Arduino to command the projects. This time, the student teams presented the Pellet Heater described before, controlled using Arduino.



Student teams at the Robotic Fair 2019
(click the pics for more details!)

- **Local Press**

The local press and local television informed about the Open Science School methodology and the work the student teams were doing on the different missions during this Erasmus+ Project. Furthermore, **the student teams participated in the project PETIT** (Education Project on Technology, Innovation and Work) and for the final presentation the teams displayed and presented in the Secondary School SES Serra de Noet in Berga the Pellet Heater monitored by Arduino.

BERGUEDÀ • SOCIETAT

Més de 800 estudiants s'acosten a la ciència a la Fira del Coneixement

L'institut Pere Fontdevila mostra el seu projecte relacionat amb el desenvolupament sostenible

Estudiants durant la visita a la Fira del Coneixement de Berga en un dels estands, ahir al matí

Student teams at the Robotic Fair 2019
(click the pics for more details!)

STUDENT TEAMS' VOICES – JOURNEY DESCRIPTION IN CATALAN

To explain the path taken during the OSS journey, students made a collage in the Mobility Event in Poland. Here is the narrative of each team regarding their OSS Journey as expressed through their collages

Història del projecte Open Science Schooling – FEM SABÓ *(homemade soap)*

A l'institut Pere Fontdevila, a 4t d'ESO, es fa una petita iniciació sobre com fer una bona recerca i un bon treball, ja que a batxillerat es fa el treball de recerca. Ens van informar sobre tot el que hauríem de fer durant aquell curs i vam començar tan aviat com vam poder. Primer de tot vam fer grups depenent dels nostres interessos, i l'àmbit de ciència va ser un dels que més ens vam centrar, ja que participavem en un projecte anomenat Open Science Schooling el qual el seu principal objectiu era saber que la ciència la podem trobar en qualsevol lloc i fer-nos adonar que és molt important en el nostre dia a dia.

Un cop fets els grups, vam començar fent una pluja d'idees sobre diferents temes per treballar. Al nostre grup no ens va costar gaire decidir-lo perquè des d'un bon principi ens va cridar molt l'atenció la investigació i la creació de sabons casolans els quals finalment també hi vam afegir olis essencials i en vam fer un estudi. Un cop feta la recerca de tota la informació necessària, vam passar a la part pràctica del nostre projecte: la creació del nostre propi sabó.

Primerament vàrem aprendre a fer una destil·lació d'oli de plantes aromàtiques:

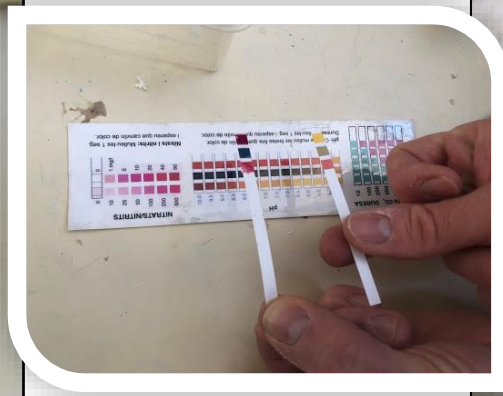
En el nostre institut disposem d'un laboratori on vam poder fer totes les proves i això ens va facilitar molt la feina ja que trobar un espai on realitzar els experiments és bastant difícil. La primera prova de fer sabó que vam realitzar va ser una mica desastre, vam seguir la recepta que havíem buscat prèviament per Internet però ens va sortir un resultat que no esperàvem, ens va quedar un espècie de "roc" que no s'assemblava per res al sabó.

Un cop vist això el següent dia que vam fer l'experiment vam utilitzar una altra recepta ja que vam pensar que el que havia fallat en el primer intent era això. En aquesta segona prova el resultat que vam obtenir era totalment diferent

al primer però tot i això tampoc era el que ens esperàvem ja que no va quedar una mescla sòlida sinó que es podia veure com l'oli estava al fons del pot. Això va fer que quedessim una mica decepcionades ja que pensavem que mai aconseguiriem el resultat que volíem però el professor que ens ajudava a fer el projecte ens va animar.

La tercera prova tampoc va ser la final, ja que ens va quedar com desfeta i no vam arribar mai a saber perquè. En aquest intent ja hi vam afegir el color

Al cap de 4 intent ens va sortir el sabó final, al anar fent variacions a la recepta al final ens va sortir el que desitjàvem. Tenia una textura sòlida, un color rosa i feia olor a romaní que va ser l'oli que vam destilar.



