

Adrian Allan | Dornoch Academy | Dornoch | Scotland, UK

## **Smells Like Teen Shampoo**

This project involved a school collaboration with a local Scotch whisky distillery. The pupils distilled essential oils from plants using microscale distillation equipment and analysed the chemical components using thin layer chromatography (TLC).

They produced a uniquely scented shampoo and tested their product in terms of pH, foam formation and the ability to clean doll and horse hair.

They promoted their product, demonstrated their understanding of shampoo chemistry and presented their data at a poster session made a poster and developed a pleasant smelling to a professional scientist from Whyte and shampoo. They also enhanced their presentational Mackay. They subsequently published a peer skills when they promoted their own unique shampoo reviewed report on their project in the Young to a professional scientist. Scientists Journal.



Students got the opportunity to be creative when they







TLC analysis of clove oil (CO), eugenol (E) and carvone (C).



Part of a poster showing the cleaning effect on shampoo on horse hair.

**Conclusion:** Our collaboration with a local chemical industry resulted in students improving their technical, analytical and communication skills. They also got to use their sense of smell and be creative which made this project relevant and stimulating.



Mgr. et Mgr. M. Konečný, Bc. D. Alexová | Mensa grammar school | Prague | Czech Republic

## **Entertaining gases experiments**



We demonstrate how to easily connect teaching of Physics and Chemistry on the example of one specific topic – gasses.





FACULTY OF MATHEMATICS AND PHYSICS **Charles University** 



András Róka (dr) Chemical Institute of Eötvös Loránd University, Budapest, Hungary

Our time-travel-story from embryo age to the development of cognition.

The tricks of "Vital Force"

from



to

It is true that the theory of vitality proved false when Wöhler synthesized urea,

but the birth and development of new life from only one cell is still a real wonder.

But how can we move, work, think or love, how can we live at all at such low tempetarure?

We can not explain this wonder with only reason, because every level of organisation cooperate with something.









**Special thanks to** 



Andrea Auth & Ferenc Arató | University of Pécs | Pécs | Hungary

## MathterMinds

### A game-based toolkit for fun and effective math learning

MathterMinds is an educational learning toolkit designed to replicate and improve traditional math textbook and conventional math practices.

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THE EUROPEAN NETWORK FOR SCIENCE TEACHERS

Ariana-Stanca Văcărețu | Colegiul Național Emil Racoviță | Cluj-Napoca | Romania

## MatLan

# Learning Math and Languages Through Research and Cooperation

The aim of this project is to valorise students' creativity and innovation by inviting them to discover and research mathematics.

The students experience an authentic mathresearch process in school, with both a theoretical and an applied dimension, while **collaborating** with **peers** from Lycée d'Altitude de Briançon.

Their research work is **facilitated** by the math teacher and **professional researchers**.



Student - researcher discussion



French-Romanian students' exchanges



French-Romanian students' virtual exchanges

Through inquiry based learning methods, the students experience mathematical modelling. Research topics are essential – e.g.: the Fern, Modelling plant growth, CCTV in operation.



In the research workshop, by collaborating with peers and being supported by professional researchers, students get to mathematically investigate issues that no-one has an answer to yet.

- This project has been funded with support from the European Commission.



THE EUROPEAN NETWORK FOR SCIENCE TEACHERS

Denise Thomas | Gower College | Swansea | Wales | UK

## Using Anaerobic Digestion of Seaweed as a Renewable Energy Source

#### The design brief as given by Tidal Lagoon (Swansea Bay)

"Devise an innovative way of using sustainable energy in the Tidal Lagoon". With an ever increasing worldwide demand for energy and the need to decrease fossil fuel use, marine macro algae (seaweed) can be seen as an alternative feedstock in anaerobic digestion for the production of renewable fuel, such as biogas. This can be stored and used in the lagoon visitors centre for many different uses such as energy generation, lighting and central heating.

Having researched the principles of anaerobic digestion, the team designed and built a prototype with the help of students at a local University and equipment from a DIY store. It was an opportunity to appreciate





Fig 2:Creating a "feed-door" for the digester in a local university workshop

## the value of teamwork, shared responsibility and division of labour.







The team concluded "we believe this type of energy to be the future for our planet; land space is finite and we may not have enough to provide energy through conventional means. If we were to turn to the seas for a source of biofuel we would have a much larger resource"

Anaerobic digestion (AD) is a biological process in which organisms break down biodegradable material in the absence of oxygen. Seaweeds are species of macroscopic, multicellular marine photosynthetic algae. The ecology of seaweed depends on the presence of seawater, light for photosynthesis and a point of attachment. Thus seaweed is often found close to the shore.

The team thoroughly enjoyed working with students in Higher Education and engineers from a local company on a "real life" problem. As a teacher it was an opportunity to extend links to University, employers and industry specialists.



Ulrike Englert | Willibald-Gluck-Gymnasium | Neumarkt i.d.Opf | Germany

## Our School - an "EnergyPlusHouse" **Building Automation System of a New School Building**



**Efficiency of Ventilation** 

#### **Systems**

- Evaluation of room temperature and air humidity by datalogging
- Processing and analyzing the data
- Students of the Upper Secondary in cooperation with the university of Braunschweig/Synavision



#### **Intelligent Automation**

- