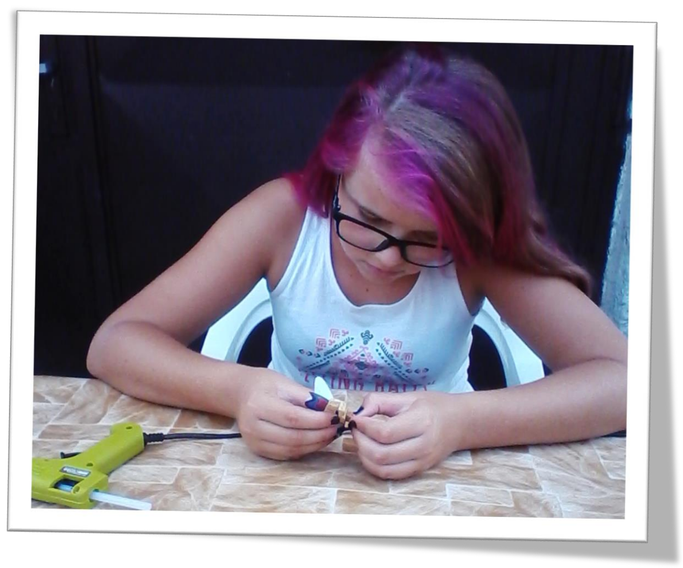
Low-Cost and Recycled Science

SCIENCE ON STAGE 2019 CASCAIS
THE EUROPEAN NETWORK FOR SCIENCE TEACHERS

Monika Vanyová | Basic school of Jan Amos Comenius | Tvrdošovce | Slovakia

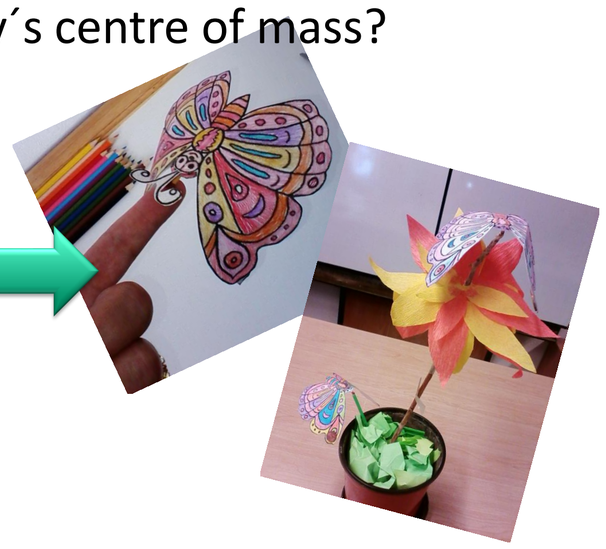
Clothes peg and paper physics

The project is aimed at experimentation with clothes pegs or paper that offer many opportunities to explain and understand different physical concepts.



The experiments involve measuring mass, length, volume, density or force on a clothes peg, a clothes peg toy to determine its centre of mass, clothes peg catapult, a toy cannon made of a clothes peg and metal ball, equilibrium with clothes pegs on a lever and many others. They can be conducted by teacher or more inquiry approach can be used when students themselves design, prepare and present the experiments in front of the class or during a school day for other students, teachers or even parents.

Where is the butterfly´s centre of mass?



Use clothes peg and paper in science (chromatography).

I need to measure length, mass and volume of a clothes peg.
Can you help me to choose the right measuring tool?

Clothes peg is made of wood.
What is the wood density?

$$\rho = \frac{m}{V}$$

Would you use the whole clothes peg to measure its mass and volume?

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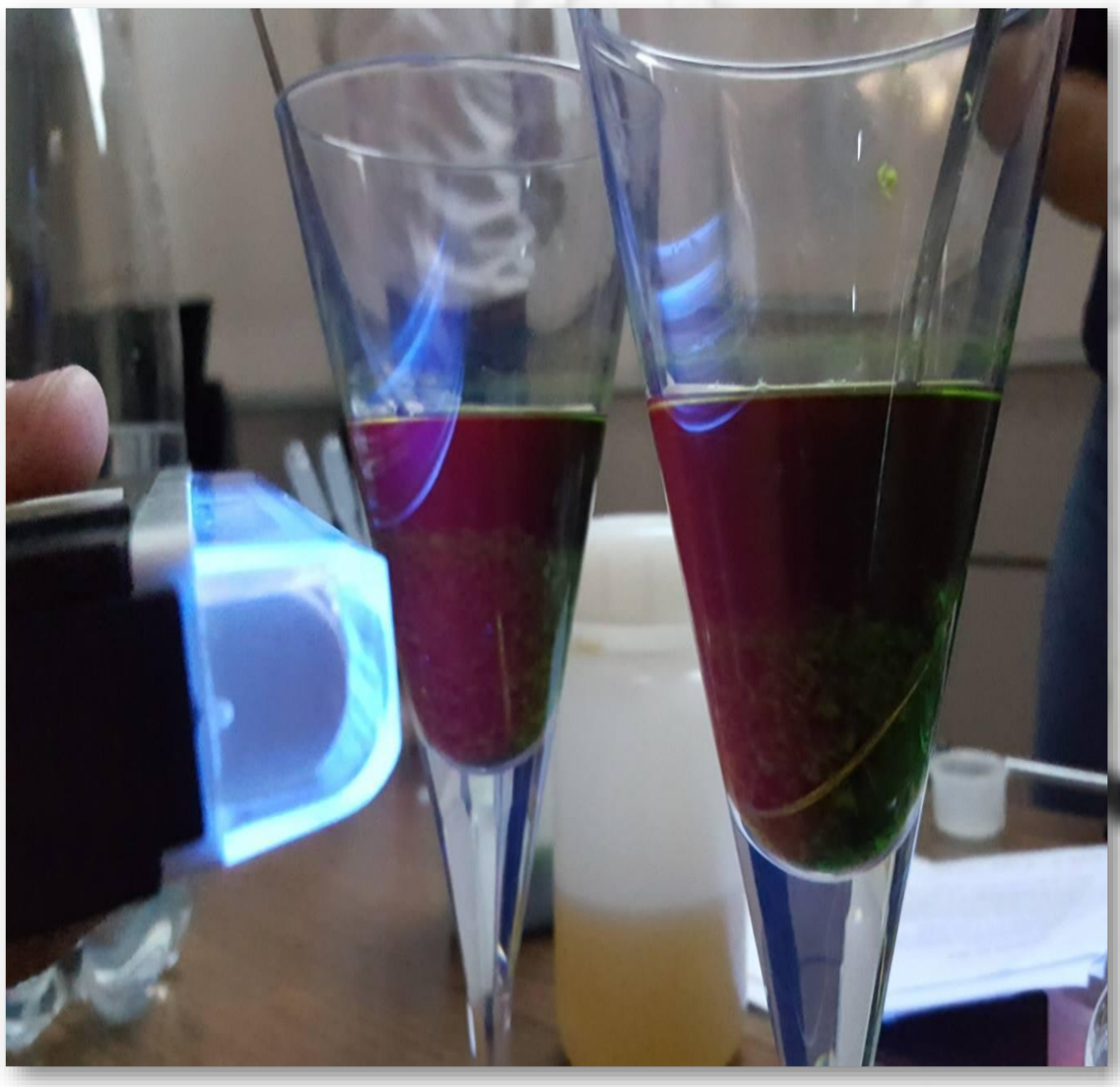
Alenka Perko Bašelj, Ljudmila Vrhovnik, Gimnazija Moste | Ljubljana | Slovenia

Dinner for two or how to teach natural phenomenon through roleplay

The Jolly Chemist Inn



In "Dinner for Two" students **play the role** of waiters and guests in a restaurant serving pseudo-ordinary dishes and drinks, but because of **irradiation of UV light**, they have an exciting, unexpected and unusual look, which calls for humorous inputs. Performers and the audience are entertained with what is seen and heard, as well as they adopt and consolidate the **phenomenon of fluorescence**. An **additional explanation** of the ingredients in dishes and drinks that exhibit flourescence is provided in the menu.

Real life example + simple experiment + roleplay + laughing → Excite curiosity + initiative for learning + inspiration for further research

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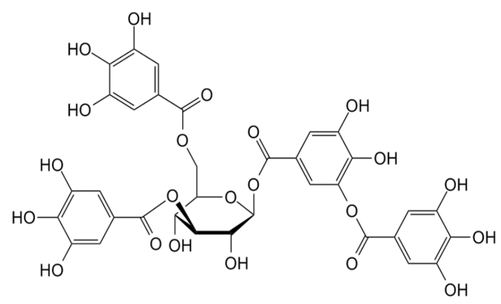
Renata Flander | Davorin Jenko Primary School | Cerklje na Gorenjskem | Slovenia

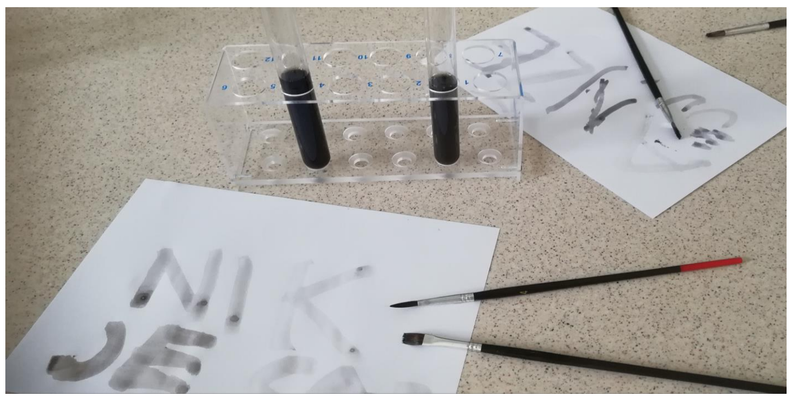
Tannin

„tan for leather, ink or medicine“



Why do we have bitter and dry feeling in the mouth while eating some food?

