FROM TEACHERS FOR TEACHERS

Základná škola s materskou školou Nižná brána Kežmarok

GA STŘÍBRO

Joint projects

Jitka Soukupova| Gymnazium Stribro| Stribro | Czechia
Janka Siskova|ZS a MS Nizna Brana | Kezmarok | Slovakia

Czech-Slovak alphabet of science experiments from children to children

The scientific alphabet – joint project of Slovak primary and Czech secondary school

Czech-Slovak alphabet of science experiments from children to children:

- to each letter of the alphabet we added two simple experiments – each one presented by children from each country;
- for each letter of the alphabet, we chose a keyword for which we prepared an information card;
- for each keyword we provided some historical information, interesting facts and instructions for the experiment in Czech and Slovak languages.

Key steps for students in implementing a joint project:

1. enrichment of vocabulary in English, Slovak and Czech on the basis of simple scientific experiments
2. simple science experiments connected by keywords of the relevant letters of the alphabet and carried out by both teams of students
3. design, implementation and presentation of experiments with respect to the selected letter and keyword - for example see attached cards for letters C, P, M, O with detailed description of the selected experiments
4. teamwork at the international level and across the age categories of primary and secondary school
5. presentation of information and experiments for younger / older pupils from the Czechia / Slovakia
6. finding, processing and presentation of information (historical / cultural / geographical / specific national) about the selected keyword for the performed experiment
7. presentation of a joint project at science events and festivals in the Czechia, Slovakia and abroad
8. presentation of experiments from the project within various charitable events in kindergartens, libraries, retirement homes, etc.
9. preparation and implementation of Czech-Slovak-English brochures and calendars with final project outputs
10. connection of science project activities with other disciplines and school subjects - art and language activities, geography, biology and ecology, history

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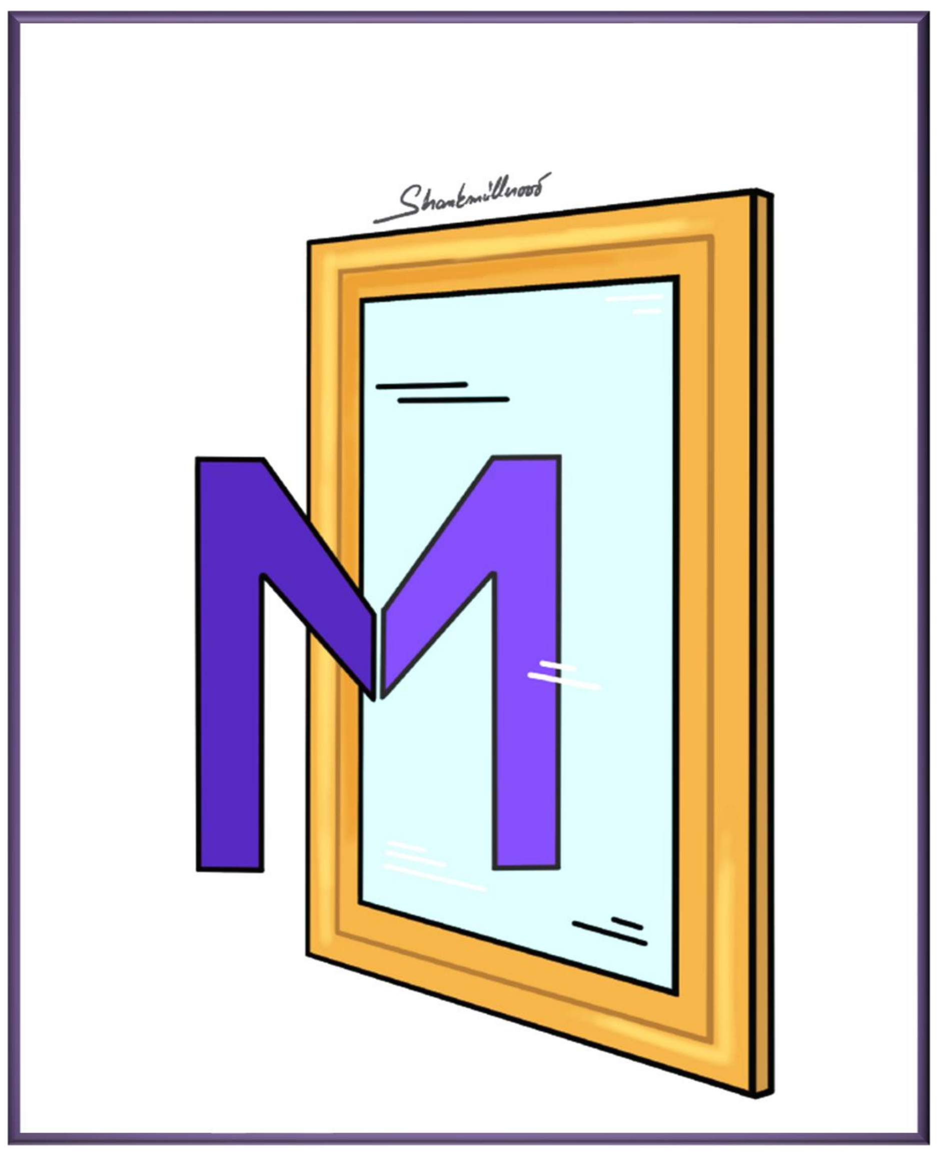
M – mirror – zrkadlo - zrcadlo

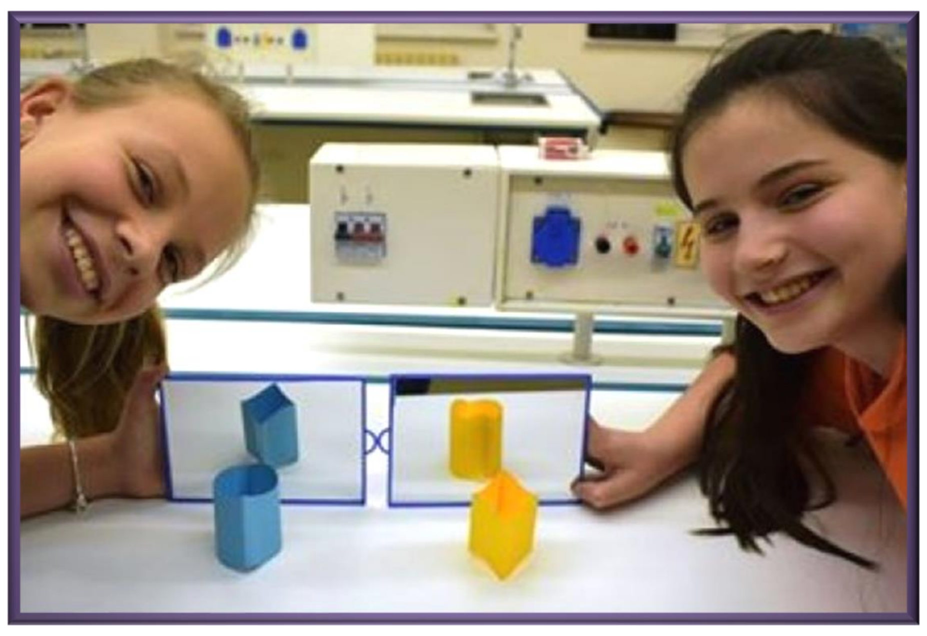


History of mirror

As the first mirror is the considered water surface, where people could observe both their surroundings and themselves. In the 6th millennium BC, the first objects of the so-called obsidian plate appeared and were used as the first official mirrors. At the beginning of the 2nd century BC, production was already advanced and people invented metal mirrors, which were made of polished bronze.

