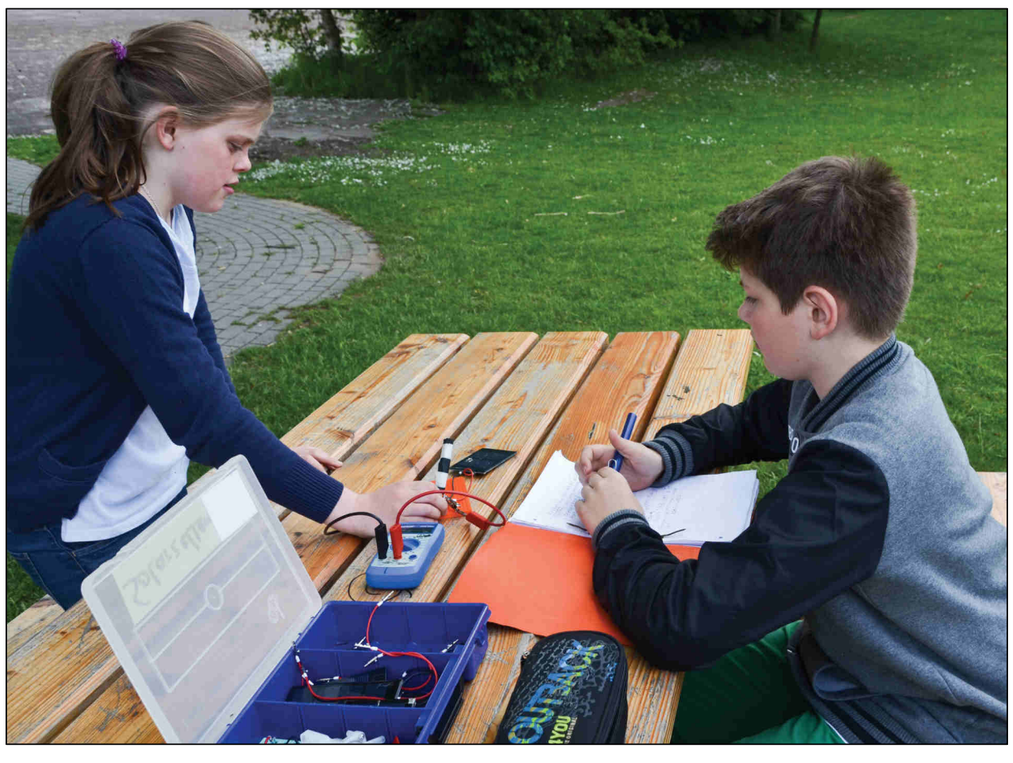
Science and our Environment

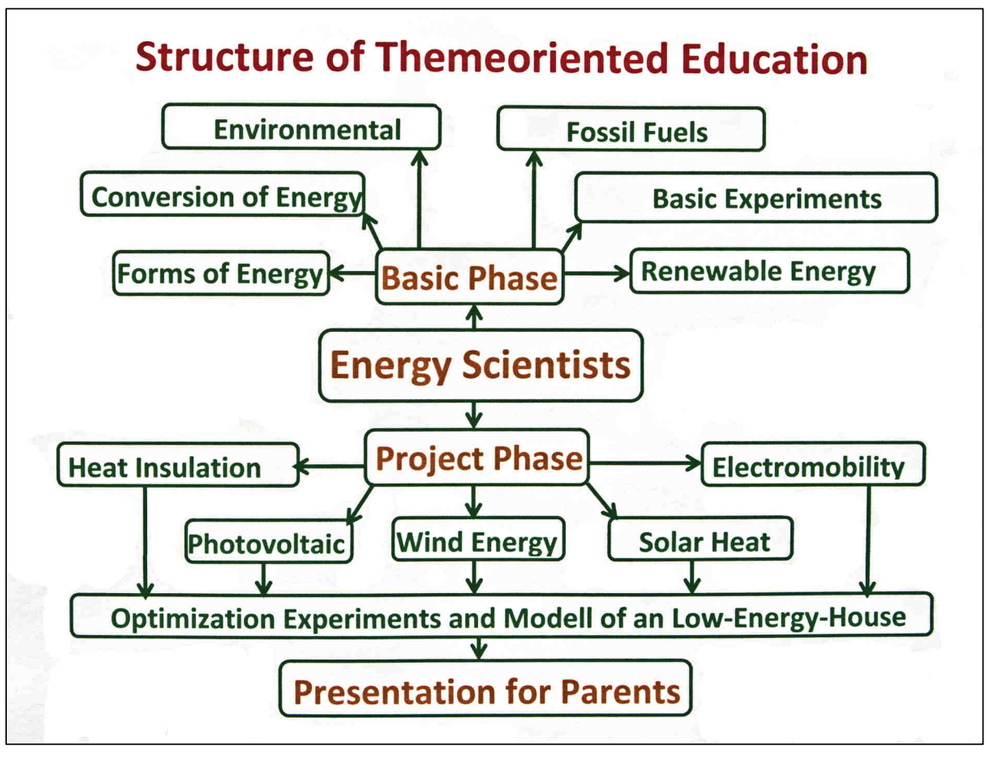
SCIENCE ON STAGE 2017 DEBRECEN
THE EUROPEAN NETWORK FOR SCIENCE TEACHERS

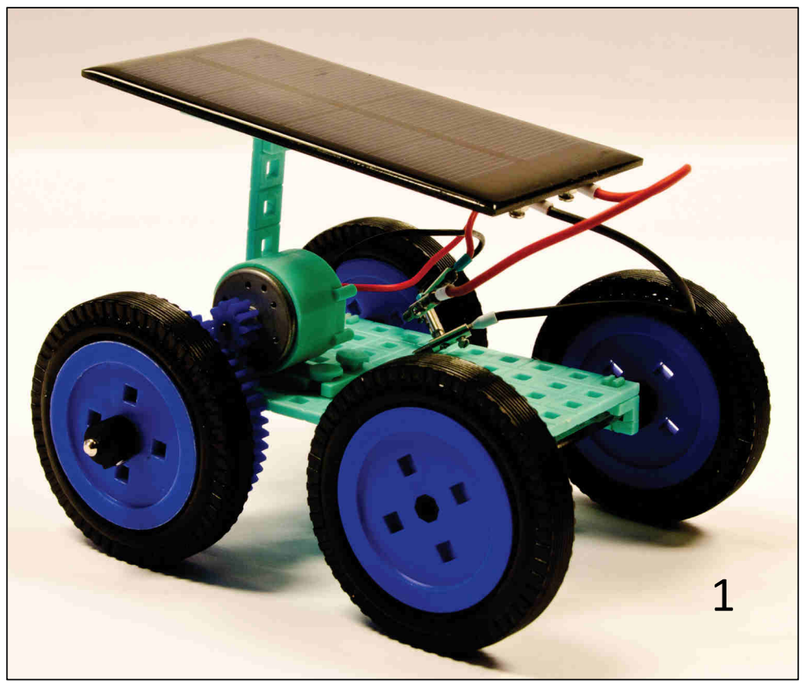
Dieter Schmidt | Integrierte Gesamtschule Oyten | Oyten, Lower Saxony | Germany