To find out make an easy investigation with experimenting in the kitchen. Boil tea or bark in the water, filter the solution to get an extract and put pieces of chicken skin into it. Tannin will compress the skin collagen. It can bind parts of proteins together in a way that we get a leather instead of skin. The same substance causes contraction of mucosa to heal the wounds and makes our mouth dry after the consumption of unripe fruit .



If we add a few drops of iron (III) chloride we get a black-blue solution called iron (III) tannate, which was once used as an ink. To avoid the chemicals, we can also put rusty nails into the extracts. To make science more fun we prepare different solutions to get colourful ink.

Tannin addresses students with different interests (tannery craft, medicine, ink), is easy to realise and fun. Students learn about science (percipitation of proteins …) about investigations (hypothesis, variables …) and develop experimental skills.

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Branko Koprivnikar & team | Gimnazija Litija| Litija | Slovenia

See, Think, Unlock! – GimLit Fortress

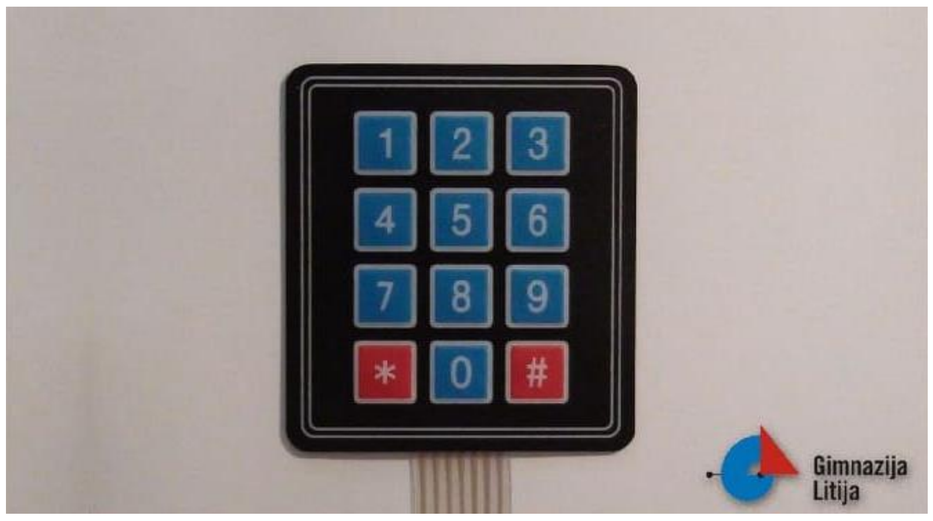
GimLit Fortress – a physical puzzle

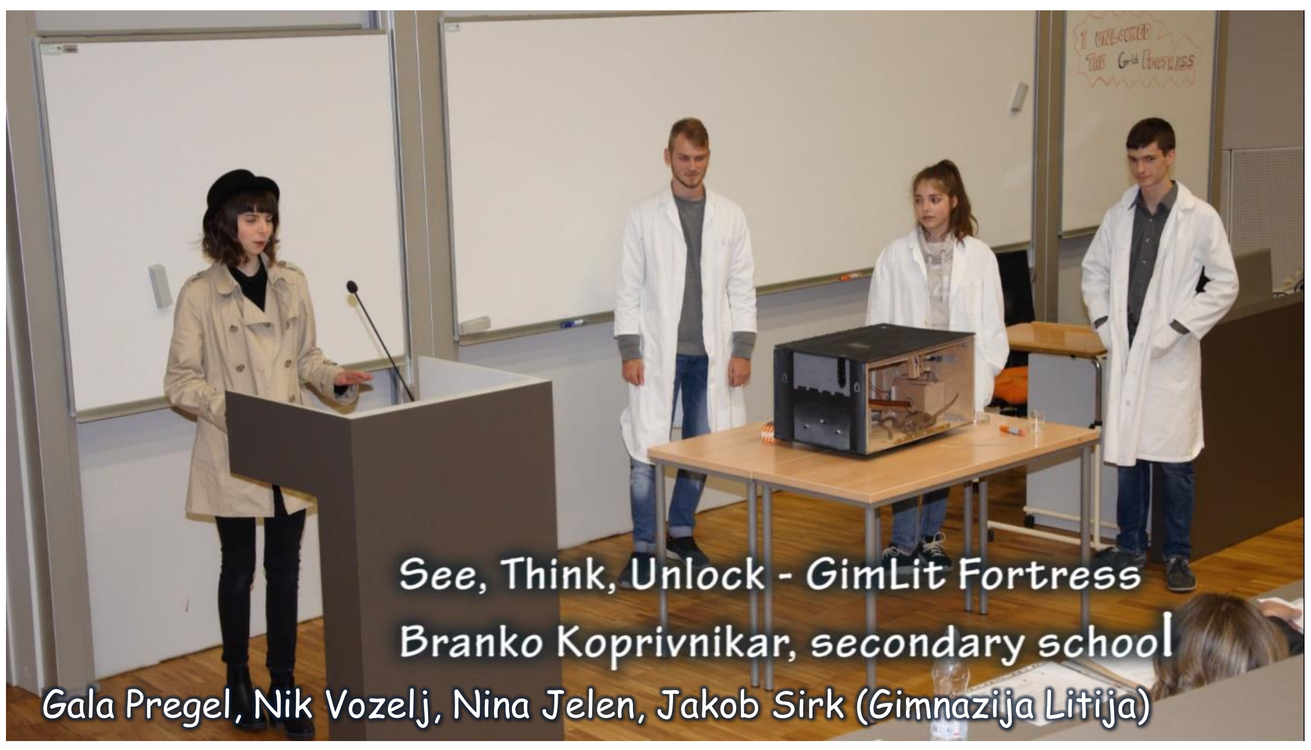
If you enjoy challenging puzzles and physical experiments, give it a try and escape our Fortress!

The concept of GimLit Fortress is simple:

if you **solve the puzzles**, you **unlock the door** and therefore **„escape“** the fortress. But as soon as you get into it, it turns out to be quite a challenge. First you will need to find the secret code, only then you can advance to the second phase. But of course, the code is hidden from the (naked) eyes. After you have entered the correct code, you gain access to the second puzzle and so on it goes until you unlock the door.

The puzzles are based on **various physical experiments** so it requires a bit of fundamental knowledge of physics to solve them (but nothing too specific). In order to find a solution just the knowledge of physics is not enough, so you will need to **think out of the box** and be **creative**.





Our fortress of physical puzzles is a very creative project, which will occupy the brain of every problem solver. It requires thinking „out of the box“, so it promotes logic and creativity and it‘s an interesting way to learn about physical experiments.

Low-Cost and Recycled Science

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THE EUROPEAN NETWORK FOR SCIENCE TEACHERS

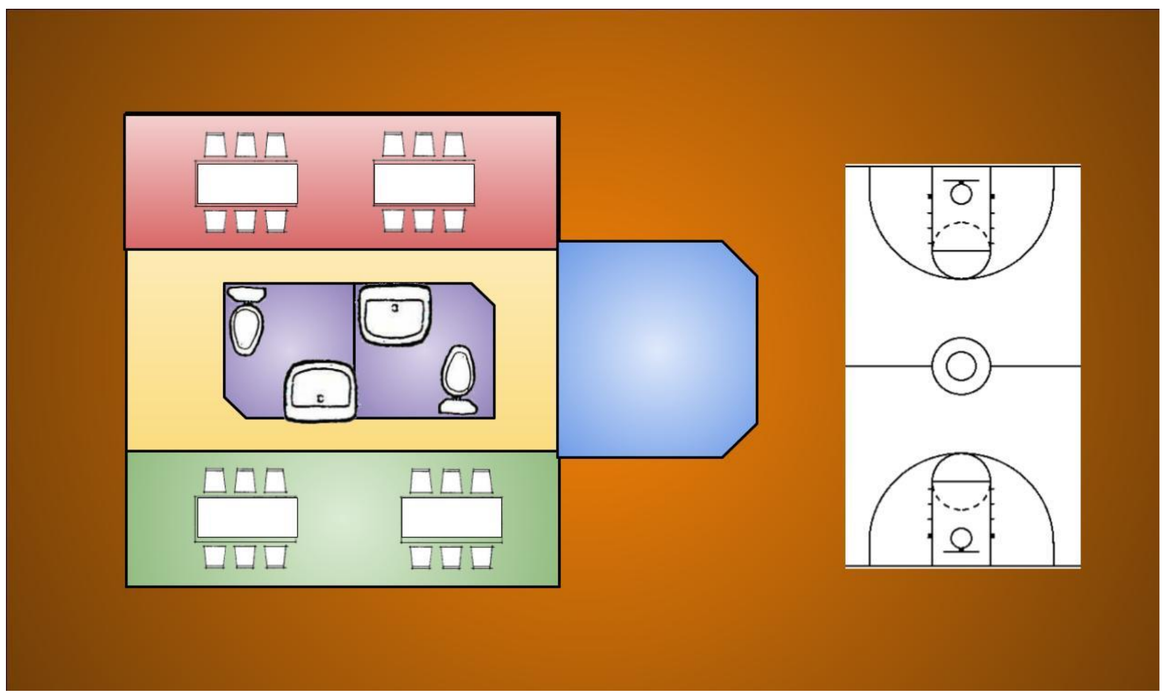
Carolina Clavijo Aumont| Itaca HighSchool | Tomares (Sevilla) | Spain