I vàrem comprovar si feia escuma com qualsevol sabó i així va ser. Aquí podeu veure una foto:

Amb tot aquest procés pràtic vam aprendre a no donar-nos per vençudes en els moments més difícils i a seguir intentant el que volíem.

El projecte Open Science Schooling ens ha ensenyat que la ciència és fundamental en la nostra vida i que nosaltres, en un futur, serem els que la farem evolucionar i tot dependrà d'ella.

Personalment ens ha semblat una gran experiència que hem après moltes coses i ens ha ensenyat que sempre et pots trobar en problemes, però has de buscar una forma per resoldre'ls.

En la nostra opinió, creiem que si es vol participar en un projecte com aquest que hem participat nosaltres, la principal cosa que s'ha de fer és un bon treball amb un resultat satisfactori. Has de ser constant i has d'estar interessat en el treball i la recerca i distribució d'informació és molt important ja que influeix en el seu resultat. La part més bona 'aquests projectes és que t'involucres molt en el món de la ciència i aprens a experimentar i a buscar informació d'una manera més extensa. Les estades en els diferents països són una bona manera per relacionar-te amb altra gent, descobrir nous llocs i sobretot una bona forma per practicar l'anglès, però el més important és que guanyes una gran experiència que sempre recordaràs.

Abril Rota
Ares Torra

La Qualitat De L'aigua I De L'aire A Gironella *(Air and Water Quality in Gironella)*

Quan a l'institut ens van dir que havíem de fer un projecte de recerca, se'ns van acudir moltes idees interessants, tot i que en vam haver de descartar unes quantes perquè no teníem prous recursos per poder fer una recerca àmplia i, per tant, tampoc un treball elaborat com nosaltres volíem.
Finalment, vam acabar decidint el tema del treball que realitzaríem durant el curs, en funció dels recursos dels quals disposàvem i de la utilitat i rendiment que se li'n pogués donar posteriorment.
El projecte que vam dur a terme consisteix en un anàlisis de l'aigua i l'aire de la nostra vila, Gironella. Ens vam endinsar en el tema de la qualitat mediambiental de la salut, ja que pensem que és un tema interessant que està relacionat amb la contaminació, l'aire, l'aigua i les malalties que hi estan involucrades.

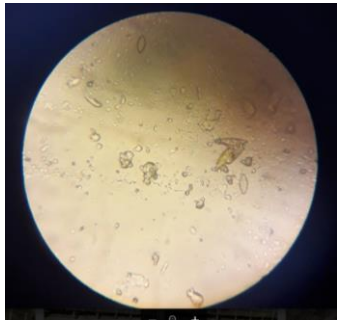
El primer que vam fer va ser pensar i trobar alguns recursos que poguéssim utilitzar per obtenir la informació necessària per tal de poder desenvolupar el nostre projecte i obtenir-ne el màxim de rendiment. Després, vam buscar informació en diverses pàgines web, vam consultar a alguns professors, també vam buscar a l'exterior del centre (a la llibreria del poble, a la biblioteca,...). Per últim vam analitzar i organitzar tota la informació obtinguda i vam fer una exposició.

Vam utilitzar diferents pàgines web per informar-nos sobre el concepte de contaminació i, seguidament, vam buscar els diferents efectes que aquesta podia causar a la salut i al medi ambient.

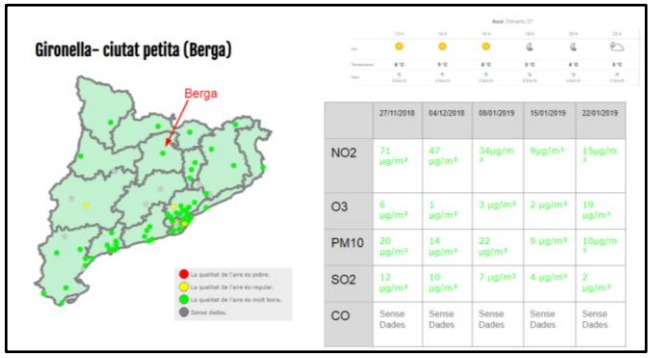
Després, ens vam endinsar en el tema de l'aigua. Vam començar fent un anàlisi de la qualitat de l'aigua del nostre poble. Seguidament vam realitzar una descripció de l'hàbitat i vam analitzar-ne la qualitat fisicoquímica de l'aigua. El resultat va ser l'esperat: la concentració de nitrats va resultar ser baixa (entre 0 I 5 mg/l) I el ph neutre (igual a 7). Finalment vam prendre mostres de l'aigua del riu,

les vam estudiar al laboratori de l'institut i les vam observar amb el microscopi. Vam trobar molt pocs organismes a la mostra, només hi havia 3 nematodes i algunes diatomees.