6-graders explore renewable energy

A science-social studies-technics project

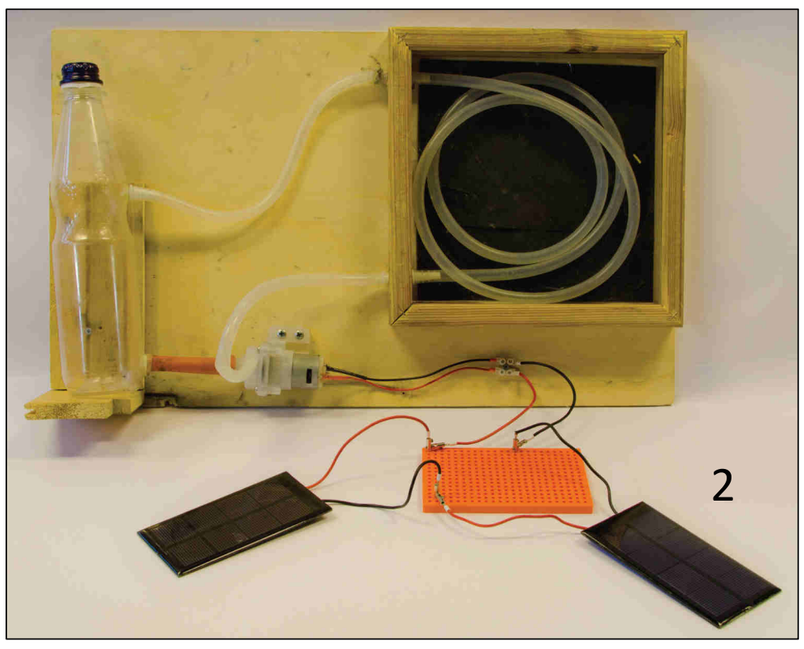


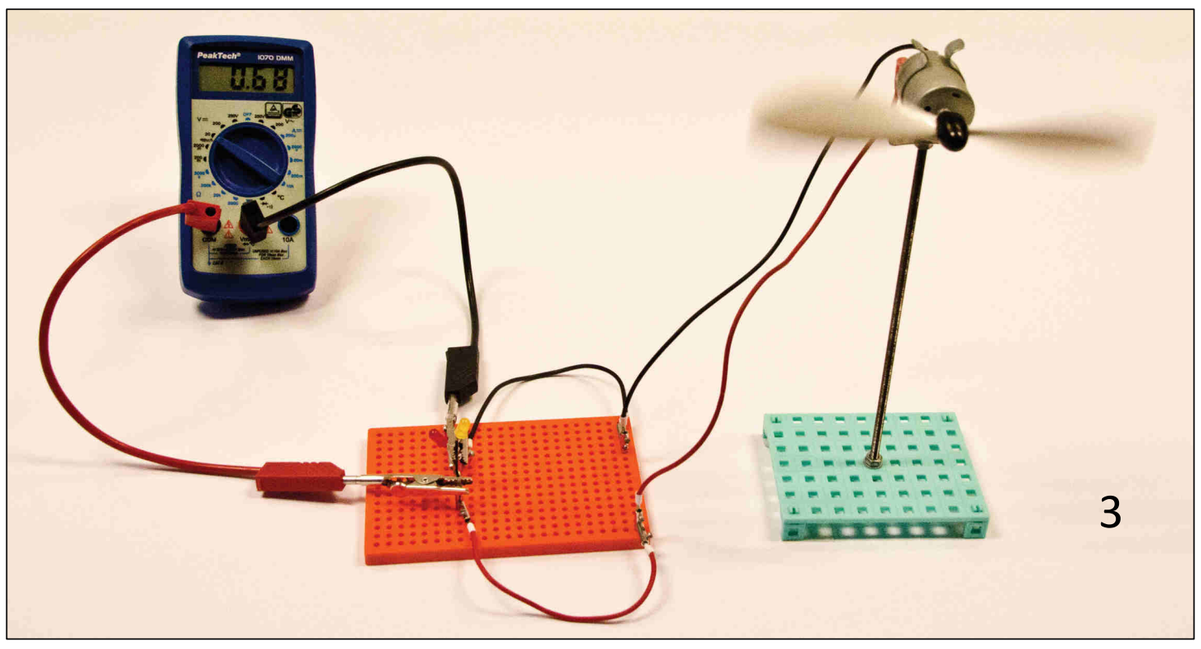




During the **basic phase** the pupils learn the basics about the renewable energy-topics. In the **project phase** they specialize in one of the energy-supply elements of a low-energy house. They optimize …

- … a solar car (1): How do I have to construct the car to make it faster?
- … a solar collector (2): How do I have to modify the modell to warm up the water?
- … a wind mill (3): How do I have to construct the rotor to increase the amount of electrical energy?





Conclusion: The pupils enjoy this activity-oriented project. They study theoretically as well as experimentally!