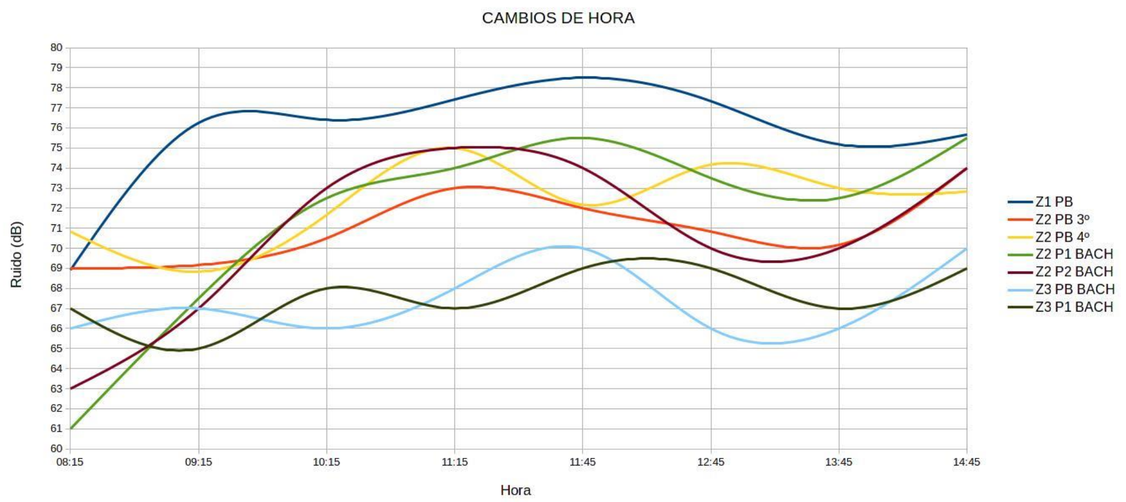
IES ÍTACA

To a low-carbon economy in the High School.

Every year CO_2 emissions increase. The sources of these emissions are varied, but people are the final cause. Our society is not concerned about the importance of this, but if we aware people from youth, situation will change.

Our investigation examines the environmental situation of our schools in different environmental sectors: water and electric consumption, waste and recycling, green areas and noise. Every sector has its own objectives.





Our objective is to propose various improvements in the educational sector to reduce carbon emissions, our impact in nature and economic spending which could be utilized in other sectors also.

Conclusion: We have verified that by changing our habits in our daily life, our schools would save a lot of money on energy and the consumption would be surprisingly low. But for this to happen we would need everyone's help

Low-Cost and Recycled Science

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THE EUROPEAN NETWORK FOR SCIENCE TEACHERS

Javier Julián Fernández | IES Ramón Muntaner | Valencia |Spain

¿ What does umami taste?

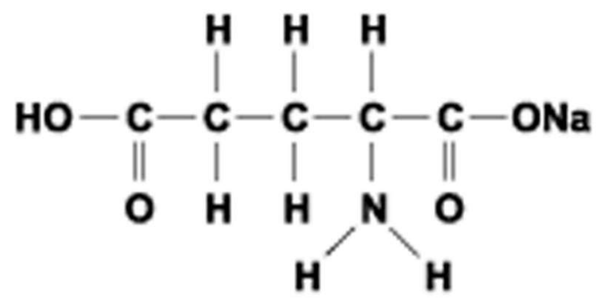
An innovative inquiry based on scientific method for less than 2 €

BASIC INFORMATION

Umami taste was identified the first time in 1908 by Kikunae Ikeda and was internationally recognized as the fifth flavor in the late 1990s. It is described as the savoury taste and Glutamate is the chemical compound which makes you feel the umami taste.

We discovered that there are people who DON'T LIKE the UMAMI taste and others who DON'T NOTICE IT.

Monosodium Glutamate molecule



$C_5H_8NNaO_4$ 169,111g/mol

THE INQUIRY

1 Search information about umami and monosodium glutamate (its industrial production, umami cell receptors, genes Tas1r1 and Tas1r3, glutamate-rich foods, E-621 additive, Chinese restaurant syndrome, its possible dangerousness, physiological functions ...)

2 Buy a 200 g package of Monosodium glutamate for 1,50 €.

3 Add 2.54 g in 1 litre of water (0,015M).

4 Start tastings, offering each person 10 mL of 0,015 M dissolution of monosodium glutamate.

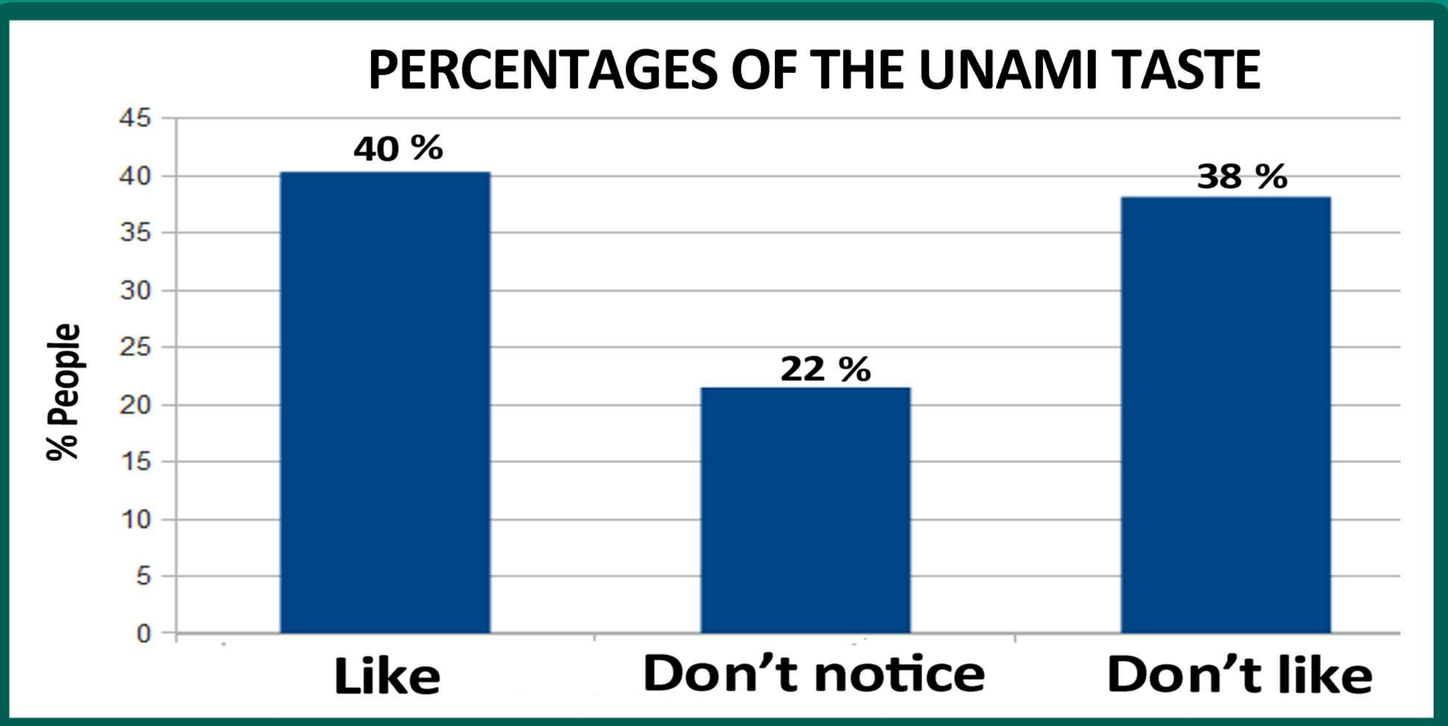
5 Analyze the results and get the percentages of those who like, don't like and don't notice it.

OUR RESULTS

1 Percentages: - 40% Like
- 38% Don't like
- 22% Don't notice

2 No differences between sexes

3 The T1R1+T1R3 receptor is the only one in the tongue that detects glutamate.



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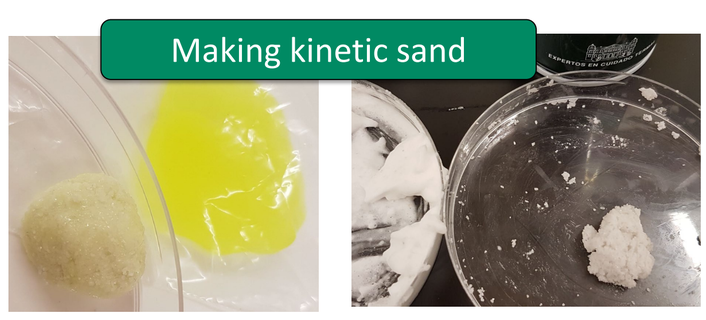
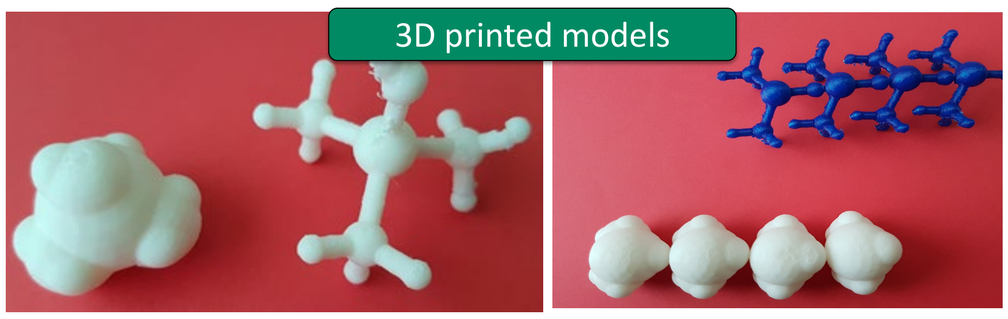
Fina Guitart; Carme Artigas; Jordi Cuadros | CESIRE Department of Education; La Salle Montcada; IQS School of Engineering |Barcelona, Spain

Superficial changes, new properties!