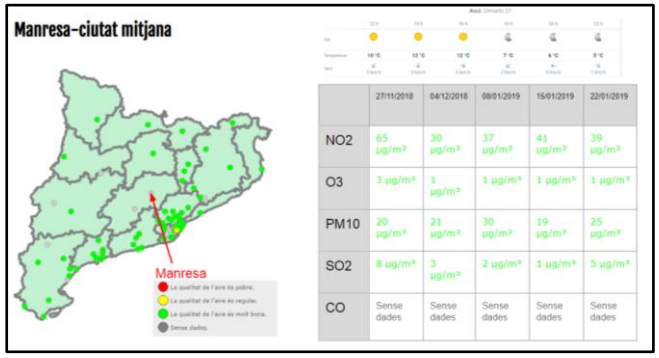
Nematodes Diatomees



Vam arribar a la conclusió de que la qualitat del riu és bona, però no hi ha gaires animals. L'estudi el vam dur a terme durant l'hivern, així que, possiblement va ser degut a l'època de l'any que no hi haguessin gaires animals. Pensem que si féssim el mateix estudi però en època calorosa, l'estiu per exemple, el resultat seria bastant diferent. Vam poder comprovar que a l'hivern, la temperatura de l'aigua és baixa i la majoria d'organismes són inactius. Després, vam fer un anàlisi de la contaminació de l'aire. Els nostres objectius eren comparar els nivells de contaminació atmosfèrica entre ciutats grans, mitjanes i petites a Catalunya en un període de temps. Com a ciutat gran vam utilitzar tres llocs diferents Barcelona, que té 1.620.343 habitants, com a ciutat mitjana vam triar Manresa amb 76.250 habitants i com a ciutat petita vam triar Berga amb 16.199 habitants.

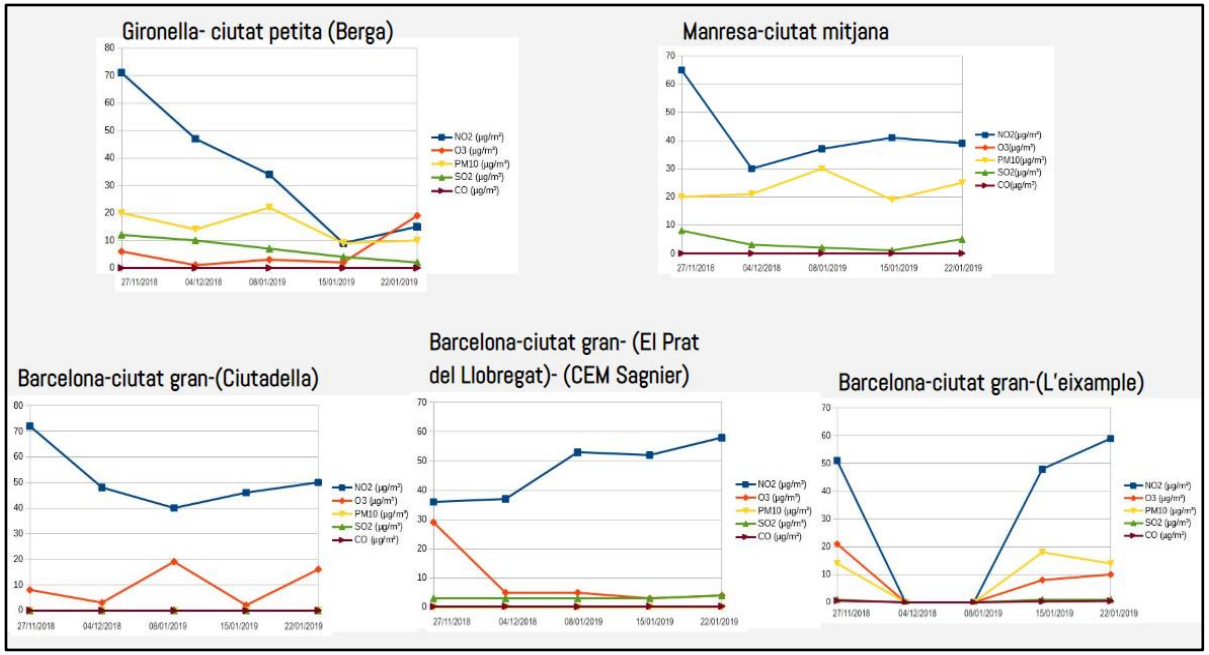


	27/11/2018	04/12/2018	08/01/2019	15/01/2019	22/01/2019
NO2	71 µg/m³	47 µg/m³	34µg/m³	9µg/m³	15µg/m³
O3	6 µg/m³	1 µg/m³	3 µg/m³	2 µg/m³	19 µg/m³
PM10	20 µg/m³	14 µg/m³	22 µg/m³	9 µg/m³	10µg/m³
SO2	12 µg/m³	10 µg/m³	7 µg/m³	4 µg/m³	2 µg/m³
CO	Sense Dades	Sense Dades	Sense Dades	Sense Dades	Sense Dades

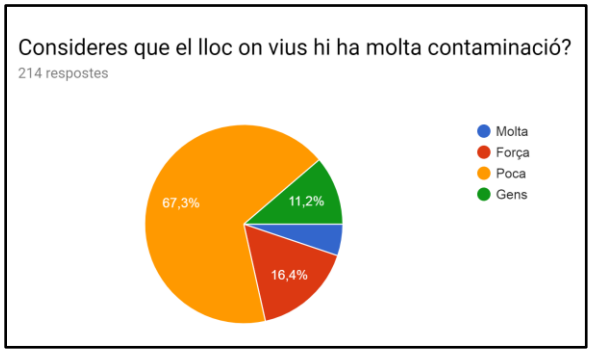


	27/11/2018	04/12/2018	08/01/2019	15/01/2019	22/01/2019
NO2	65 µg/m³	30 µg/m³	37 µg/m³	41 µg/m³	39 µg/m³
O3	3 µg/m³	1 µg/m³	1 µg/m³	1 µg/m³	1 µg/m³
PM10	20 µg/m³	21 µg/m³	30 µg/m³	19 µg/m³	25 µg/m³
SO2	8 µg/m³	3 µg/m³	2 µg/m³	1 µg/m³	5 µg/m³
CO	Sense dades	Sense dades	Sense dades	Sense dades	Sense dades

Tots aquests anàlisis els vam realitzar amb l'ajuda d'una pàgina web per anar controlant cada semana la qualitat de l'aire dels diferents llocs. Finalment vam arribar a la conclusió de que on hi ha més contaminació és a Barcelona, excepte en alguns valors de l'Òxid de Nitrogen. Científicament està demostrat que a les ciutats grans com que hi ha més activitat industrial, més moviment de cotxes... hi ha més contaminació.

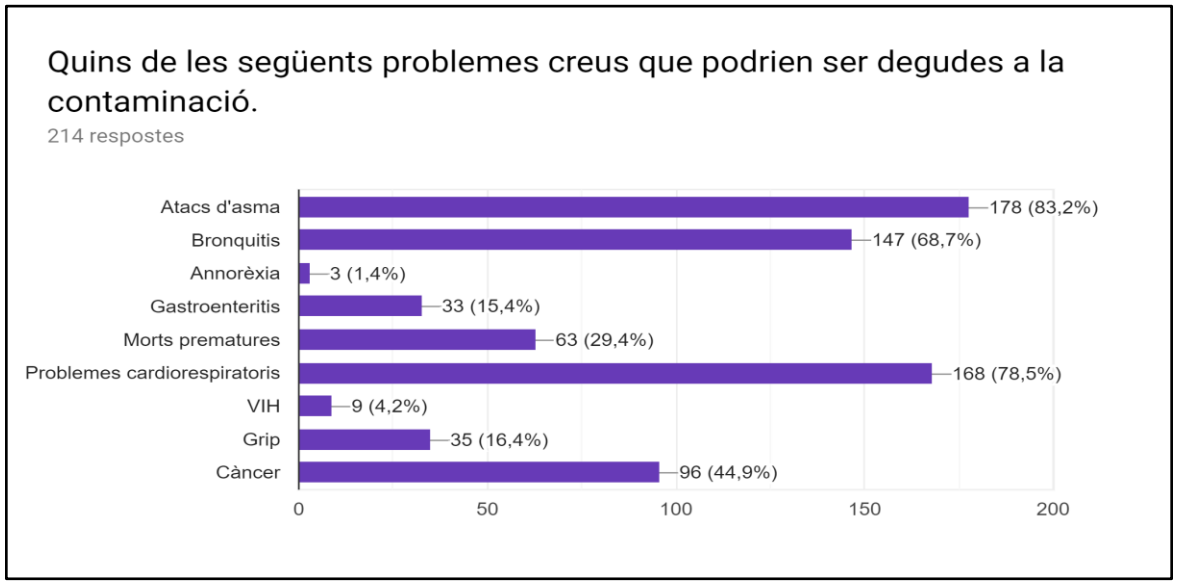


El dia 27/11/2018, però, hi va haver un increment molt gran a tot el país. Probablement va ser degut a que hi va haver temps anticiclònic, on l'aire fred es va dipositar a les parts baixes del territori i va fer que els contaminants es concentressin a l'aire de les ciutats. Aquests són els gràfics de cada un dels llocs amb els nivells de contaminació de cada element. Això ens va ajudar a poder comparar millor la contaminació a cada localitat. Finalment, vam buscar informació en diverses pàgines web per informar-nos bé sobre com els principals contaminants de l'estudi anterior podien afectar a la salut respiratòria, especialment en grans ciutats com Barcelona. Vam poder informar-nos molt sobre l'impacte de la contaminació de la salut, diverses



recomanacions, i algunes mesures de millora. El nostre objectiu d'aquesta recerca era entendre els efectes de la contaminació a grans ciutats. A partir d'això, vam arribar a la conclusió de que no és gens bona per a la salut i que s'haurien de tenir en compte les mesures de reducció d'aquest tipus de contaminació, com per exemple reduir els desplaçaments en vehicle privat, facilitar la dispersió de les partícules en suspensió, seguir un model urbà sostenible i saludable. Un cop feta la recerca vam decidir fer enquestes a gent de Gironella, Manresa i Barcelona per poder observar i comparar els problemes respiratoris que hi ha en diferents parts de Catalunya. Això ens va ajudar a relacionar les dades dels gràfics de la contaminació amb els problemes de la gent segons la zona on viuen. També vam fer una pregunta per poder saber els coneixements de les persones sobre els problemes respiratoris. Amb l'enquesta vam observar que un 20,6% de les persones enquestades tenen o han tingut problemes respiratoris, i un 80% no creuen que el lloc on viuen estigui contaminat.

Vam arribar a la conclusió de que les persones de ciutats més grans pateixen els efectes de la contaminació més elevats que les persones que viuen en les ciutats més petites. I amb les dades de les taules vam poder comprovar que, per exemple, el 17 de novembre el NO2 estava en nivells més elevats en la ciutat de Berga que a la de Barcelona. Per tant la contaminació no sempre es queda al lloc on es genera, sovint es desplaça pels corrents d'aire de l'atmosfera i pot afectar a zones llunyanes.



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GENERAL PERSPECTIVES

REFLECTIONS

This section presents the reflective perspectives of students and teachers post facto about their OSS journey. Reflection is synonymous with thinking and reflective thinking is nothing but re-conceptualizing of experience, investigating it further to bring forth further unseen facts which serve to either justify or nullify a certain suggested belief (Ord, 2012, p. 66), leading to more relevant action. An experience gained is transformed into learning through the process of reflection, which inherently bridges the gap between a theory and experience. "Reflection leads to understanding, which in turn leads to more informed action Sandra (2017).

Students' experiences of their participation in the co-creation activity as Young Co-creators were collected using the following methods:

- Structured questionnaire with the Likert scale format, which was distributed to the participating partners in June 2019 with separate set of questions administered to students and teachers respectively.
- Oral face-to-face group interviews to students, to capture post facto reflections during the mobility event in September 2019.
- Representation of the students' journey during the co-creation activity, in the form of group collages that was organized in September 2019.
- Student blogs
- Students' YouTube videos created for the purpose of showcasing their work at the mobility event. (Behind the scenes testimonials required)

The oral face-to face interviews at the Mobility Event in Łukow focused on capturing narratives of students on the following questions.

1. Why the team leaders of Young Co-creator groups are mostly boys. What is deterring girls to take on the role of team leaders and lead the tasks?
2. What is their opinion on OSS method of learning? What is their personal preference between OSS and traditional pedagogical methods?

The following key themes found from the interview transcriptions

1. Students' discovery of themselves through OSS activities
2. Their perspectives on the mobility event as a forum of knowledge exchange
3. What it meant to be a young co-creator (subjective, objective perspectives)
4. The challenges they faced – Time constraint, language constraint.
5. Their perspectives on OSS as a new didactic method vs. traditional method of learning

During the semi-structured interviews, it was found that in most of the participating teams, although it comprised of both boys and girls, boys took initiatives to lead the teams.