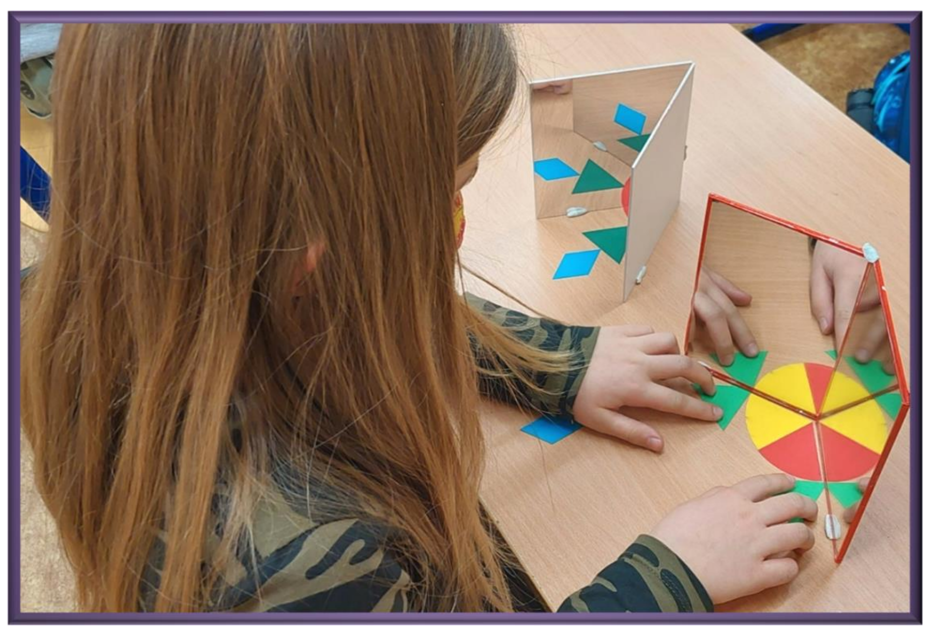
Czech team experiment: In front of and behind the mirror

We need: mirror, 3D printed optical illusion The front half of the shape is convex, the back half of the shape is hollow, if we do not have a mirror behind the optical illusion and we do not see the back side, the eye adapts and the brain conceives the image according to the front side. Thanks to the mirror, we observe the front side separately and the back side separately, and the image we see is therefore confusing for humans, because again the brain "conceives" the other half according to visual perception, and so we see two different shapes in front of and behind the mirror.



Slovak team experiment: Mirror images

We need: 2 mirrors, geometric shapes, (other small objects) Place the two mirrors opposite each other so that they form an angle of 60 ^{o}. We store geometric shapes or other small objects in the created space. The reflection is repeated in the mirrors, so the image is multiplied 6 times, because we chose an angle of 60^{o}. Depending on which angle we choose, a different image will be created for us. It's a 360^{o} ratio. Does it work with other angles? What we have to think off is a share of 360, which is a full angle. For our angle 60^{o} it is 360/60 = 6, 6 – 1 = 5. This is the number of reflections in the mirrors. We let students look for other "nice" angles (90,45,30).



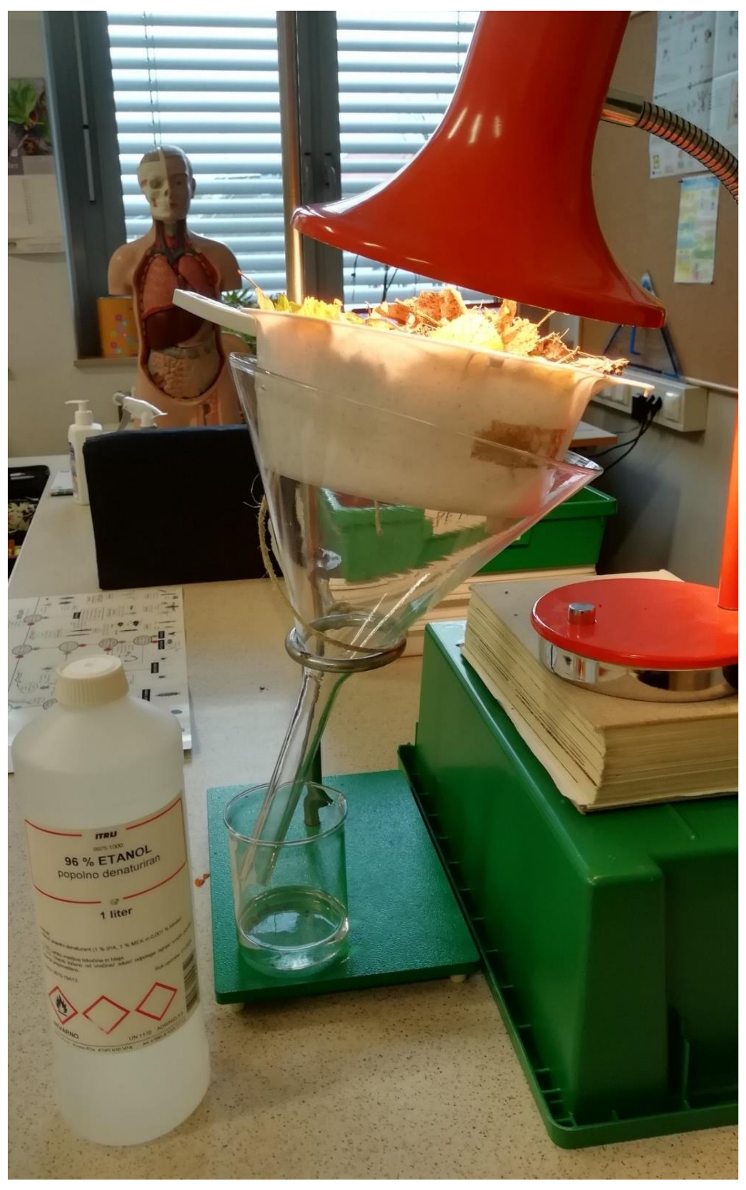
FROM TEACHERS FOR TEACHERS

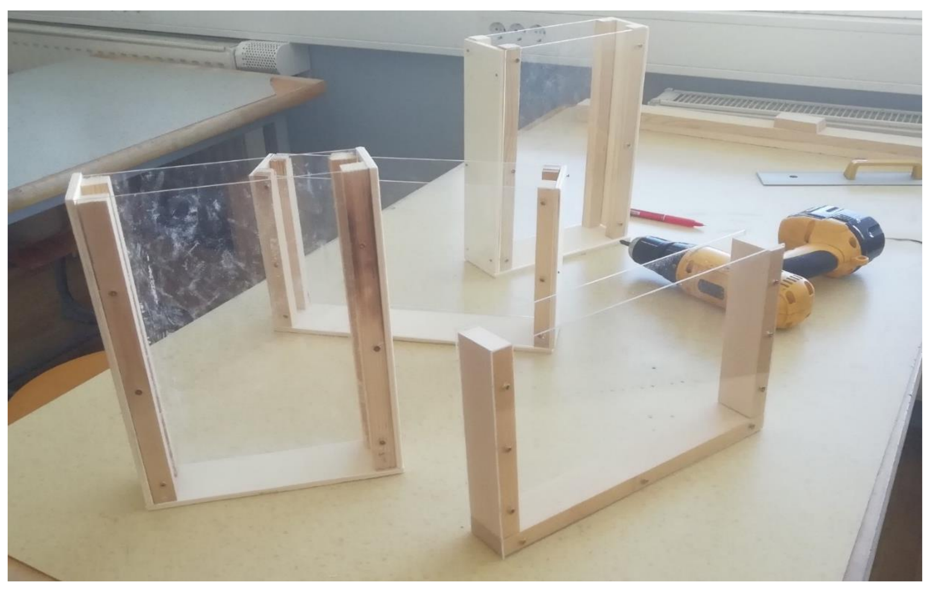
JOINT PROJECTS

Sarah Eames|Sandfield Close Primary School | Leicester |England
Renata Flander|Davorin Jenko Primary School | Cerklje na Gorenjskem |Slovenia

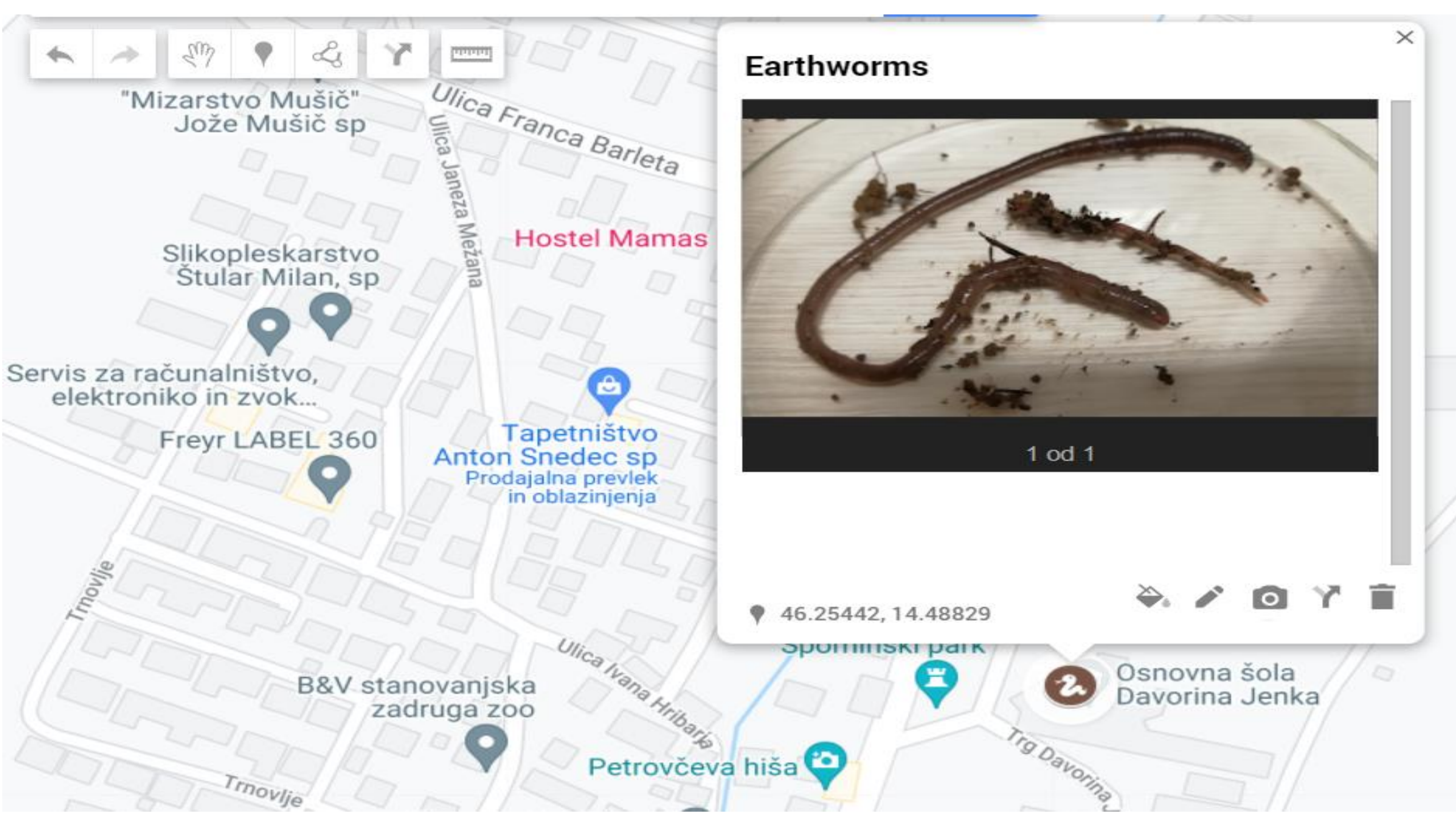
What’s under our feet?

Our schools asked the same question as Charles Darwin, “**How many earthworms are below my feet?**“
We also wondered would our earthworms be the same as in other parts of the world? How could we find them? How could we investigate them? We investigated the animals below the ground with a simulation of **Tullgren funnel**. For observation of earthworms we made a **wormery**.





Working Scientifically skills included; sorting and classifying, pattern seeking, research using books and experts, learning about differences and similarities, asking questions, making observations, and many more.



We improved our knowledge with the questions;

- *What is directly under your feet? How did it get there?*
- *Is it a natural or a manufactured material?*
- *How deep is it? What is below it?*
- *Who could have walked there before?*
- *How has it changed over the years?*
- *What will happen to it in the future?*
- *How can we ensure it will stay healthy?*

With collaboration we managed to show the pupils the biodiversity (animals, plants, rocks) at different levels in the ground. We discussed the responsibility of taking care of an organism. We discussed the ethics of keeping animals. We investigated other animal species in the soil. A Google Map was created so that others can join in our worm watching and hunting.

FROM TEACHERS FOR TEACHERS

JOINT PROJECTS

Nino Abesadze/Emma Lindahl | Public School no 22/Älghults friskola | Tiblisi/Älghult | Georgia/Sweden

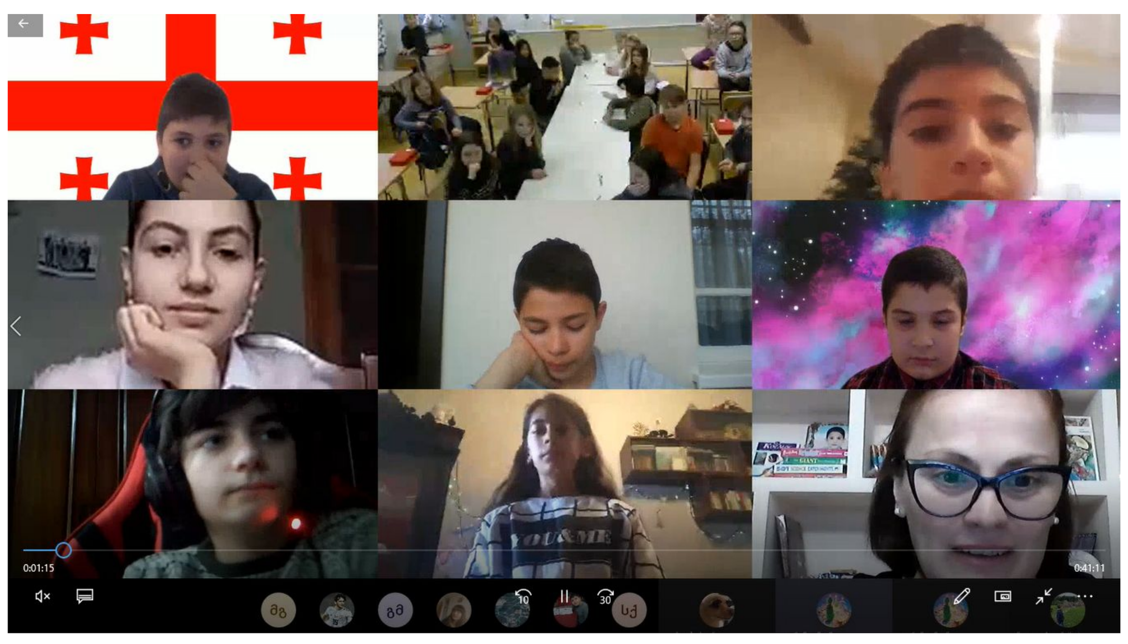
Learning about space through light vs learning about light through space

SCIENCE ON STAGE FESTIVAL 2022

During this project Georgian and Swedish students met over the computer and taught each other about space and light. They made models explaining different phenomena in order to make physics easier to understand.

During our online meetings the students discussed space and light. To finish the project the students explained the models to each other.

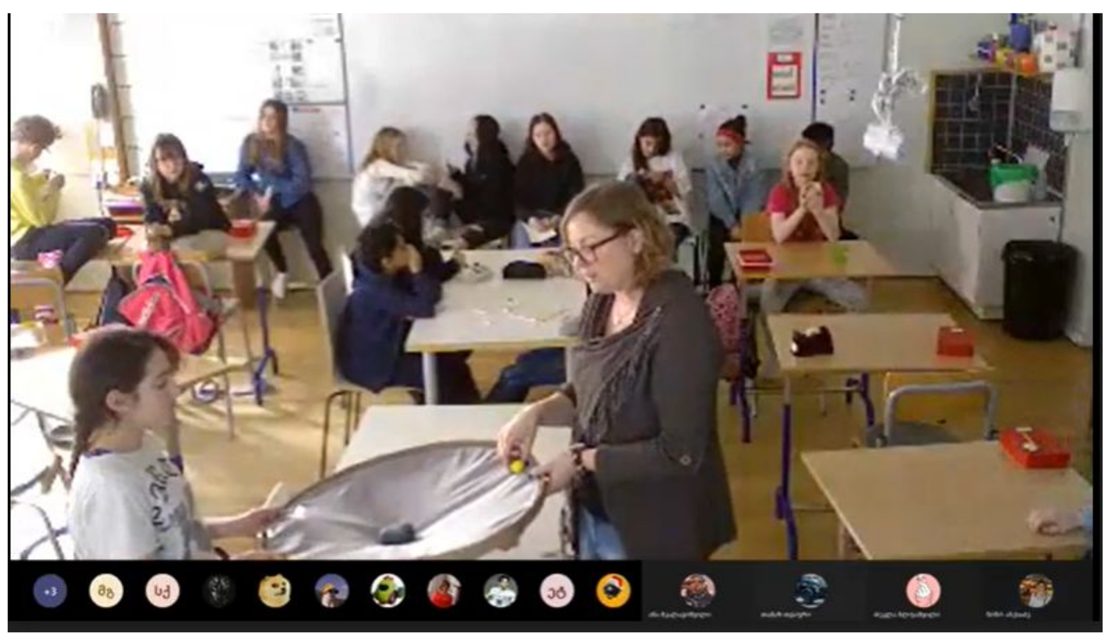
We also learned more about each other by sending boxes filled with what the students thought were representative for their country and Earth it self.