Learning with magic sand and kinetic sand

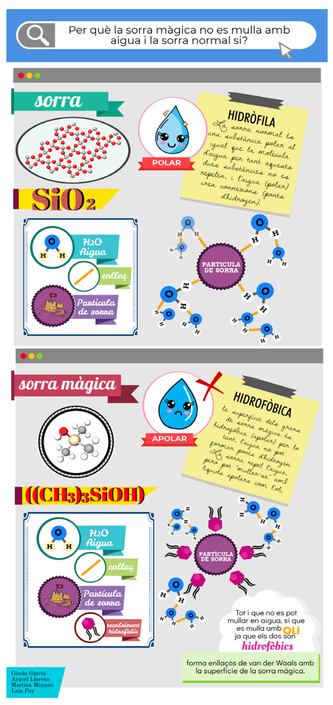
Properties of so called magical, kinetic sands compared with common sand are explored by performing simple and surprising experiments. Phenomena are explained with the support of digital technologies, in order to stimulate students' creativity in elaborating explanations and interpreting phenomena. Homemade experiments to make these amazing sands using common sand are also performed.



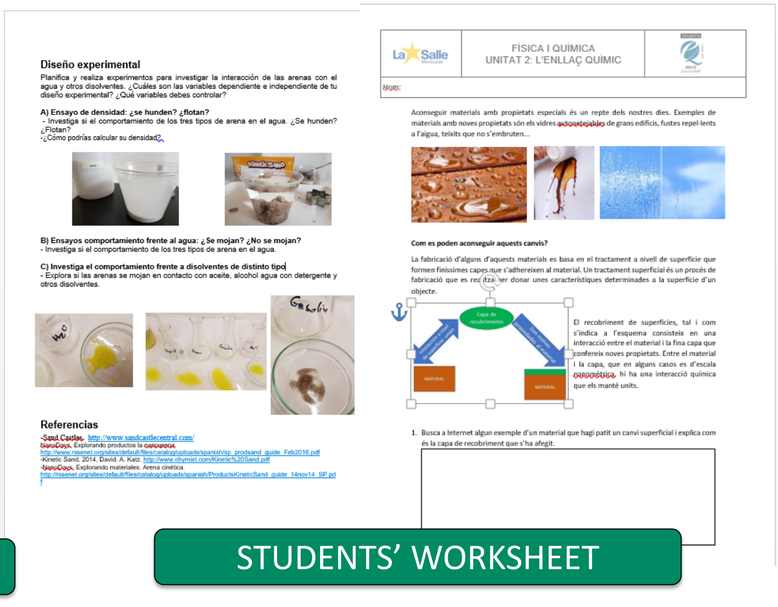


The project is structured in three modules, composed in a whole of a set of 12 activities and each activity has a worksheet which includes the information about context, curricular connections, questions, challenges and proposals for inquiry, practical work and references.

STUDENTS' PRODUCTIONS



TEACHERS' MATERIAL



STUDENTS' WORKSHEET

Conclusion: In the context of new materials, students investigate properties of different sands, manufacture them from homemade materials, and interpret phenomena at the molecular level, using animations, molecular and 3D printed models.

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THE EUROPEAN NETWORK FOR SCIENCE TEACHERS

Iria Vidal Legaz| IES La Florida | Las Torres de Cotillas | Spain

Searching for Pythagoras

Everything is number

Last year our travelled to the VI century b.C Crotona to visit the **Pythagorean Community** and deepen **on their way of life and discoveries** through the following activities:

- ✓ The musical scale
- ✓ Building the dodecahedron.
- ✓ Irrational numbers.
- ✓ The twelve knots rope.
- ✓ Is this angle straight?
- ✓ Puzzles.
- ✓ Checking the theorem.

Our activities are accompanied by QR codes that lead to our blog, in which we are reporting our work: www.floridamateslab.blogspot.com

Our trip has been a success, we have learned a lot about everything that surrounds this mysterious character, through manipulative and playful activities. Now we are fully trained to bring the secrets of Pythagoras to the whole world.

Low-Cost and Recycled Science

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THE EUROPEAN NETWORK FOR SCIENCE TEACHERS

Dan Englundh | Martin Koch-gymnasiet | Hedemora | Sweden

Experiment with scrapyard findings

To decide density and mean density of a tube of different materials can be tricky!

By reusing different materials, found partly in scrapyard, we can learn about density, mean density and finally apply the knowledge and understanding in other experiments.

- Calculate density of the tube, determine the material of the tube.
- Seal the tube openings, calculate the mean density and then answer the question “will the tube float or sink in water bath?”

- What happens to the candle when it slowly burns down?

High value for students learning process, low environmental impact and low cost and are some benefits with the idea of reusing material and other “everyday” items.

Low-Cost and Recycled Science

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THE EUROPEAN NETWORK FOR SCIENCE TEACHERS

Pia Johansson | Hamnedaskolan | Ljungby | Sweden

Flash and Thunder; Let‘s Talk About Energy!

Flash and Thunder

- Glue the pen
- Put it in the middle of the aluminum form
- A dark room
- Place the styrofoam on a table
- Rub it with the wool piece, about 10 sec
- Use the pen as a handle
- Place the aluminum form on the styrofoam
- Approach your finger to the aluminum form
- Hold with a finger on the metal pins on one of the ends on the fluorescent lamp
- Connect the other end with the aluminum form

Pet-Lamp

- Cut the long side and the bottom of the bag
- Fold it out, mark a hole for the bottle in the middle and cut it
- Fill the lamp with water and tighten the capsule
- Insert the bottle, a little more than halfway, into the hole
- Tape the plastic so that it is light-tight around
- Bring the construction in a dark room
- Put the bottle on a table, stretch out the plastic and rise the bottle
- Light with the lamp on the top

The students learn and predict the outcome of the experiment and explain the results to their classmates. The benefits of the project affect them to become more curious, motivated and interested in working with Science, Technology and Math.

Low-Cost and Recycled Science

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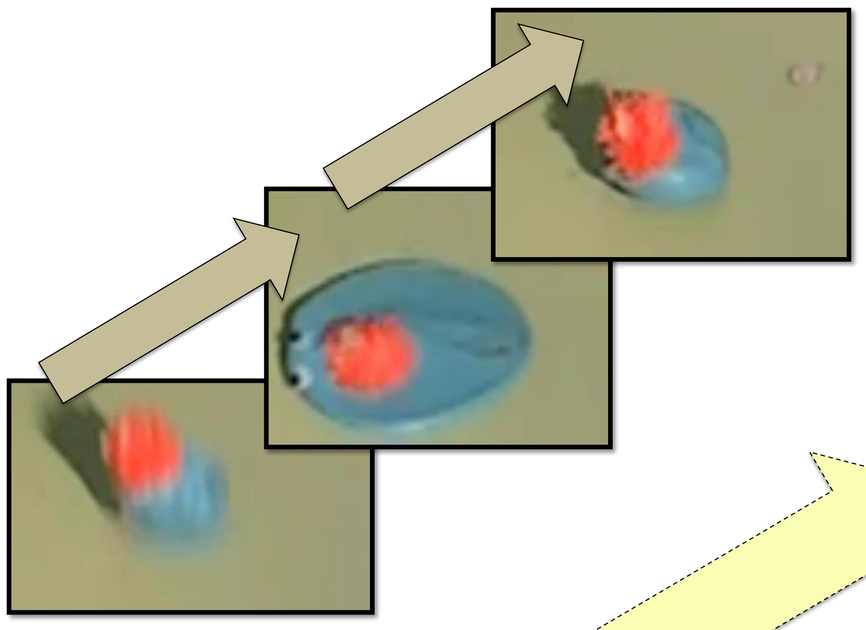
Felix Speerli| Primary School| Zwillikon & Wolfhausen| Switzerland

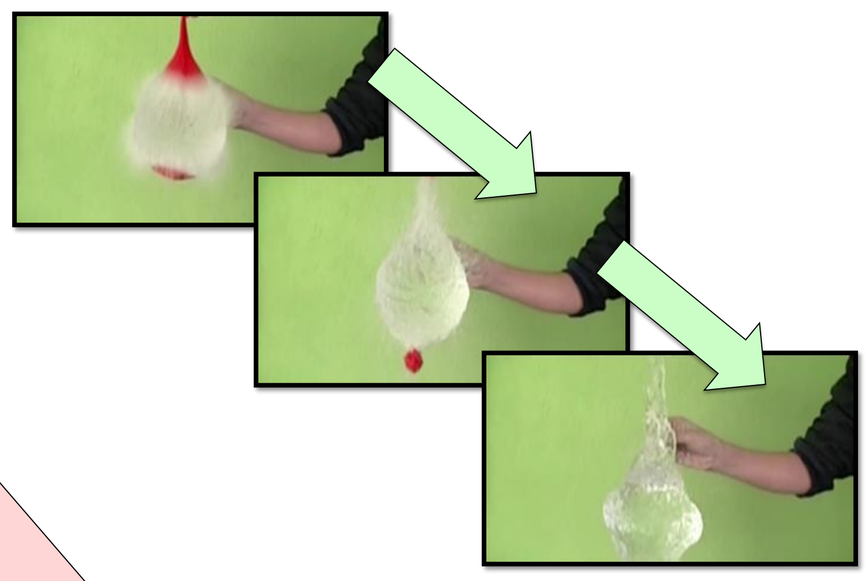
Project Time Machine

Make something visible that’s too fast or too slow for our eyes



The children are allowed to choose the experiment themselves

DEFINE RESEARCH GOAL
What do you want to find out?