Science and our Environment

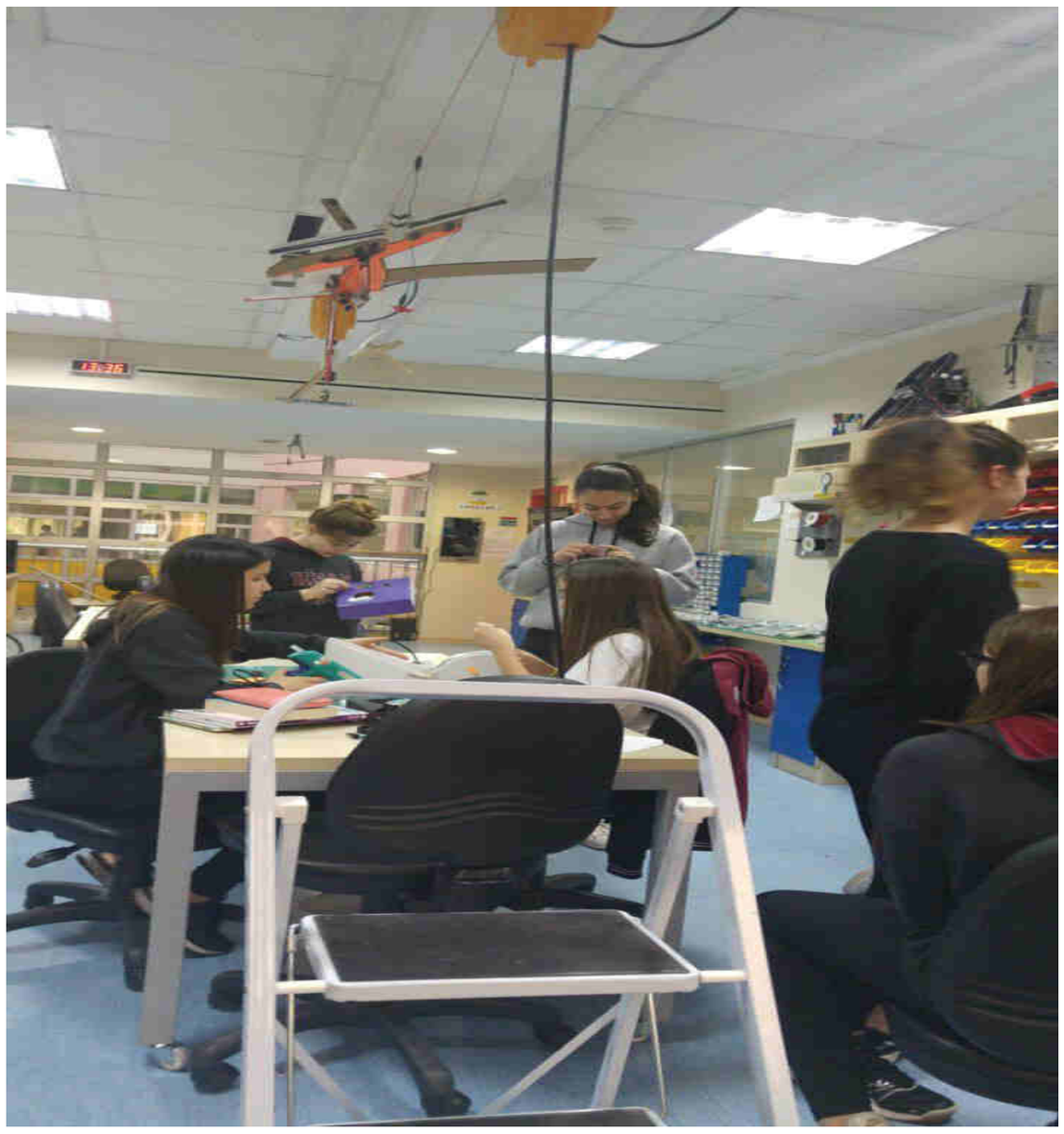
SCIENCE ON STAGE 2017 DEBRECEN
THE EUROPEAN NETWORK FOR SCIENCE TEACHERS

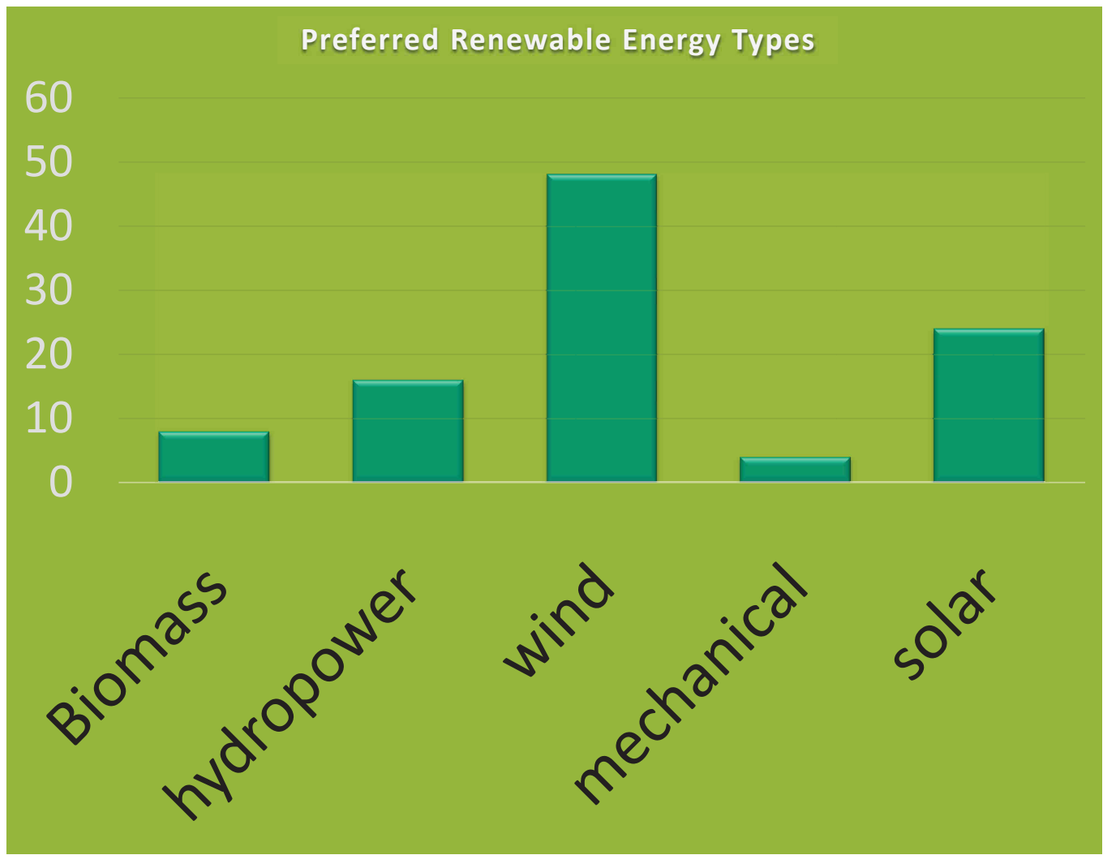
Hatice Ergi and Özge Aydemir
HISAR SCHOOL| ISTANBUL | TURKEY

RENEWABLE ENERGY

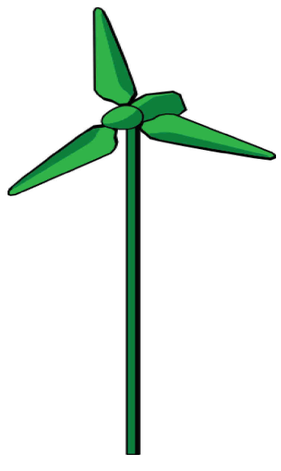
This is a PBL project centered on energy sources and their effects on the environment in which students design a model that would supply the energy need of one of our science laboratories to decrease the use of fossil fuels as a solution to the problem that is “Which alternative energy source is suitable to generate electricity to meet the energy need of one of Hisar School’s science laboratory sets?“. After a detailed research, students present their models explaining how it would contribute to solutions to the energy related problems and discussed which model is the best solution to the PBL problem they are given.

100% Great!





According to class discussions, considering the environmental factors that school is located in, students decided that wind energy is 48% more useful compared to others.



Science and our Environment

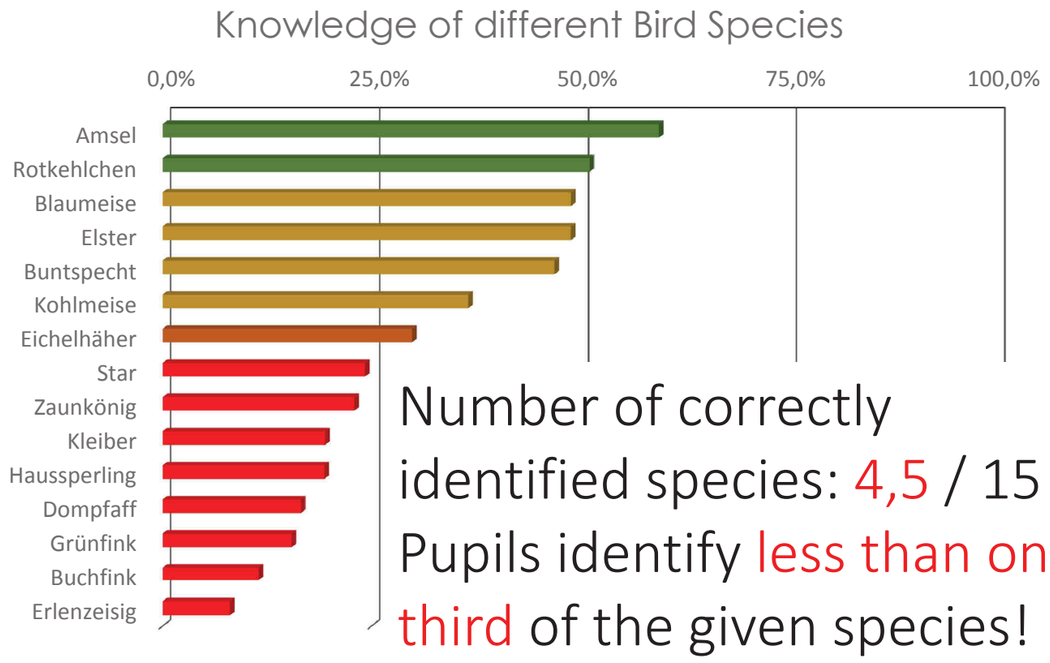
SCIENCE ON STAGE 2017 DEBRECEN
THE EUROPEAN NETWORK FOR SCIENCE TEACHERS

StD Thomas Gerl | StR Johannes Almer | Ludwig-Thoma-Gymnasium | Prien | Germany

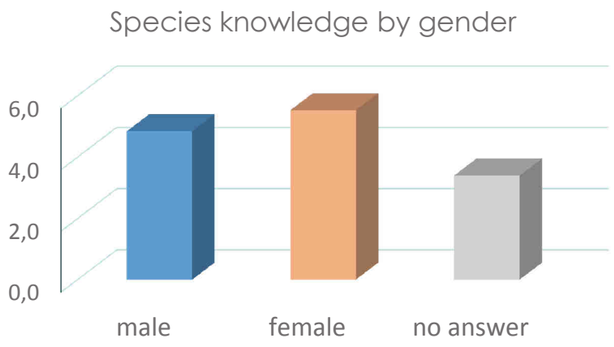
BISA – Birds in School Assessment

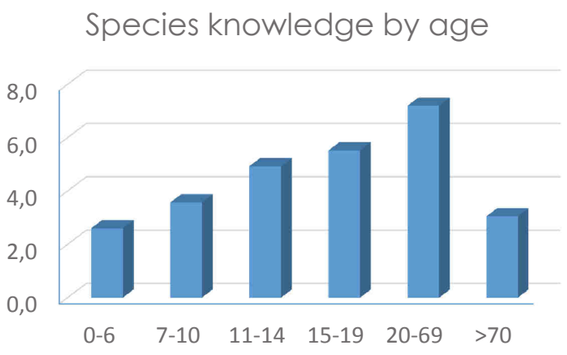
Biology, Physical Science, Computer Science and a lot more

How many passerine birds can pupils identify?



Number of correctly identified species: 4,5 / 15
Pupils identify less than one third of the given species!



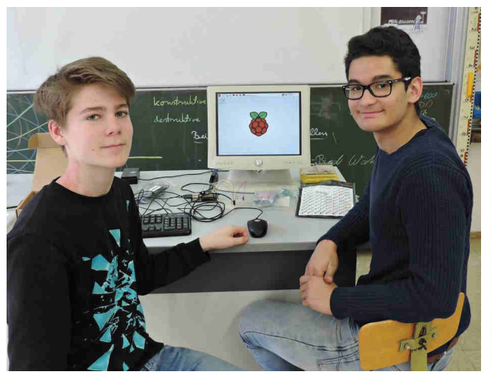


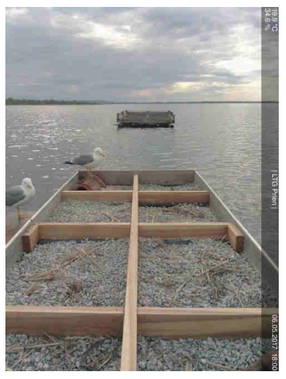
How does our project improve the knowledge of species ?

BISA

„Observing by using HighTech“

Development of a Low Cost/High Tech observation tool





RaspberryPi controlled device to watch nesting activities in remote areas

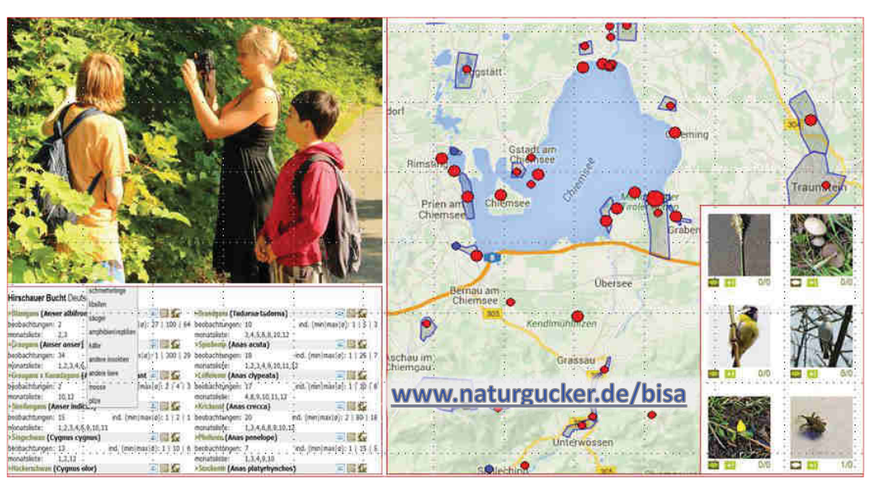
- ✓ Webcam (including infrared detector)
- ✓ Integrated temperature sensor
- ✓ Motion sensor, …

„Outdoor and Online“

„motivating practice“

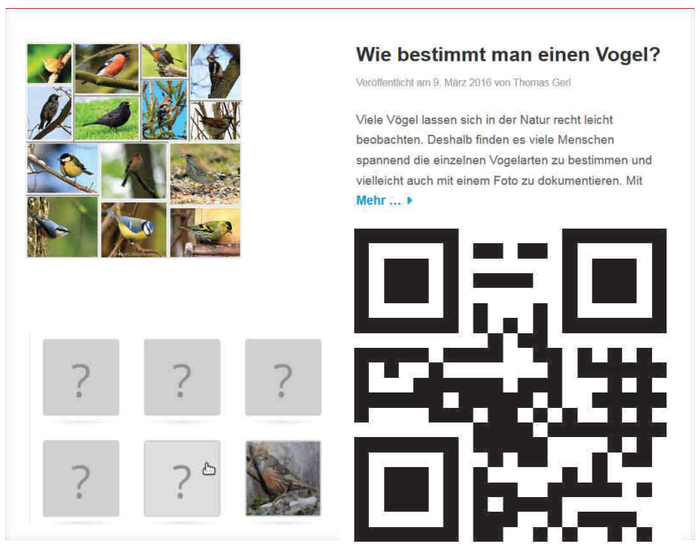
Outdoor Observation tools

Online documentation tools



Online identification exercises

at www.vogel-bisa.de



Indoor teaching materials

C	D	E	F	G	H	I	J	K	L	M	N
Klasse	s(W1)	t(W1)	s(W2)	t(W2)	s(W3)	t(W3)	MW (Streck	MW (Zeit)	Flugzeugtyp	Länge	Breite
6d	12,95	2,15	8,3	1,59	14	1,73	11,75	1,82	1	29	13
6d	12,02	1,65	12,75	1,83	10	3,36	11,59	2,28	1	29	10,8
6d	13,95	3,13	7,4	1,35	11,8	2,32	11,05	2,27	1	30	8,4
6d	10,7	2,4	9,6	2,6	11,65	2,22	10,65	2,41			

Scientific research:
e.g. paper plane competition

contact: gerl@ltgprien.de

Science and our Environment

SCIENCE ON STAGE 2017 DEBRECEN
THE EUROPEAN NETWORK FOR SCIENCE TEACHERS

Gerald L. Decelles III | Skagerak International School| Sandefjord | Norway

Building a Sustainable Future

Introduction

Working both individually and in small groups, students try to address the challenges of sustainable development in the future. The project is design to make students part of solving the problems of the future and to push them outside of the comfort zone.

Phase 1

After short lectures/movies on the energy challenges of the future students begin the first stage of the project by researching and testing energy efficient home designs utilizing the Energy 3D computer simulation. Students use and apply the Scientific Method with the simulation, testing for a single variable, and using the simulation's analysis tools to analyze results that will be disseminated in a lab report.

Students in Phase 1 of the project work independently to investigate factors that impact the energy efficiency of their design.

Phase 2

In the second stage of the project, students work in small groups or pairs to apply what they have learned during the first stage of the project to a design challenge; creating an energy efficient home design that meets an applied set of design specifications (footprint, cost, etc.). Students continue to utilize the Energy 3D simulation to create and test their design. Utilizing the simulations software, students are able to print out plans that allow them to construct their design out of foamcore board or cardboard. Students present their projects through a research poster and constructed house design at a sustainable design exhibition.

At the exhibition, students were able to present their work to a diverse community.

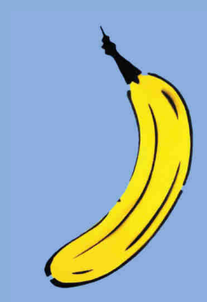
Students in Phase 2 had to build their design model, a part which many students found the most challenging and the most enjoyable.

100% Great!

In order to tackle the problems of tomorrow, students need the ability to create and build solutions today.

SCIENCE ON STAGE 2017 DEBRECEN
THE EUROPEAN NETWORK FOR SCIENCE TEACHERS

All BANANA!



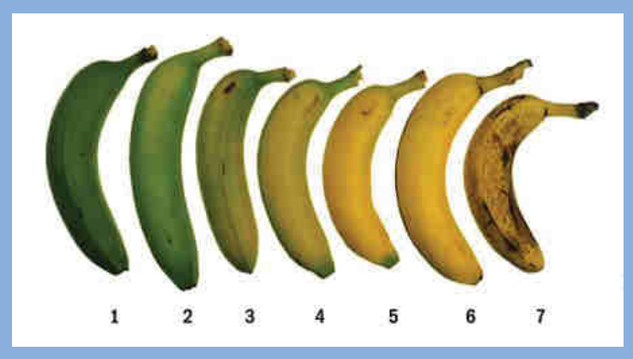
Short experiments around bananas

Science on Stage - SWITZERLAND

Dr. Sacha A. Glardon (Gymnasium Bäumlihof, Basel) & Thomas Scheuber (Gymnasium Kirschgarten, Basel)

Ripening

- *Why is a ripe banana sweet, juicy, soft and tasty, whereas a unripe fruit is sour, farinaceous and hard?*
- *Why does the colour change?*



Ethene (= Ethylene) 

Starch	*Amylase*	Glucose „sweet&juicy“
Chlorophyll	*Hydrolase*	Anthocyanin
Pectin	*Pektinase*	less Pectin „soft“
large org. substances	*Hydrolase*	flavouring substances
Acids	*Kinases*	neutral

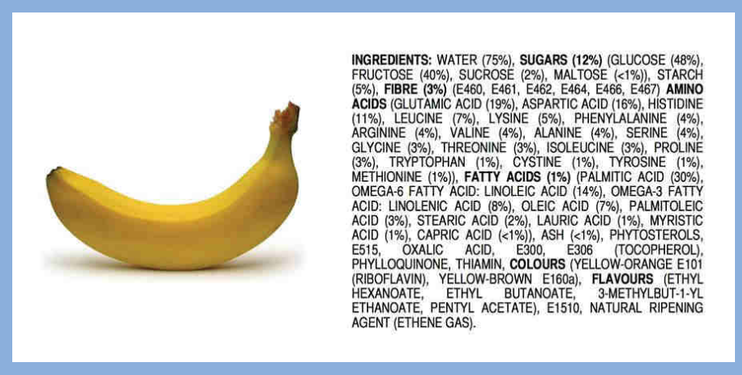
Bananas

80’000 tonnes of bananas are imported every year into Switzerland. The per capita consume is 10 kg per year. This is after apple the second most eaten fruit.
•*What is the situation in your country?*
Globally bananas are with respect to cultivation and consumption the most important fruit: 100 Mio t/y. The majority of it are plantain and are consumed in the producing countries. The export market is 16.5 Mio t/y.

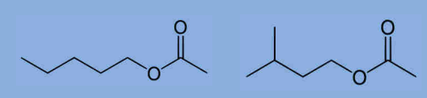
Banana (Musa) is a monocot plant. There are about 70 species originating from tropical and subtropical Asia und the western Pacific region. Best known at our latitude is the dessert banana (*Musa* x *paradisiaca*).

Substances of content

- *What is the difference between natural and artificial flavours?*

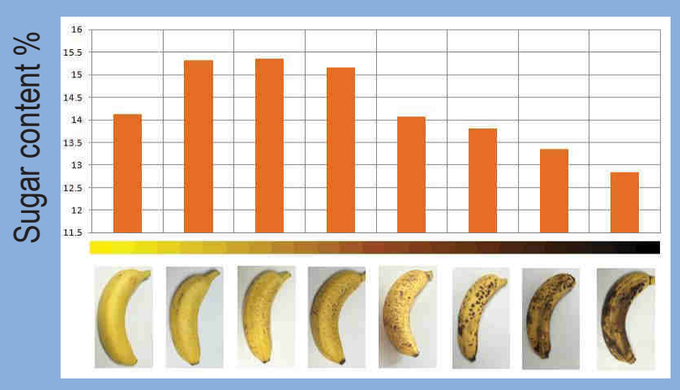


Synthesis of the banana flavour:
Esterification of 2ml conc. Acetic acid with 2ml 2-methyl-1-butanol or 1-Pentanol: Synthesis of Amyl acetate (pentyl acetate) or Methylbutyl acetate.
Experiment: Mix the educts and add 2 drops of conc. acid sulphur, add boiling stones, heat the mixture in a test tube to 80° C.



Ripeness & Sugar

- *Which banana is the sweetest?*



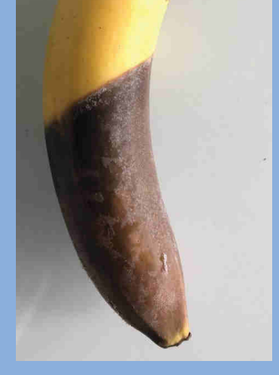
The sugar content is measured with a refractometer and a graph drawn showing sugar content versus ripeness.

- *Why does the sugar content increase and decrease?*
- *Where is the sugar coming from?*

Melanin & Tyrosinase

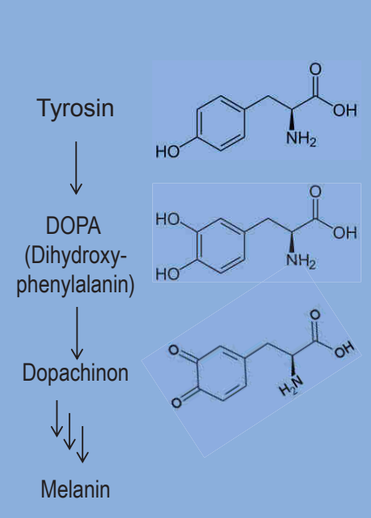
If you dip one half of a banana into boiling water, it turns black

- *How and why does the black area appear?*
- *How can it be prevented?*
- *Can similar processes be found in humans?*

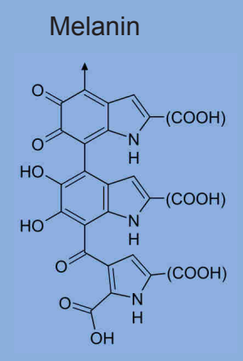


The heat from the boiling water destroys the cells on the edge of the banana peel. The enzyme Tyrosinase is released and starts the production of Melanin. The peel isolates the inner tissues and prevents the denaturation of the enzyme.

Tyrosine activity: Oxidation of Tyrosine



Melanin



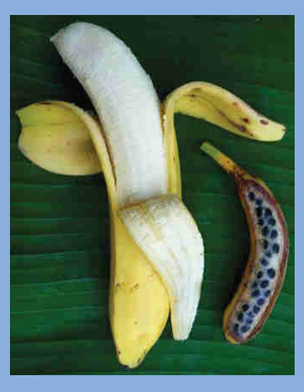
–(COOH) stands for either –H or –COOH or other chemical groups. The arrow indicates another spot for the bonding of a functional group

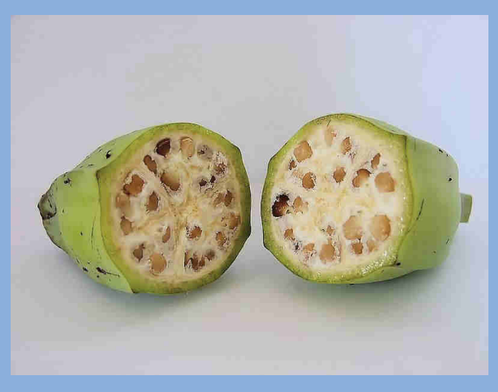
Ripeness & Starch

Iodine - potassium iodide (Lugol) staining of longitudinal and transverse sections of differently ripe bananas.