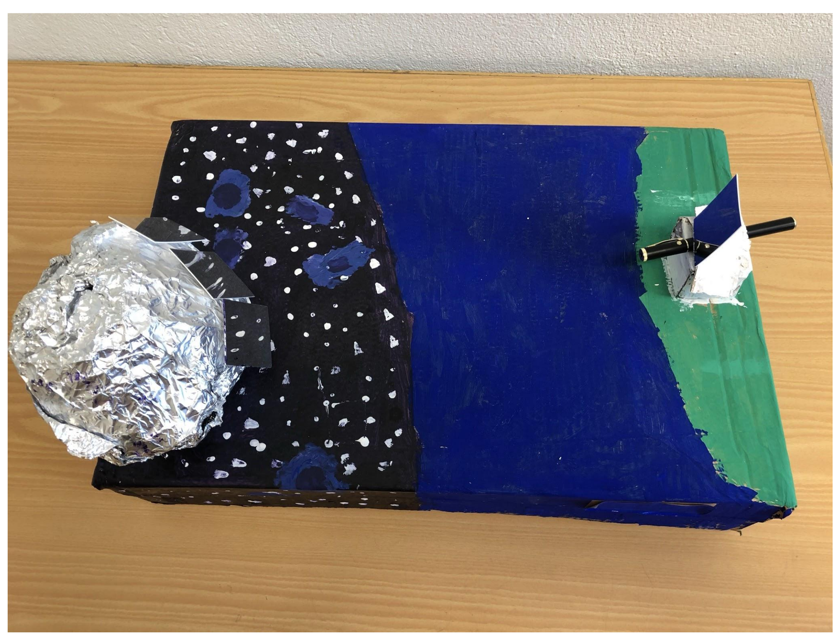


Online meetings.

Students models.

SonS in Portugal 2019.





Georgian box to space.

Crossing topics, crossing borders and crossing ages.

A good recipe for making science and making friends!

JOINT PROJECTS

FROM TEACHERS FOR TEACHERS

Declan Cathcart, Temple Carrig School, Greystones, Ireland
Andrea van Bruggen- van der Lugt, Willem van Oranje College, Waalwijk, The Netherlands

The Good, the Bad and the Complex

Food and Biotechnology

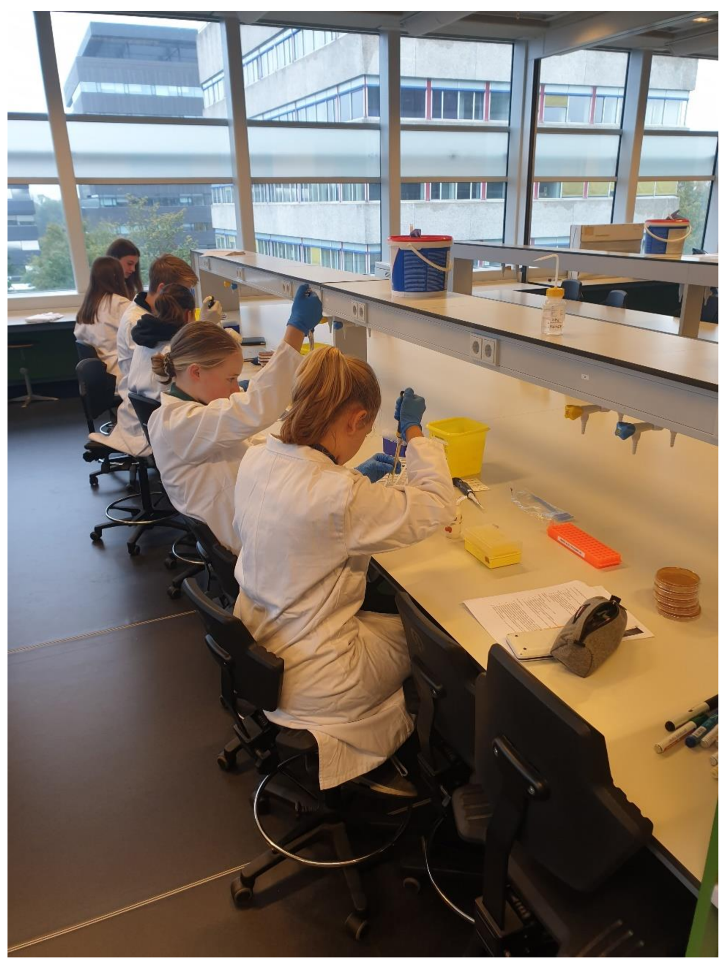
A series of activities have been designed and developed for secondary school laboratories and classrooms. The aim of the project is to improve students conceptual understanding and investigative laboratory skills by framing these activities in an inquiry-based, structured problem-solving approach in the context of food and microbes.

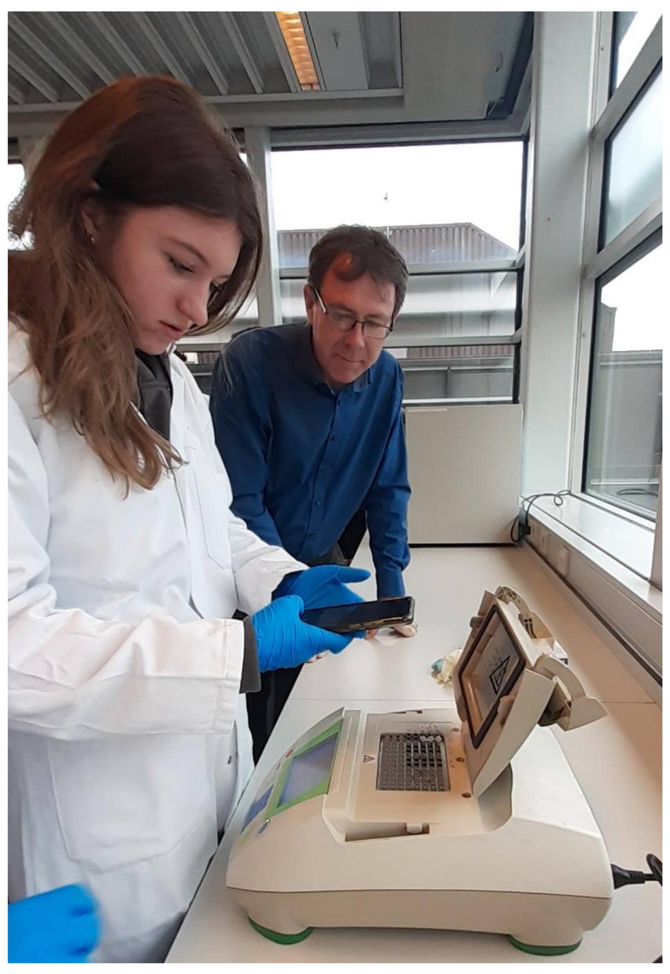
Part 1 – The Good – Lactic Acid Bacteria

Investigation of 'probiotic' lactic acid bacteria in fermented food.