Does the experiment fit the order?

CREATE HYPOTHESIS
Which result can be expected?

ORGANIZE EXPERIMENT
What do you need?
When are you doing it?
Where are you doing it?

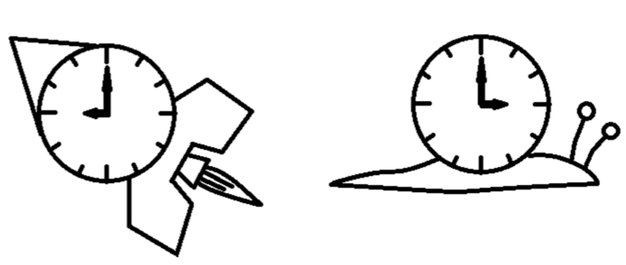
The children had to ...
... procure all materials
... set an appointment
... borrow the camera

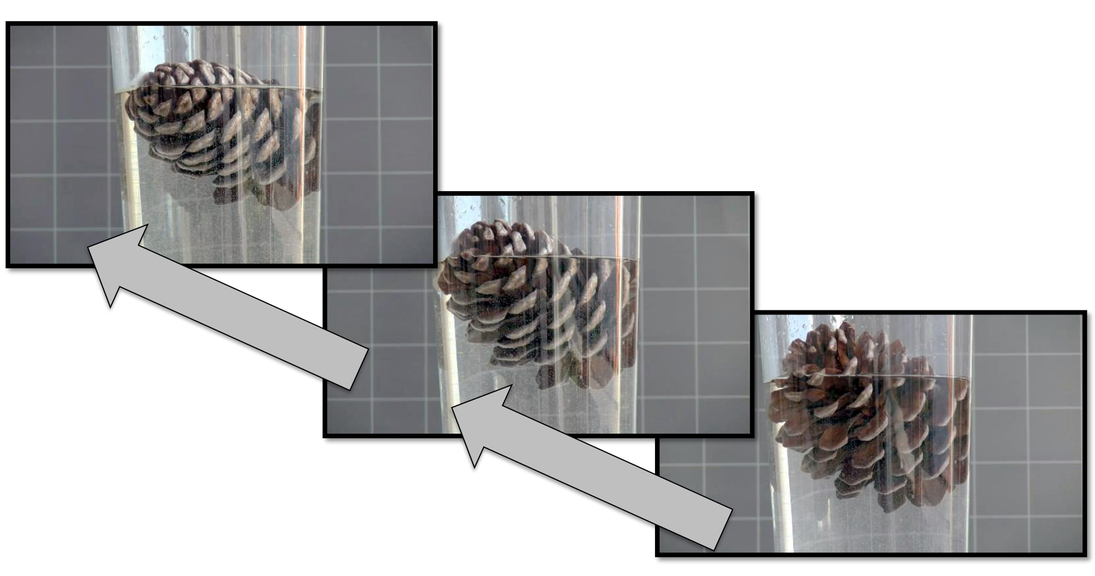
IMPLEMENT EXPERIENT
watch and record

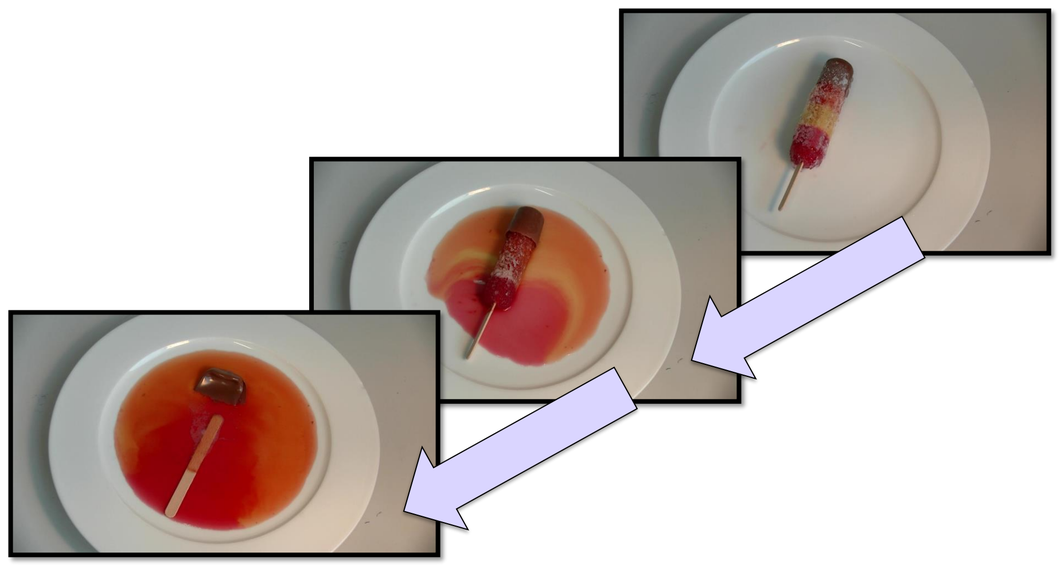
They could perform their experiment at school during lessons or at home and produce the slowmotion or timelapse video

EVALUATION
Analyze and present results

After analyzing the video they had to record their observations in an audio file, which was combined with the video.







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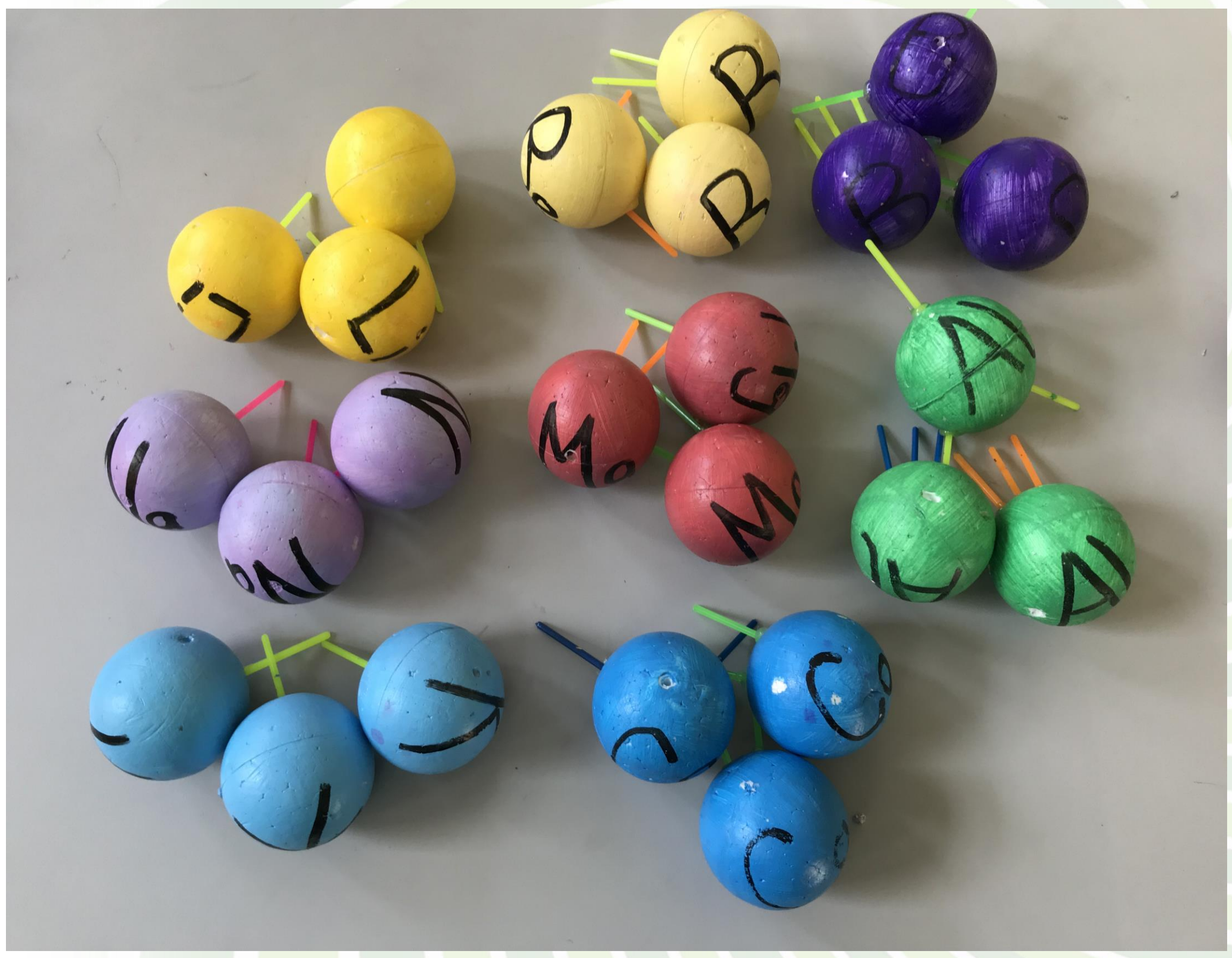
Semih Esendemir| Emine Emir Şahbaz Science and Art Center | Eskişehir | Turkey

Ionic Bond Puzzle

The concept of ionic bond formed by the combination of element, electron exchange, and the chemical bonding of the elements not being fully understood by students is the starting point of this project. In the 2016-2017 academic year, exam analysis and qualitative interviews with the students show that the subject is not understood due to being abstract. This educational material designed to solve this problem.