•*Why does a banana not store sugar directly, but takes the ”starch loop way”?*
•*What are anabolic and catabolic processes?*

Plant breeding



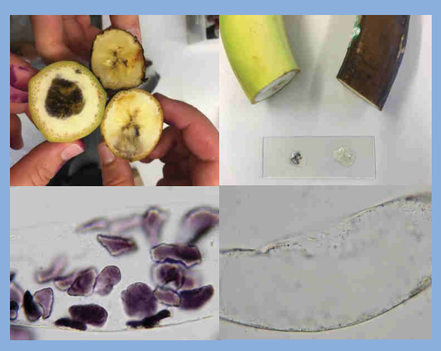


Farmers in Southeast Asia first domesticated bananas. This cultivation goes back to 8000 BCE. The modern banana *Cavendish* is a hybrid of at least two species: between *Musa acuminata* and *Musa balbisiana*. The fruit of the wild species contains big and hard seeds. Cavendish became triploid through polyploidization. It is sterile and shows parthenocarpy (production of fruit without fertilization of ovules). Reproduction occurs through artificial vegetative propagation (sucker removal). Big plantations are vulnerable to parasite, most recently the banane was at risk due to the fungus TR4. The genome oft he double haploid DH-Pahang (picture in the middle) is completely sequenced

Future prospects & Ideas

The banana as point of origin for interdisciplinary collaborations
•Catalase Activity
•Measurement of the sugar content (qualitatively and quantitatively)
•DNA – Isolation
•Extraction of colour components
•Nutrients and Calculations of Energy
•Biogeography
•Business and Fair Trade
•Colonialism
•Banana as a icon/symbol and banana in Arts

Microscopy & iPhone Photo



•*What are amyloplasts?*

Lugol staining and microscopic examination of thin sections of differently ripe bananas. Documentation with a smart Phone camera.

References

- https://de.wikipedia.org/wiki/Bananen
- http://omlc.org/spectra/melanin/
- https://de.wikipedia.org/wiki/Eumelanin
- http://www.food-scientist.com/en/banana01
- http://horttech.ashspublications.org/content/3/3/338.full.pdf+html
- http://postharvest.ucdavis.edu/Commodity_Resources/Fact_Sheets/Datastores/Fruit_English/?uid=9&ds=798
- http://www.education.com/science-fair/article/measure-sugar-ripe-fruit/
- https://alienplantation.wordpress.com/2012/07/12/this-sht-is-bananas/
- http://www.storyfilter.com/viel-chemie-ist-der-banane/2190/
- http://www.tagesanzeiger.ch/wissen/medizin-und-psychologie/Wissenschaftler-testen-Hautkrebs-mit-Bananen/story/17713388

Science and our Environment

SCIENCE ON STAGE 2017 DEBRECEN
THE EUROPEAN NETWORK FOR SCIENCE TEACHERS

Anna Hellman | Östrabogymnasiet | Uddevalla | Sweden

Natures impact on your well-being

In a time when many people are stressed out, my project leads up to inspire students to use nature as a feel-good factor and to scientifically prove natures healthy effects.
Research shows that when visiting nature, your brainwaves change from β-waves (14-30 Hz) to α-waves (8-13 Hz)
Both waves are sent to, and processed, in the brainstem but when β-waves will affect the release of stress hormones, like adrenaline and nor adrenaline, α-waves release anti-stress hormones like dopamine and serotonin.
Parks, gardens and other urban green spaces are ”enough”; you don´t necessarily need to travel far away to reach spectacular wilderness to feel good!

	In classroom After 10 min of relaxation	In nature After 10 min of relaxation
Pulse	76	70
Blood Pressure	118/76	110/69
Self-assessment	6,1	7,3

1. In the classroom.
The students measure pulse, blood pressure and do a self-assessment on a scale from 1 to 10, how they feel right now.

2. In the nature.
We set off walking, maximum 1 km preferably to a place with a beautiful view. The student do their 3 measurements again.

3. Back in the classroom.
The students compile their results and I tell them what science has researched about the subject so far.

NATURE –
A feel-good
factor for free!

Conclusion: The pulse and the blood pressure decreases when being in the nature and 96% of the participants in the study, self-assess that they are feeling happier.

Science and our Environment

SCIENCE ON STAGE 2017 DEBRECEN
THE EUROPEAN NETWORK FOR SCIENCE TEACHERS

Hossein Rostamzadeh| Asker Upper Secondary School | Asker | Norway

Endangered Species and Biodiversity

Surveying Endangered Species in Local Ecosystems

This fieldwork project demonstrates how easily we can engange our students in authentic, real and highly relevant biological research in their nearby ecosystems. From one side we show that in order to encourage and let students learn the basics of the interplay between the biotic and abiotic factors in an eccosystem they need to leave their traditional classrooms and rather focus on the nature itself.

During this project period we move on from the theoretical aspect of biodiversity in the classrooms into the role of single endangered species in the given eccosystem. A group of up to 4 students choose 1-2 endangered species. Then the student groups collaborate with each other on collecting useful data about their favorite endangered species from databases for biodiversity and preservation. In addition, they collect any appreciable evidence about the endangered species from the field itself. At the end of this project all groups design a creative brochure about the endangered species of their focus. In the brochure they suggest some practical and useful preservation measures for local authorities and the public, as well as other important information about the species.

www.artsdatabanken.no

100% Great!

Engaging our students in authentic field research and studying biodiversity from up close is the easiest way to establish a deep and passionate relationship to nature, and thereby help preserve it.

Science and our Environment

SCIENCE ON STAGE 2017 DEBRECEN
THE EUROPEAN NETWORK FOR SCIENCE TEACHERS

Irma Hannula | LUMA Centre, University of Helsinki | Helsinki | Finland

Sundial

ARCturus Resource Centre

A sundial is a simple device, which uses sunlight in the daytime to show time.
The basic idea in a sundial is that a thin or a little thicker stick fixed on a base produces a shadow, the tip of which shows the time on a scale drawn on the base.
Several important issues for consideration:
* Weather conditions
* Safe location
* Pretty design
* Educational tool
* Decorative artwork