Part 2: The Bad – Shiga Toxin-producing *E.coli* (STEC)

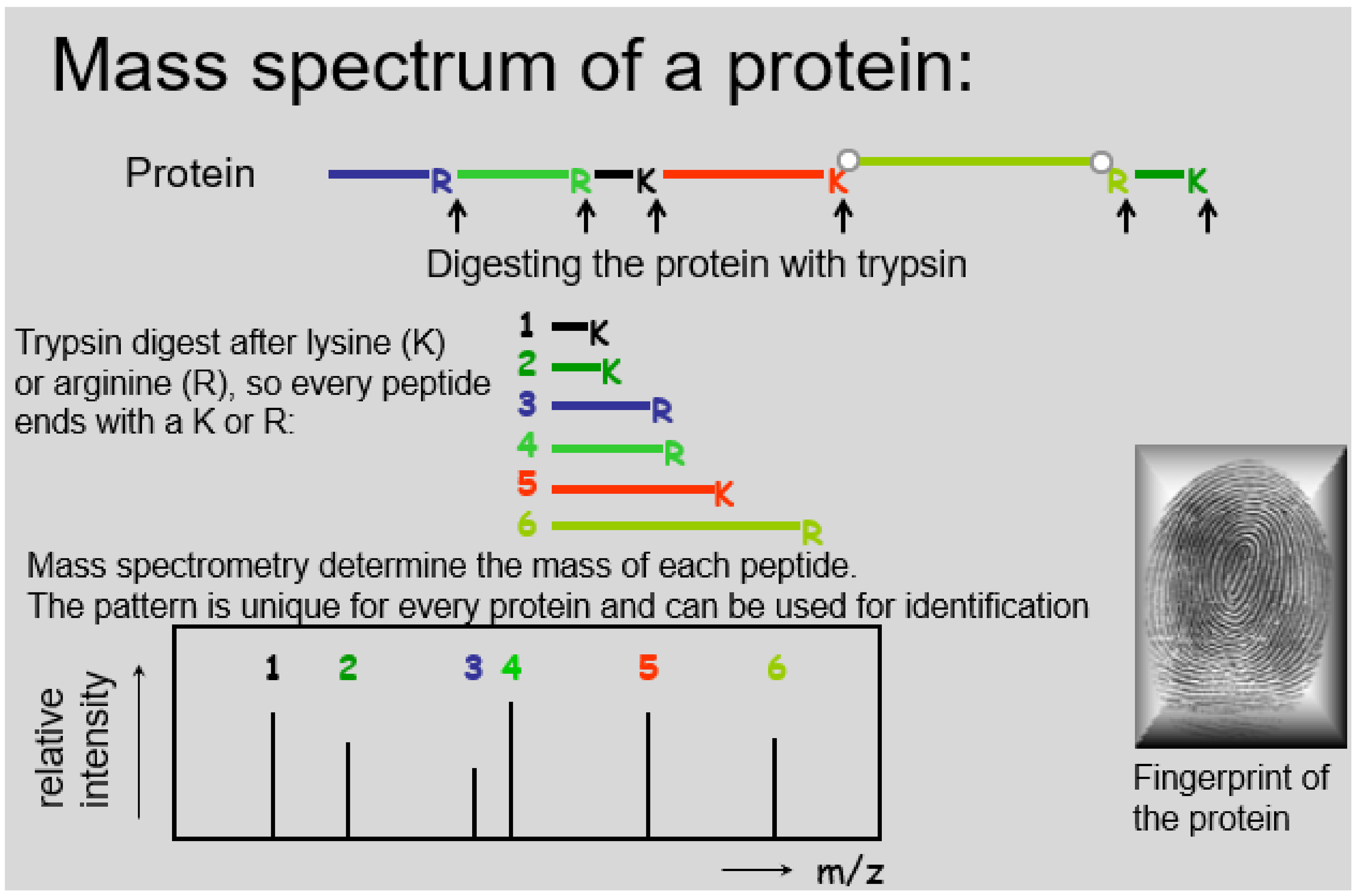
Lab activity with PCR-based diagnostics for the detection of Shiga toxin-producing *E.coli* (STEC) strains.





Part 3: The Complex – Shiga Toxin proteins

3D -visualization of Shiga Toxin proteins (PyMOL).
Detecting Shiga Toxins from STEC using mass spectrometry data of a trypsin-digest of the protein.



Future development of the project

Investigation of the survival of 'probiotic' strains in gut models.
Epidemiology of an *E. coli* outbreak – a case study/ role play.
LabXchange – pre- and post laboratory activities.

Acknowledgment

Support is gratefully received from
Amgen Biotech Experience
U-Talent – Utrecht University

AMGEN Biotech Experience
Scientific Discovery for the Classroom
U-TALENT

Conclusion: We have developed a series of inquiry-based activities for students to learn some of the important concepts and techniques of food biotechnology.

JOINT PROJECTS

FROM TEACHERS FOR TEACHERS

SCIENCE ON STAGE FESTIVAL 2022

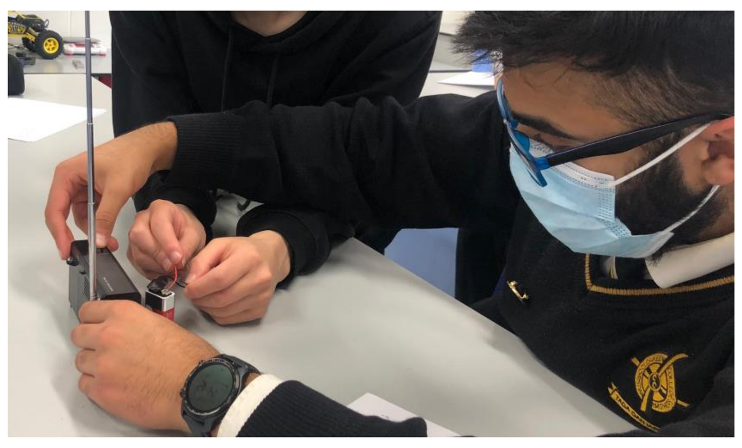
Máire Duffy | Clonkeen College| Dublin| Ireland
Nelson Correia | Escola Secundária Maria Lamas| Torres Novas| Portugal

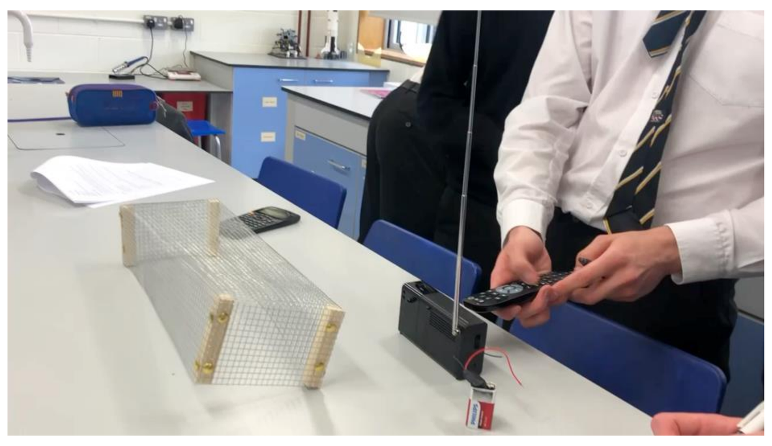
Radio Astronomy in Schools

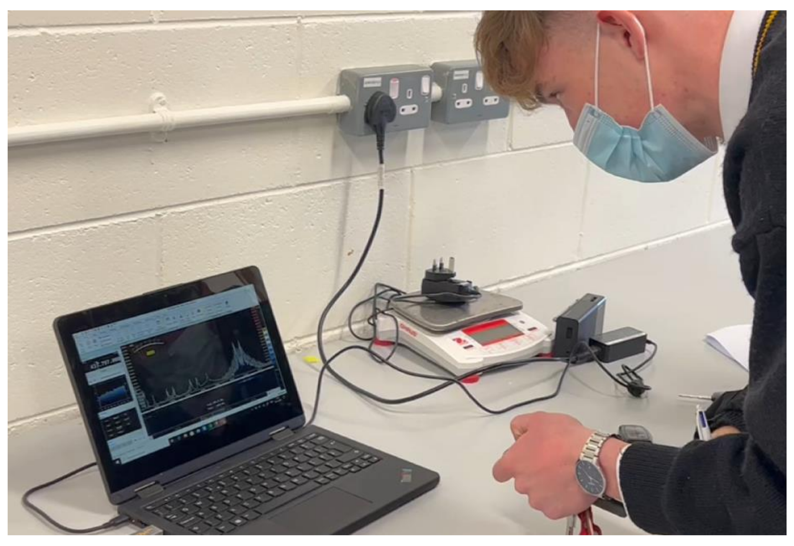
Radio Astronomy at School is a project that aims to promote students' interest in astronomy and physics in the area of radio waves emitted by celestial bodies.