Pre-test-post-test model with experimental and control groups was used in the study. The study group consisted of 40 students studying in the 7-D and classes of a secondary school located in Odunpazarı district of Eskişehir province. The 20-question achievement test used to collect data was prepared by the teacher of the project according to the objectives of the subject.

The purpose of this study is to provide a more effective teaching of ionic bonds with a prepared educational material.

Scan QR code for video

Conclusion: Teaching methods such as explaining, question-answer and educational material method for the subject of ionic bond have increased the academic achievement of the experimental group students statistically significantly.

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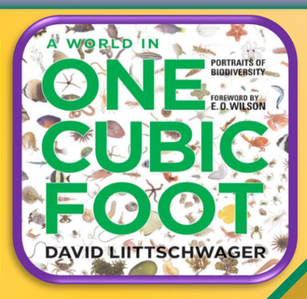
THE EUROPEAN NETWORK FOR SCIENCE TEACHERS

N. Sinem Mankir Oztan | Aci Schools| Istanbul | Turkey

Biocube Project-Biodiversity

«Slow down and Look at closely»

Source of inspiration:
«Smithsonian *National Museum of Natural History» in Washington, D.C*



Reasons to implement:

1. Connects field trips and science to **daily life**
2. Needs **minimal materials**
3. Enables students to **explore the diversity of life** even in a small area
4. Provides **a low-cost** science
5. Teaches how to become a **citizen-scientist**
6. Promotes **collaboration and teamwork**
7. **Examines different organisms**
8. **Compares** the biodiversity of different areas
9. Shows **the effects of climate** on living things
10. Improves **observation skills**
11. Uses **Internet**
12. Builds **interdisciplinary** relationships

Preparation and Build
- Site selection
- Trip organization
- Time
- Ws /hw
- Select building materials

Explore
- Observe closely
- Extract and collect

Identify
- Count and sort organisms
- Fill the forms
- Clean up

Share
- iNaturalist

Innovation: Interdisciplinary, cube materials, hw/ws, adapted to Istanbul, social responsibility

Scan QR to watch.

This inquiry-based project is easy, low-cost, fun, adaptable to everywhere/all grades, global and out of class.

sinem.mankir@acischools.k12.tr

Low-Cost and Recycled Science

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THE EUROPEAN NETWORK FOR SCIENCE TEACHERS

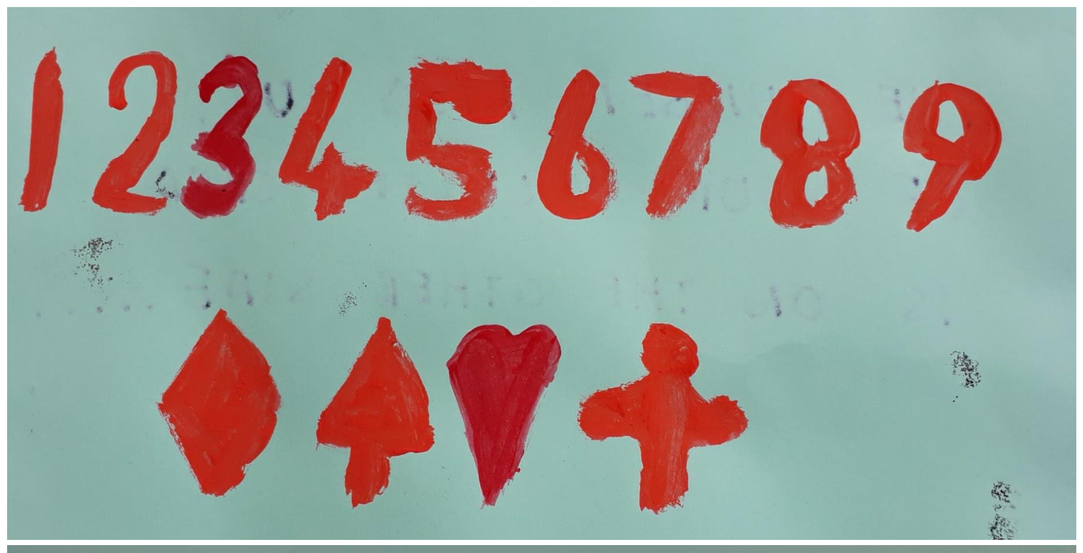
Adrian Allan | Dornoch Academy| Dornoch | United Kingdom

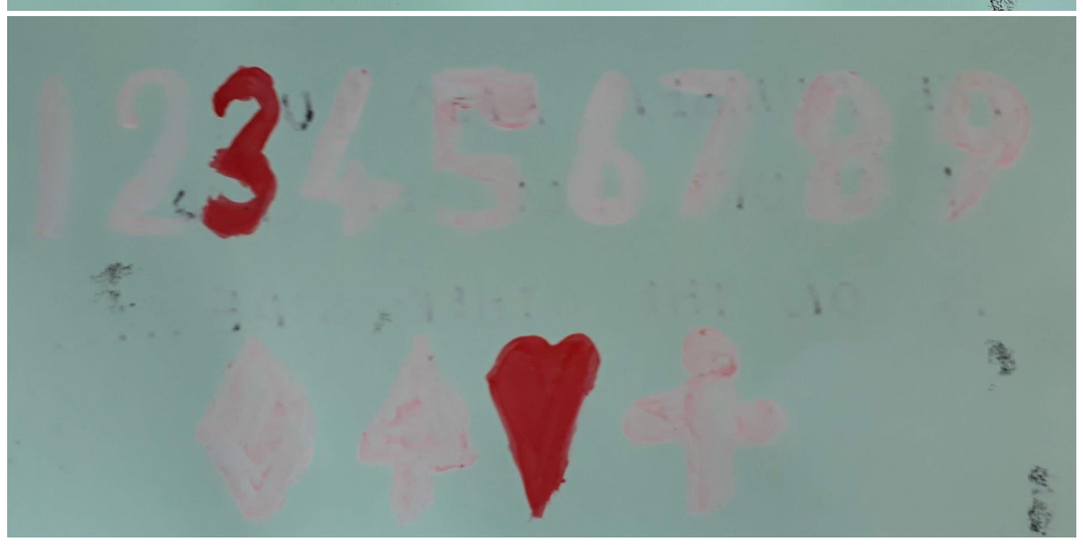
@DrAllan12

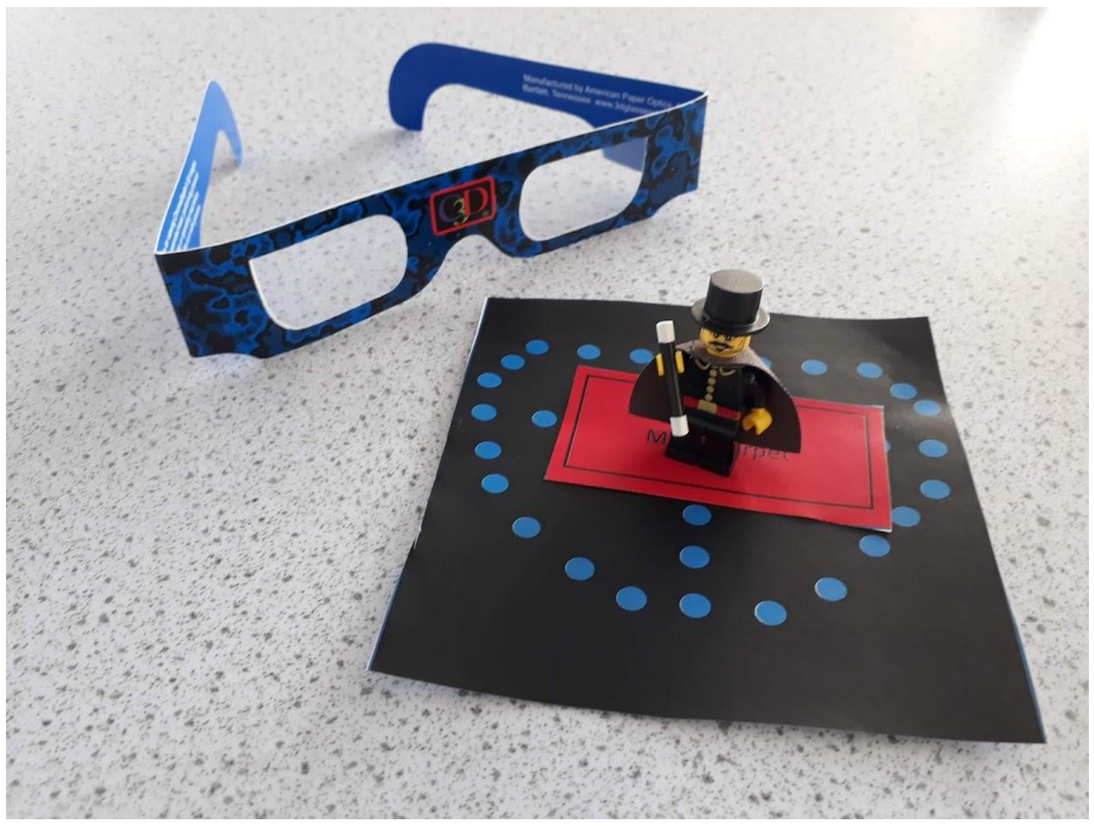
Be a Magician!