Photo: Irma Hannula

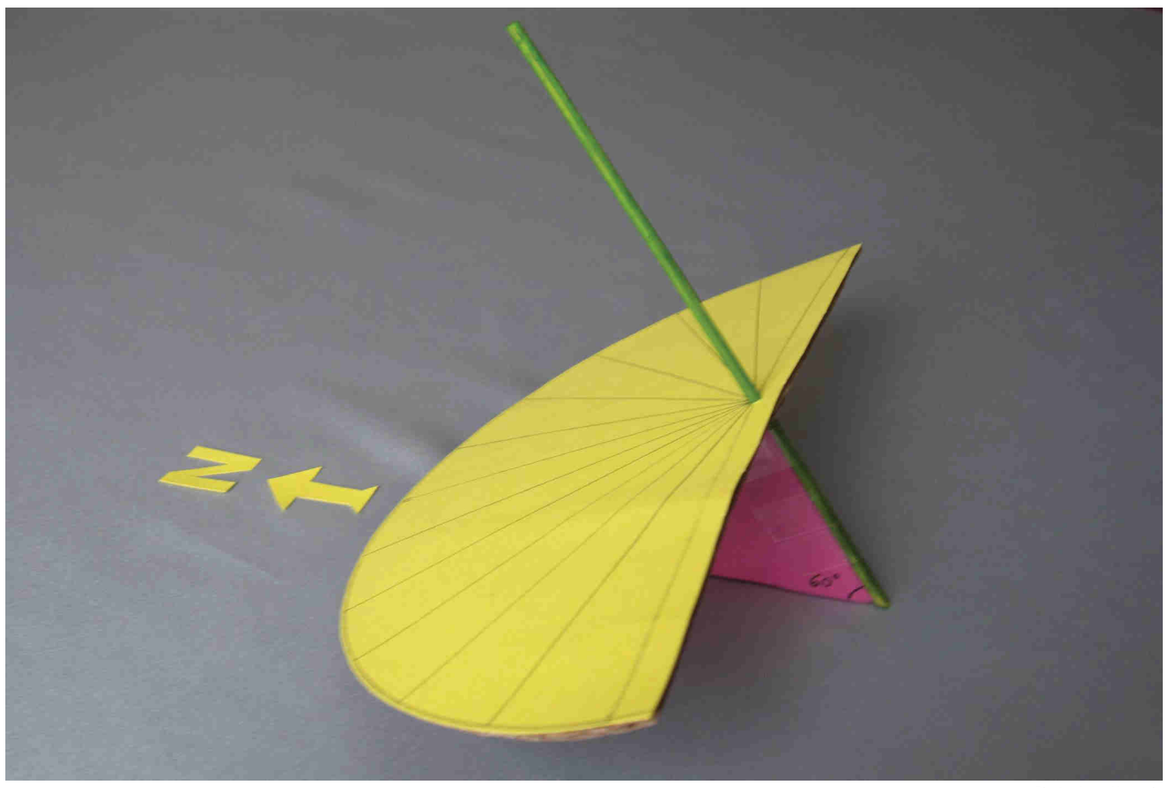


Photo: Irma Hannula

www.sundials.co.uk

The picture on the left introduces a self-made sundial. The upper picture on the right shows a sundial on the roof in Palma and the picture below a sundial statue in the park.

www.arcturusastronomy.fi

There are gorgeous sundials in ancient historical places. Some of them are in the park like statues; some are fixed on the wall or roof of a museum or an observatory.

www.arcturusastronomy.fi

Science and our Environment

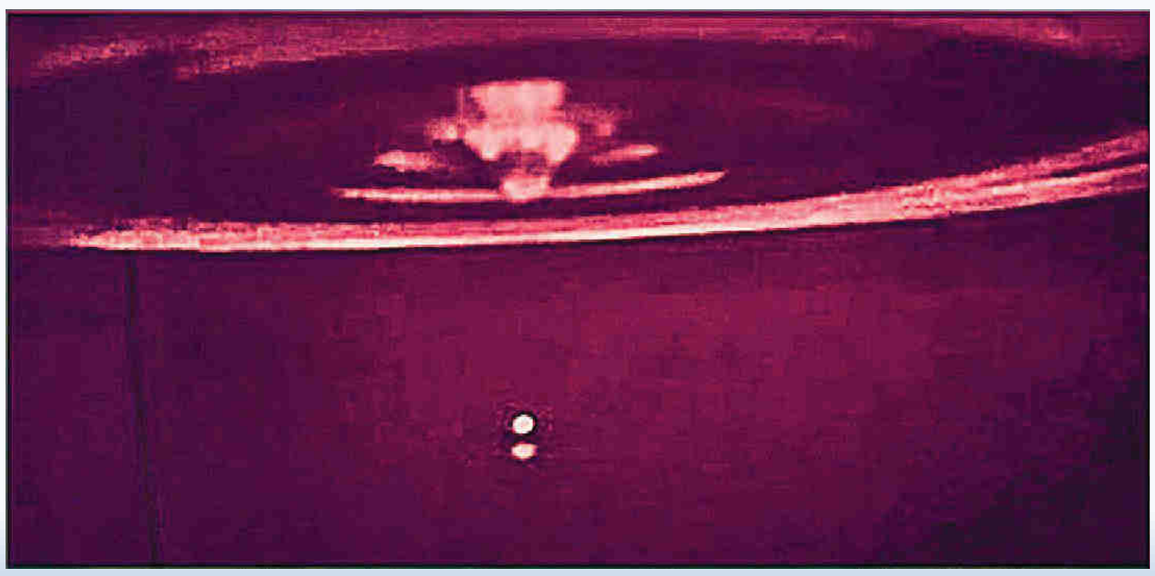
SCIENCE ON STAGE 2017 DEBRECEN
THE EUROPEAN NETWORK FOR SCIENCE TEACHERS

Dr. Jean-Brice MEYER - LP2I High school | JAUNAY-CLAN | France

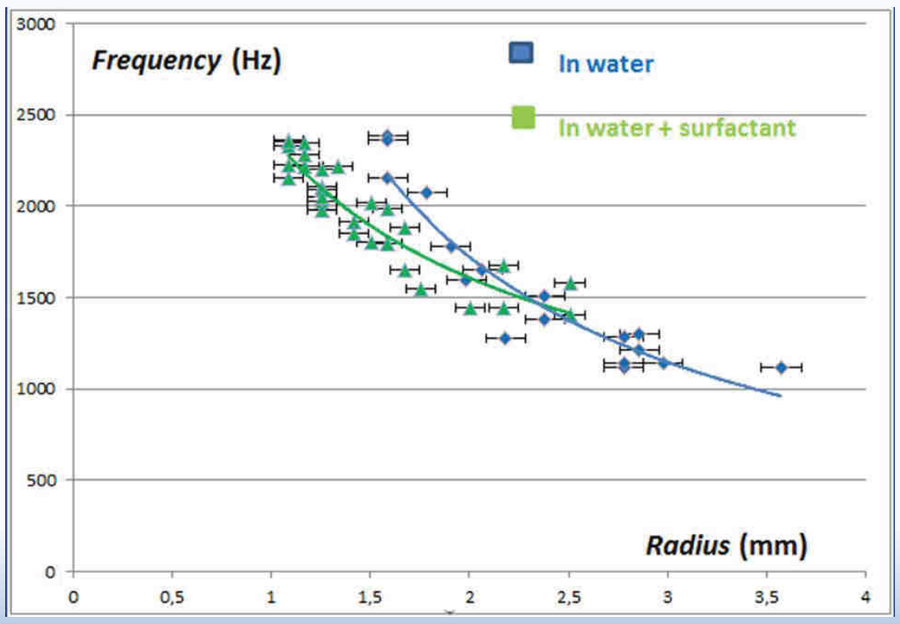
BUBBLE ALARM VERSUS SURFCATANTS

From water drop to the sound of a bubble

When a water drop falls on the water, we can hear a sound. We realized that this sound is not a simple impact noise, but a sound created by the vibration of an air bubble that apeared under the surface of the water, after the impact.
We found a mathematical relation between the bubble radius and the sound frequency.