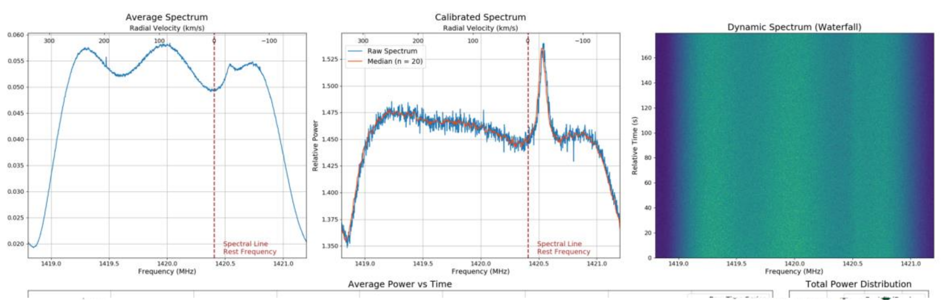
Students were involved in building three different types of radio telescopes.

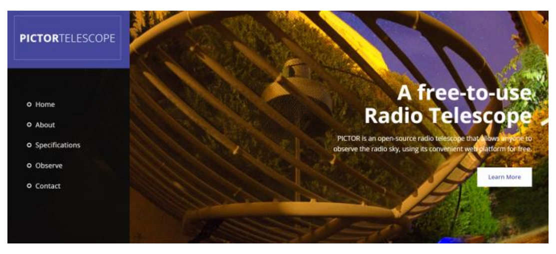
1. An Itty Bitty Telescope using a t.v. Satellite dish and a signal finder to detect radio waves from the sun.
2. A horn antenna to detect the 21 cm hydrogen line from our milky way.
3. A 2.5 m parabolic dish radio telescope in Portugal. The dish itself was donated from AMRAD.

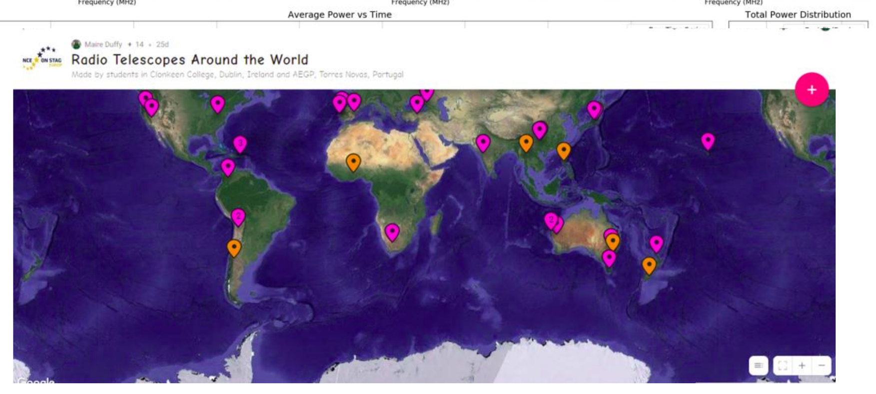


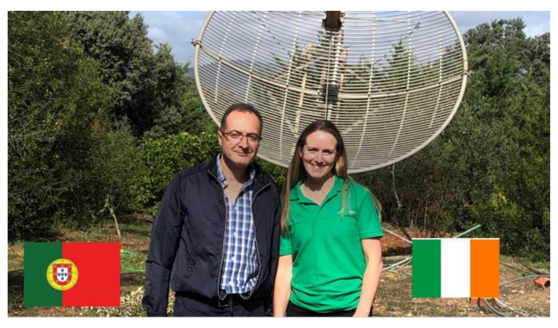




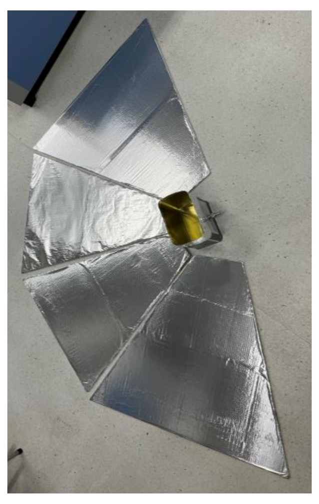


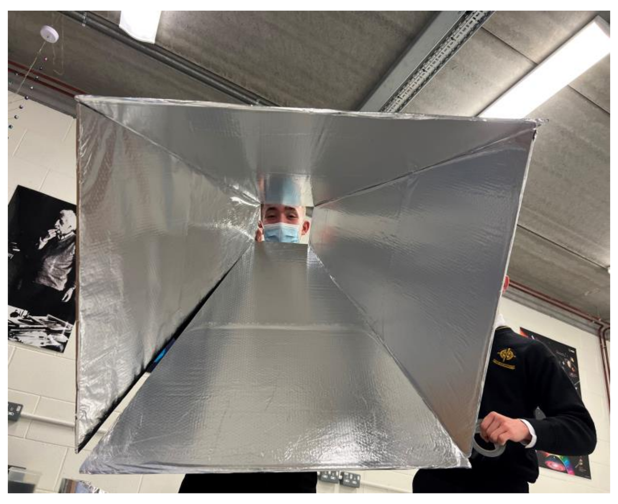






Conclusion: This project allowed students to apply their physics knowledge to real world applications and brought radio waves to life!





Students also investigated RFI (radio frequency interference) in the lab from electrical appliances, the effect of a Faraday cage on radiowaves, detected radiowaves using a Software Defined Radio (SDR) and a RTL-SDR dongle, made simple astronomical telescopes as a comparison to radio telescopes and investigated the night sky for the 21cm hydrogen line using Pictor telescope and Stellarium online. Students from both countries collaborated on a map of radio telescopes around the world using Padlet, which allowed them to see the best place to locate a telescope with the least amount of radio interference. Thanks to all the advice from both AMRAD, Portugal and I-LOFAR, Ireland.

AMRAD I-LOFAR

SCIENCE ON STAGE EUROPE

ELIXÍR DO ŠKOL

SCIENCE ON STAGE 2022 PRAGUE

FROM TEACHERS FOR TEACHERS

JOINT PROJECTS

projects developed in cooperation between teachers from different countries, one of whom at least participated in a previous Science on Stage festival

Science in your kitchen!

Ainur Smagulova | NIS - Chemistry and Biology | Shymkent | Kazakhstan
Gordon Kennedy | Educandato agli Angeli | Verona | Italy

Two cuisines joined by science!

Our project involves preparing classical dishes from two countries to engage students with the physics and the chemistry of cooking. Students are encouraged to link what they observe to the fundamental laws underlying the preparation of the dishes.

Experiments with baursak

The dough traps the CO2 produced by the yeast and expands because molecules of starch in the flour, lubricated by the liquid, can slide across each other.
The dough balls float when fried because the warm gas inside them makes them less dense than the oil. A chemical reaction in the mixture causes the golden brown colour.

- Which factors influence the outcome?
- Which gives the best result?

Didactic approach

We looked at the preparation of food through the lens of the scientific method: noting the steps, listing the materials, making observations and measurements.
In this way, the kitchen becomes a real laboratory for exploring science!

Concepts

Change of state
Interaction with light
Fermentation

Dimensions
Strength
Density
Rigidity
Plasticity
Forces

Reactivity
Extraction
Absorption
Dissolution
Mixtures
Solvent/solute

Heat
Odour
Diffusion

Playing with pasta and pesto

The physical properties of pasta change during cooking: from being rigid and inelastic, it increases in size, becomes flexible and sticky.
Making pesto involves extracting the colour and the aromas of basil leaves into olive oil.

- Why do the properties of pasta change?
- Why is pesto red in UV light?