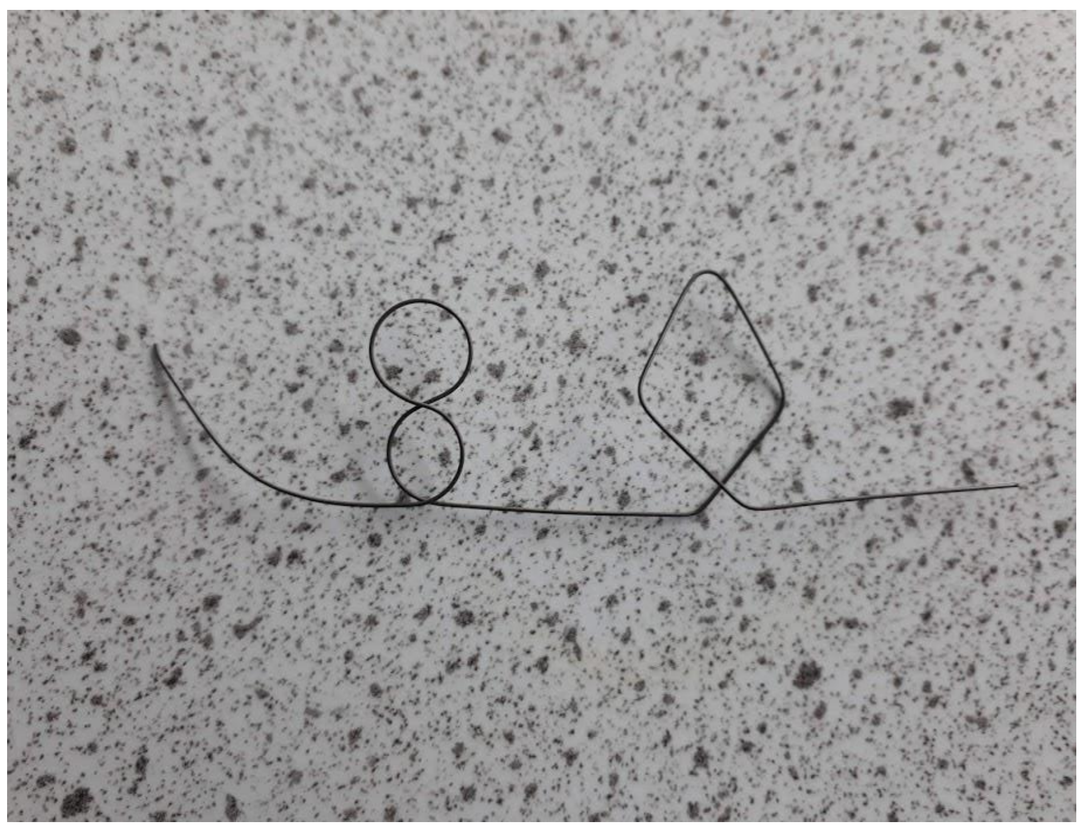
Using magic illusions to teach science

Spectacular science demonstrations and magic tricks share many things in common such as practice, showmanship, audience interaction and suspense followed by a moment of astonishment. Magic illusions were performed to pupils, the science behind the illusions was explained, then the pupils performed these tricks to parents and other pupils. Students learned science concepts and were able develop confidence and communication skills, in addition to having the great feeling of being able to astonish others.









Examples of the magic illusions are a floating carpet using Chromadepth glasses, a playing card revelation using thermochromic paint after heating the paper and metal bending into the shape of a selected card using nitinol memory wire.

Conclusion: Allowing the students to be the star performing the magic can help them to be more creative and confident at communicating science to others. This project showed anyone can be a magician!

Low-Cost and Recycled Science

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Mr Nick Baker | Queen Elizabeth‘s School | Crediton | United Kingdom

Using junk to make a device that collects energy from the Sun.

On a mission to Mars, explorers have to use the Sun‘s radiation to heat water.

One day space explorers will have to survive away from the energy infrastructure of Earth. **I challenge groups of students to use "junk modelling" to produce a working device that will collect energy from a star (the Sun).** They plan their device. They collect the bottles, tubes, bags, foil, that they need. They make their device and test it's effectiveness. More importantly, they learn about, teamwork, energy, recycling, space, perseverance, organisation and collaborative science.

At the end of the process participating students are rewarded for the device that heated the water by the greatest amount. There are also rewards for the best teamwork and the best science communication.

Conclusion: Participation in these lessons has improved students' engagement with lessons, their progress in science and their behaviour in school.

Low-Cost and Recycled Science

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THE EUROPEAN NETWORK FOR SCIENCE TEACHERS

Kathryn Horan | Pudsey Waterloo Primary | Leeds | United Kingdom

You're Fired!

A dramatic approach to primary science

Pupils will often say that their least favourite part of any investigation is the writing up afterwards, but reporting and sharing findings is an important part of the scientific process. To combat this, drama-based activities were introduced to allow pupils to share their learning in interesting ways, including:

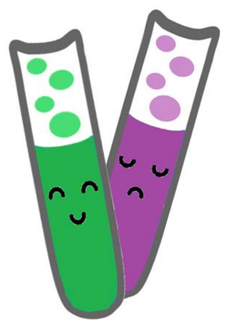
You're Fired! – Pupils take on roles as part of a system (e.g. the digestive system or parts of a plant) and argue the case against themselves being fired, describing their function as part of the whole.

Science Sales Pitch – Pupils create an advertisement or sales pitch for something, explaining how it is suited to it's purpose (e.g. selling a skeleton to an alien who doesn't have one, or a specific material to NASA that has properties making it suitable for spacesuit visors.

Newsflash! – Pupils take on the role of a TV news presenter and share their findings in the style of a news bulletin.

Using this approach, cross-curricular links can easily be added to enhance science learning, including:

- **Speaking & Listening**
- **Drama**
- **Literacy**
- **ICT**



In addition, the pieces of drama created by pupils can be useful to gather assessment information, as explaining concepts in this way requires a good understanding of them.

Using these drama activities with science concepts proved to be a highly motivating way for pupils to report on their learning in science while engaging in discussion with their peers and practising a range of other skills.

@SciKathryn

thatsciencelady.com

Low-Cost and Recycled Science

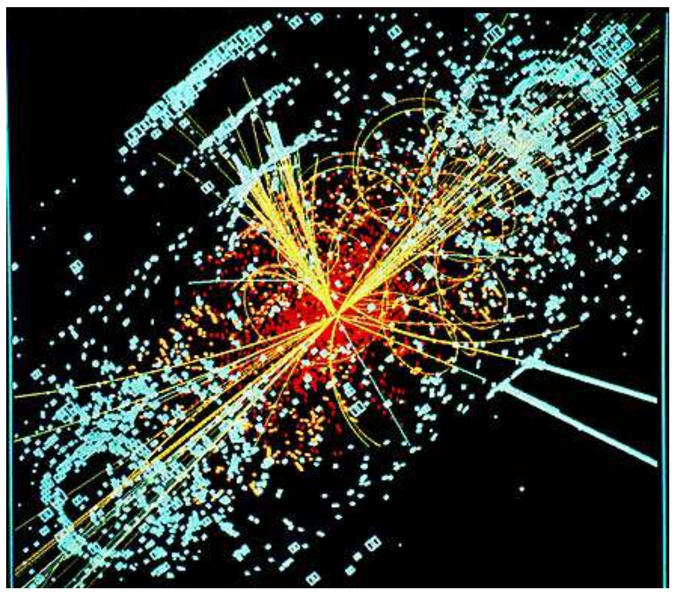
SCIENCE ON STAGE 2019 CASCAIS
THE EUROPEAN NETWORK FOR SCIENCE TEACHERS

Robin James, Exeter Road Primary School, Exmouth, Devon, UK - @SandYachtGuy on Twitter

The Hula-hoop Hundreds-and-thousands Hadron Collider (HHHC)

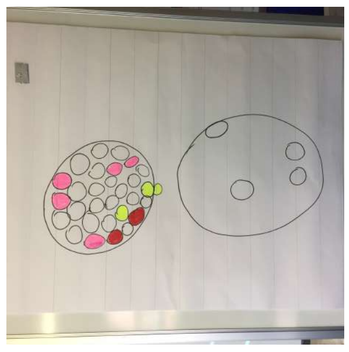
why & how?
PRIMARY SCIENCE TEACHING TRUST