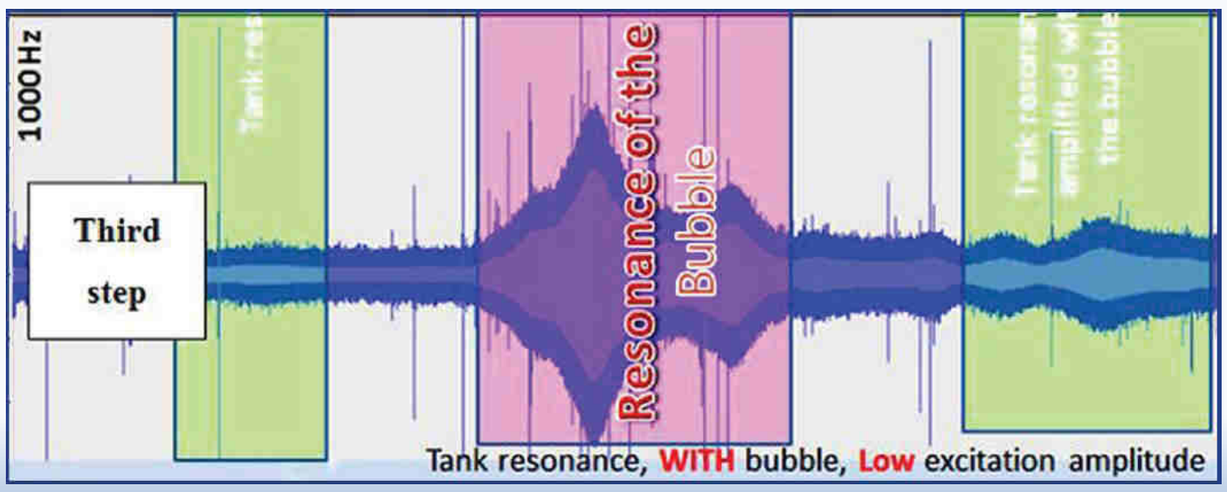
From bubble to surfactant



The frequency of the sound depends on bubble's radius, and for a same bubble radius, the sound frequency depends on the surface tension from the liquid where the bubble is.
As the surfactant can do environmental damage, we use our results to develop a method to measure the surfactant concentration of wastewater.

Determining surfactant concentration in wastewater

Indeed, with a calibration curve it's possible to determine the surfactant concentration in waste water. To increase the precision of calibration curve, we worked with only one bubble that we trapped underwater. And we used vibrator to produce forced vibrations of the bubble and to determinate its resonance frequency.



Conclusion: we hope that the originality and innovation of our method encourage public interest in and awareness of environment, especially among children.

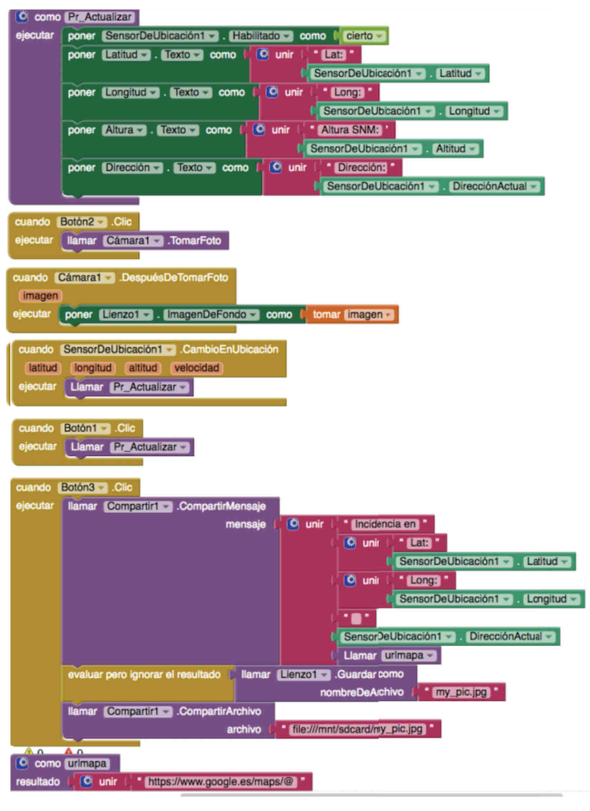
Science and our Environment

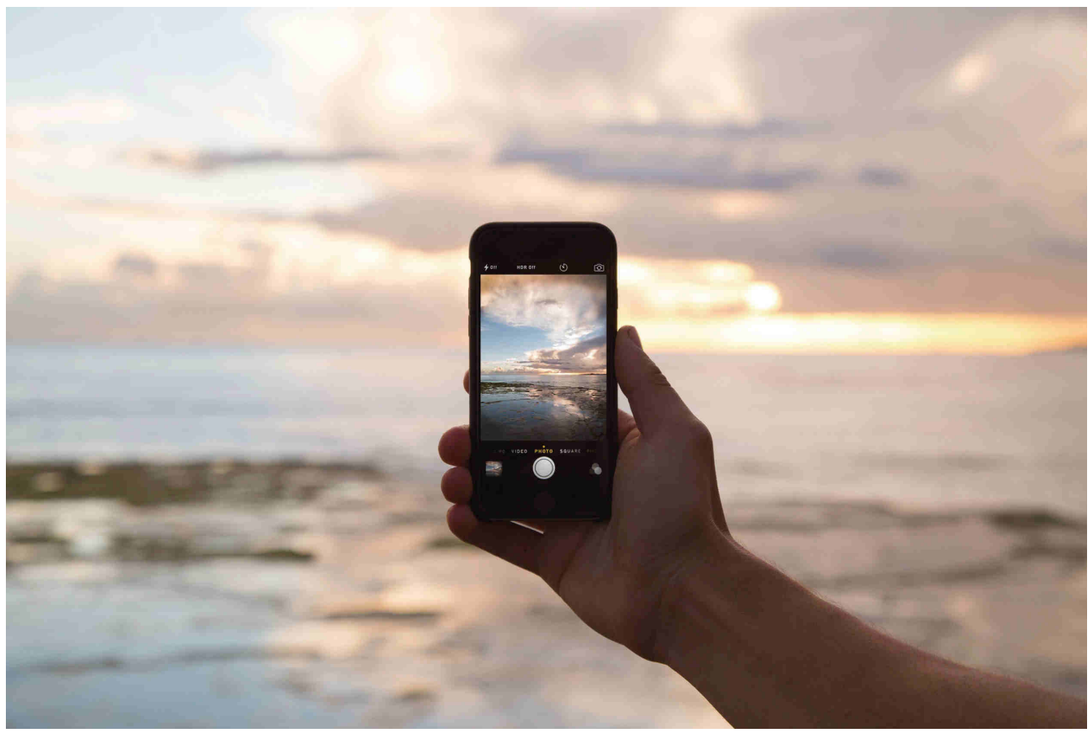
José Viñas| IES David Buján | Cambre-A Coruña | Spain

The Rhythm Of Nature

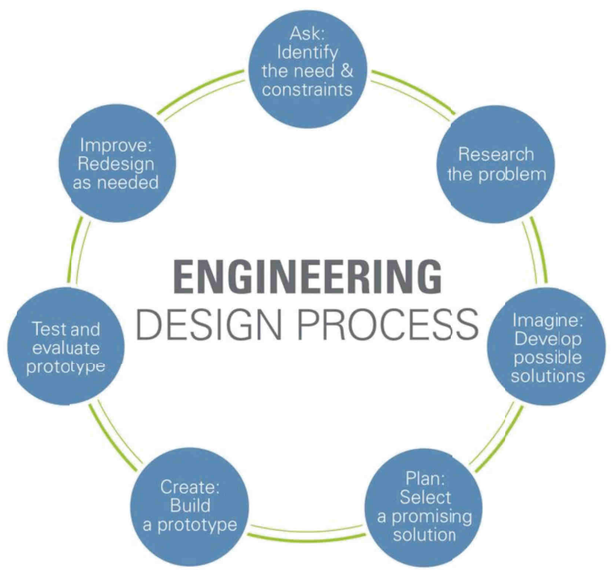
Citizen Science & Mobile Devices

The main objective of our project is to bring and make people sensitive, especially young people, about environmental projects through the technology we have, our mobile phones. Our students have identified the most important environmental problems of the surroundings (**invasive species**, **climate change** and **responsible behavior in natural areas**) they have used their computer skills and they have implemented the philosophy of citizen science to provide solutions.





Our project is innovative because we pretend to involve students on ecology and new technologies. A new approach like Citizen Science *"Science we can do together"* and new technologies like mobile phones.



Conclusion: Our projects (Asian Wasp, SpeciesCalendar & Alert PNIA) are ready to work on Inquiry Based Learning in other schools. In addition, our apps´ software is open to be replicated or modified to adapt teachers necessities in other countries.