Boys reported not being shy to interact with people and have less constrains practicing their English language skills in public. Many of them were confident and capable of expressing their opinion without stressing about their language skills (regardless of making mistakes, for instance).

Girls, on the other hand, admitted that they are rather shy and dislike public speaking, especially in English. Given a chance they could however speak in their own native languages in front of a large audience. Some of the girls answered:

"They [boys] are not so shy like us, so they can express their opinion without being stressed." (girl, Lithuania)

"Boys are more confident than girls, not always, but in most times. I think the boys are better in English, so they are not so shy like us. Some of them have better knowledge of English, and they have better skills in English. They have more self-confidence to talk to people around them, they don't think about what others say or think about them, so they don't have the thought that Oh, my God I would say that with different words and they wouldn't understand me but we are more shy. We are thinking more about what we have to say not what that we have to say something." (girl, Israel Team)

" Because, we are shy and quite different talking maybe you think that you make mistake and everyone thinks that different person and like I don't know, boys are brave in speaking English." (girl, Greece)

Another finding noted was that being a team leader required to take on a lot of responsibilities Although some students felt it didn't matter who the leader is and group work is more important.

TEACHERS' PERSPECTIVES

- Letting your ideas into everyday life, integrating them and building on them in the light of your personal experiences
- We have great capacity. Sometimes you feel you don't, but the project helps you develop it and it helps your thinking.
- The positive predisposition of the students, their active attitude, their ability to get involved, their own leadership during the process
- Students' participation is the best way to arouse student's interest and curiosity and to show the applications of science in everyday life.

WHAT DID NOT WORK WELL?

- Keeping the students motivated all the time
- The school timetable, difficulties for students when organizing time table by themselves, different teachers involved and it is difficult to co-ordinate with them.
- The subject does not fit all students' interests
- Hard or impossible to implement into regular classes and curriculum
- Big, normal size of classes do not work cause the subject is very specific and only a few students are interested in that narrow idea. I mean different students have different interests and it is a difficulty to have OSS activities work well in big groups

TIPS FOR TEACHERS

- Let your students free to pick the school subject that they want to work with – this could be done under your guidance.
- Be patient. It is not easy in the beginning. Students and you will figure out the way. You all should work together.
- Role models are a good to inspire children to study science and to develop science leadership
- Plan ahead, create educational scenarios and be ready to adjust them during the lesson according to the needs of the students
- Reshape your character, deal with your ego, analyse project influence on your life
- Schools should have real connection with different working activities and organizations around, as this would give the students a more realistic view of life
- It is better to work with smaller groups of students belonging to the same class (it is better if the students are highly motivated).
- This idea is dedicated to only a few teachers who want to improve, experiment and try new ways of teaching. Teachers have to learn a lot by themselves and mainly they don't have the time and school's support.

SELF-ASSESSED COMPETENCIES GAINED AS REPORTED BY THE PARTICIPANT STUDENTS

I. **Networking with the Community stakeholders**
The students mark that the biggest strength that facilitated their crusade was the networking with eminent experts, specialists and professionals who imparted comprehensive knowledge on the topic.

II. **Teamwork and collaboration**
Working together as a team in the immersive missions and the video creation made the process easier and quicker.

III. **New technological knowhow**
They were introduced to data collection instruments and their workings, learnt how to use professional cameras and video recording with smartphones to create videos. Learnt how to edit videos by editing applications.

IV. **Awareness of Surroundings**
The students became aware of their surroundings by making field visits.

V. **Opportunity to communicate**
Time spent with teammates as well as with the experts, specialist and professionals involved discussions, question-answer sessions, and clarification of information, planning and advice on next sub-projects on the topic. This enabled students to exercise their communication skills.

VI. **Critical thinking and decision making**
After completing each of the mission, the students understood the possibilities of creating a small-scale project on using available resources in their school.

VII. **Problem solving through project-based learning**
The students were not just being recipients of information but were more objectively involved in their learning.

VIII. **Entrepreneurship skills**
The idea of using products from nature to create a consumer goods was fostered in these missions.

IX. **Learning by doing**
Owing to this attribute of learning, the students were involved Interactive engagement, collaborative learning, were able to pay better attention, increased student engagement, more student ownership of the learning process.

Fostering Re-engagement in Science Learning through Open Science Schooling

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