Scan for additional materials

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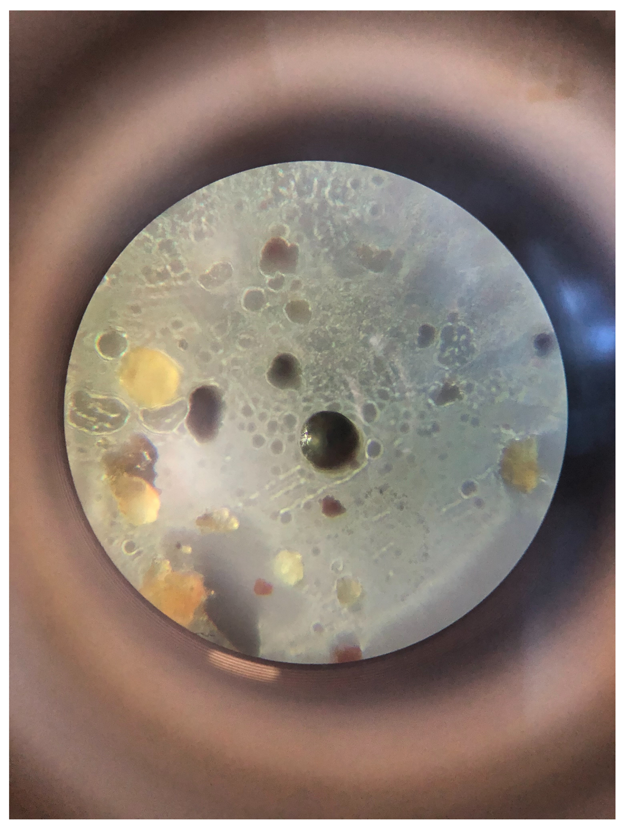
Carolina Clavijo Aumont / IES Ítaca/ Tomares, SEVILLA / SPAIN
Paul Stinson/ Sun West Distance Learning Centre/Craik / CANADA

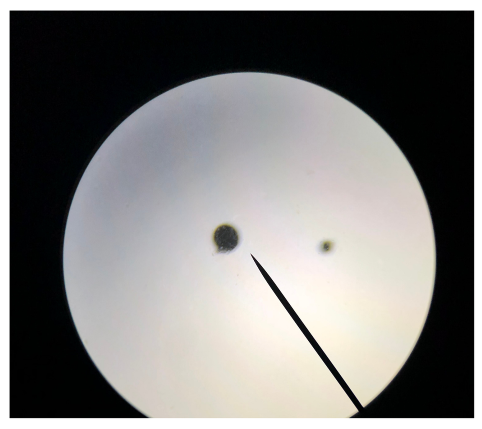
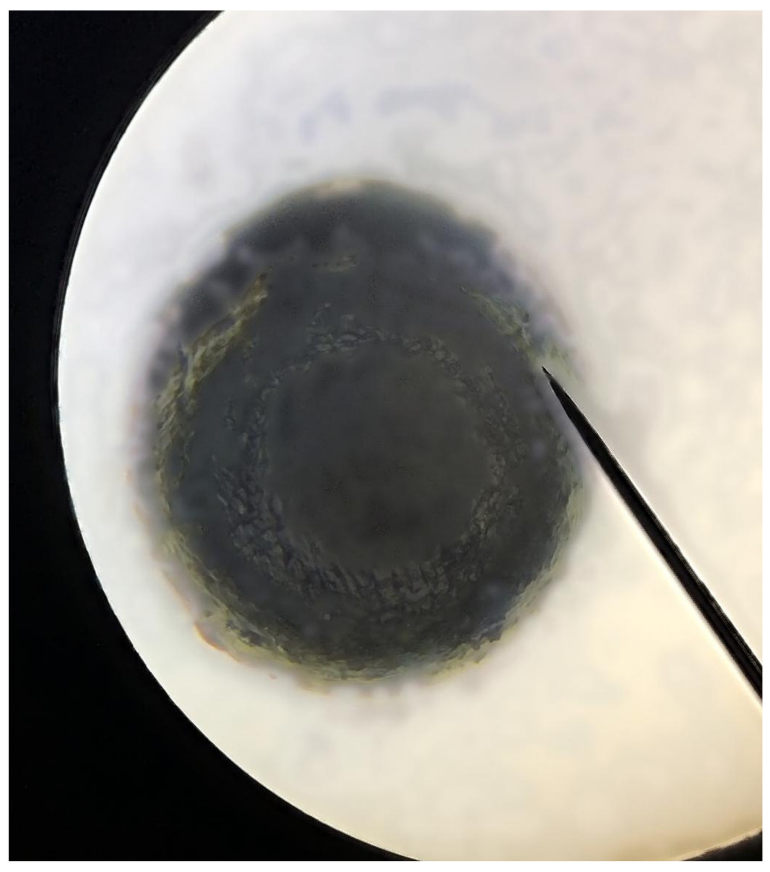
Space exploration from small scale to large scale.

Understanding Solar System Scale/ Analysing dust: micrometeorites.

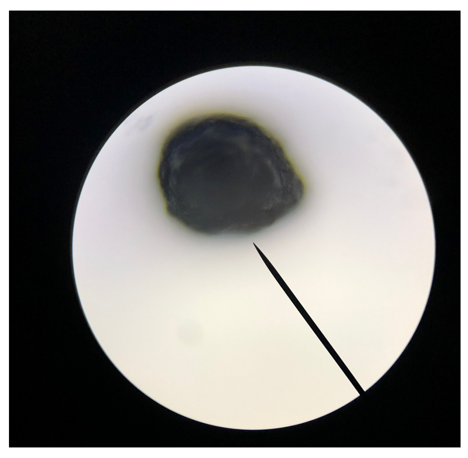
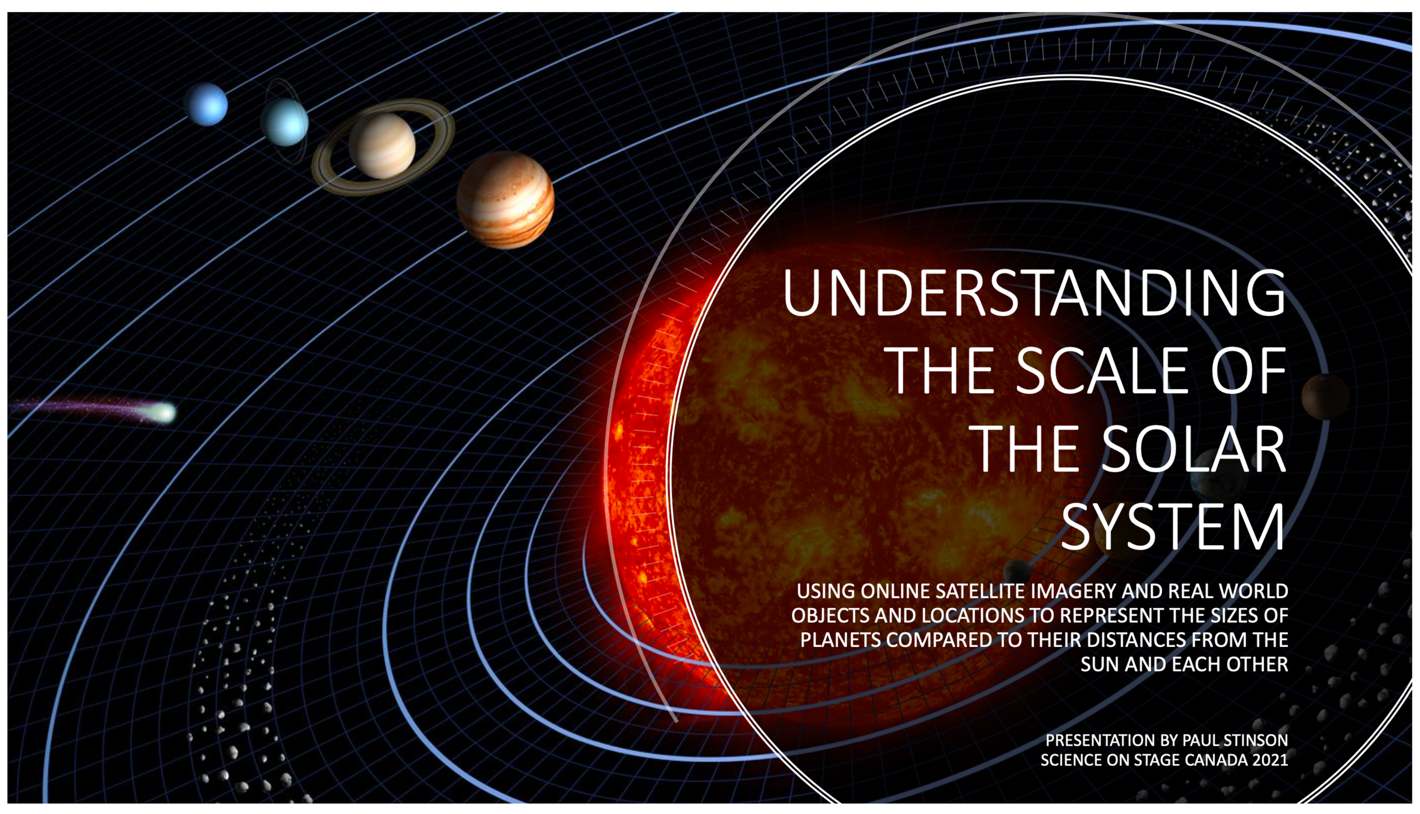
Every day on Earth, micrometeorites land on our roofs. The Earth, in its trajectory through stardust, intercepts different objects, with the help of the force of gravity. We developed an experimental method to detect and make a micrometeorite collection. Efforts were interrupted by the pandemic, affecting results. To create context for these tiny particles, students also examined the scale of the solar system in which these particles exist. Students in Spain and Canada presented to each other and shared cultural connections.