Introducing particle physics and CERN to primary-age children

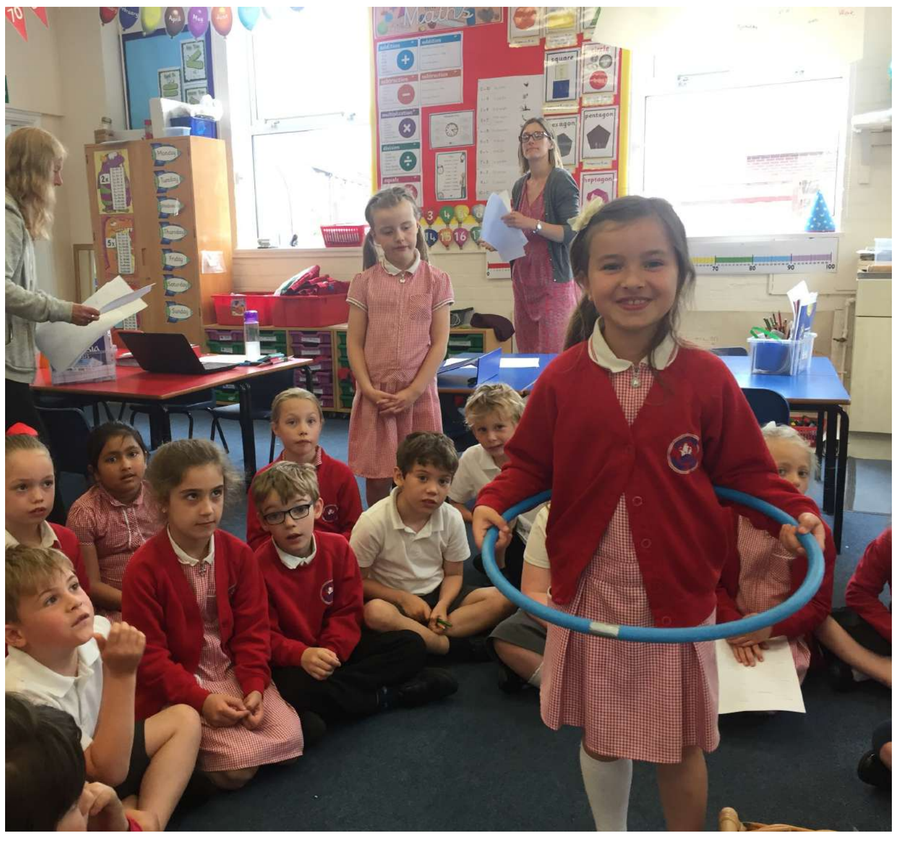


Ask an *adult* what an atom looks like, or what size it is, and the answer you get may be hazy. Really Small Things (and Really Big Things like galaxies) can be difficult to comprehend. Where do you start when you want to introduce young *children* to the concept of particle physics? The idea that there are actually some things which are *too small for us to see* seems a good place.

Microscopy draws children in. Looking closely at clothing fibres or strands of hair on a friend's head will generate gasps of wonder. Or you could try breaking a block of plasticine into smaller and smaller pieces, asking, *How small is it possible to go?*



The HHHC is a fun way to introduce children to the work of particle physicists at CERN. CERN is all about collisions, and children certainly know plenty about them from their playtimes. They won't know about proton decay, quarks or gluons – but they will know about collisions!



Just like at CERN, the HHHC produces data. Circular patterns are made when cake sprinkles (also known as 'hundreds-and-thousands') stick to adhesive tape. The tape covers a circular hole (1cm diameter) drilled in the side of a plastic hula-hoop. The particles (hundreds-and-thousands) are accelerated by the act of hula-hooping (though perhaps not quite to light speed!). The patterns produced can be predicted, collected, examined, sorted and discussed. You can even hunt your own Higgs boson!

The LHC churns out a staggering quantity of data! Mirror that process while exploring things too small to see with your eyes.

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THE EUROPEAN NETWORK FOR SCIENCE TEACHERS

Caroline Riggs | St Andrew's CofE High School for Boys | Worthing | United Kingdon

1000 paper cranes: Teaching radiation in context.

The story

Sadako was a young girl living in Hiroshima when a nuclear weapon was dropped on the city during WWII. When she was 11 she was diagnosed with leukaemia as a result of the background radiation.

Whilst in hospital she made 1000 paper cranes, in the hope that she would be granted a wish. After her death at the age of 12, the paper crane became an international symbol of the innocent victims of nuclear warfare.

In the lesson

After teaching my students about atomic structure and nuclear decay I used a lesson to tell them this story and discuss how they felt about the different uses of radioactive material.

Each pupil then made a paper crane for the display. They had the option of using written instructions, video instructions or to see a demonstration. This allowed them to reflect on the best way for them to learn this skill.

At the end of the lesson we discussed ethics, progress in scientific discovery and how this topic linked to the History curriculum.

We should always look for ways to teach **science in context**. With a story, or a debate that allows young people to form their own opinions.

@SciRiggsy

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THE EUROPEAN NETWORK FOR SCIENCE TEACHERS

Nina Hodovana | Kharkiv College of University of Telecommunications | Kharkiv | Ukraine

Physics Laboratory From E-waste or

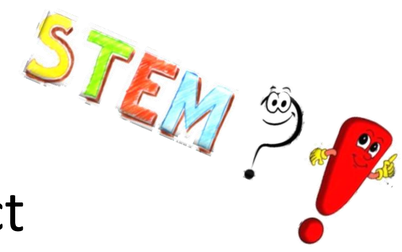
"How do our gadgets work? "

- What is a school physical laboratory?
- It is very expensive or virtual.

- What is E-waste?
- It was high-tech products, but they has been thrown away!

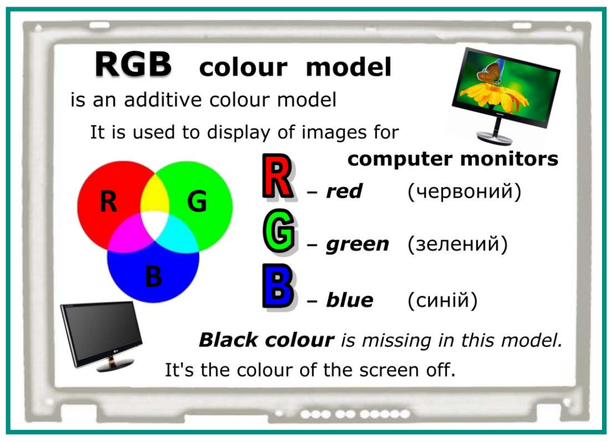
We study physical phenomena:

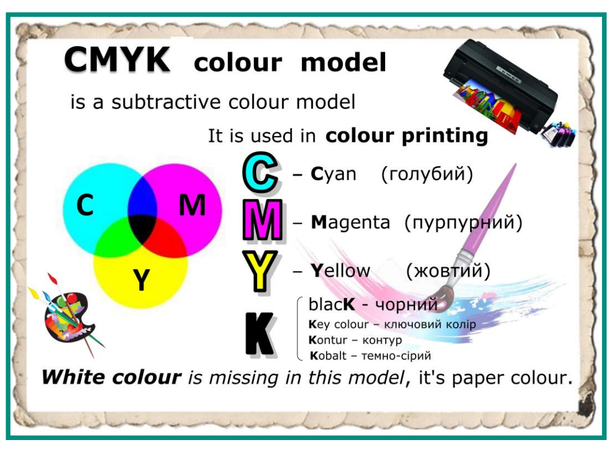
- TIR or total internal reflection
- RGB and CMYK colour models
- Interference
- Diffraction
- Polarization
- Doppler effect
- Photoelectric effect



We used in this project:

- Cases of computers
- Computer mouse
- Computer fan
- LED displays
- Photo paper
- Optical discs
- Cd boxes





We study the physical principles of telecommunication

- Optical fiber
- RGB and CMYK colour models
- Television scanning
- Liquid-crystal display
- Optical data storage
- Processor manufacturing

Our lab was created by students. We used that for scientific picnics, travelling exhibitions and popular lectures. This project aims to develop creativity and keeps students motivated.

Low-Cost and Recycled Science

SCIENCE ON STAGE 2019 CASCAIS
THE EUROPEAN NETWORK FOR SCIENCE TEACHERS

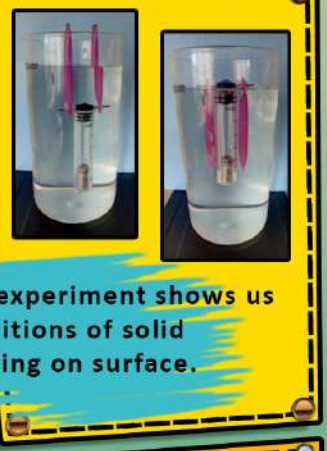
Tatiana Kravets | Educational complex «Gymnasium HEART» | Kharkov | Ukraine

Physics out of the Pocket

Objectives of this project:
to conduct physics experiments with simple and comprehensive things, without financial investments, and devices made by children themselves.

Goals of experiments:
to evoke feelings of amazement, delight and plenty of questions where the answers would perfectly match the quotation "The problem has a simple solution".

Sinking man



The experiment shows us conditions of solid floating on surface.

Orbeez

The experiment shows us phenomenon of properties of light at the border of two medium: water and air

Balance experiment

Equilibrium experiment is based on steady balance state that is reached with help of additional objects to change initial center of gravity.

In my work I demonstrate the connection between simple experiments and serious science using the same laws of Nature.