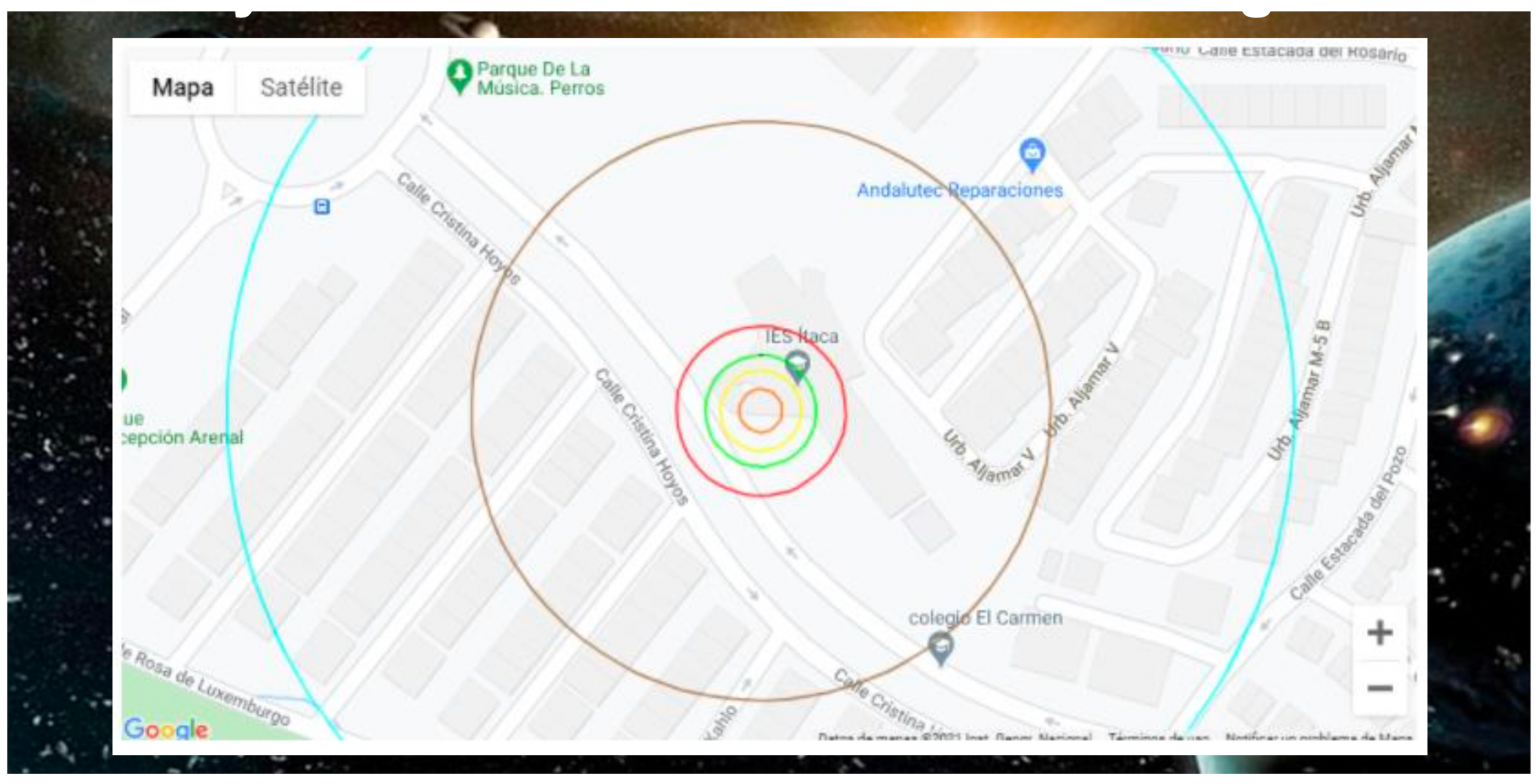








Conclusions: Students can appreciate the benefits of models in understanding the world around us, as well as how they can foster misunderstandings. They can also understand that via dust, we can make space exploration, and find stardust, little stones that come from the solar system, from outer space.

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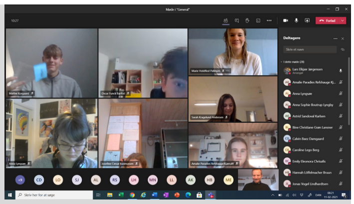
FROM COPENHAGEN TO PRAGUE

The goal of the project is to determine the distance between Copenhagen and Prague using astronomical measurements of latitude and relative longitude between the cities. We present a basic method to make the essential latitude and longitude measurements but also other optional historical measuring techniques. Note that the longitude measurement has to be caried out simultaneously in Copenhagen and Prague during the daytime hours. Note also that this method can be applied to any two cities around the world.
The project is inspired by the astronomer Thyco Brahe who was born in Denmark and died in Prague.

Project participants:
From Czech Republic teacher Vera Koudelkova, secondary school ZŠ gen. Fr. Fajtla DFC, Prague -18 with pupils aged 12-14.
From Denmark teacher Lars Elkjær Jørgensen, secondary school Allerød Gymnasium with pupils aged 16-18

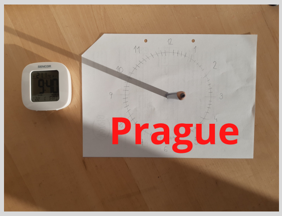


Measuring latitude

The geographical latitude is equal to the height of the north star. This can be understood using a simple geometrical argument. Carefull measurement of the north star with a clinometer wil determine the height with a ±1° accuracy

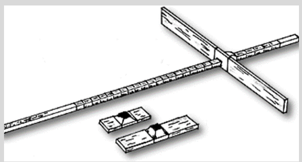
Measuring longitude

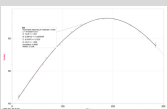
A measurement of true noon with a sundial **on the same day** will determine the difference in geometrical longitude between the two cities



Historical measuring techniques

Instead of a clinometer, you can measure the height of the north star with a cross-staff like Thyco Brahe did. Accuracy will be less than ±1°. Time of day for the sundial experiment can be meassured with an hourglass or a pendulum.,...





Results

The great circle formula

$$dist(A,B) = R \cdot arccos\,(sin(\varphi_A) \cdot sin(\varphi_B) + cos(\varphi_A) \cdot cos(\varphi_B) \cdot cos(\theta_A - \theta_B))$$

Where φ_A is the latitude of point A, φ_B is the latitude of point B, $R = 6378.245\ km$ is the earth mean radius and $\theta_A - \theta_B$ is the difference in longitude angles.

In the theory of the latitude and longitude system, the distance is calculated with the great circle formula. The calculation is easily made using an onlibe calculator like Cactus2000.
The true distance from Copenhagen to Prague is 635 km.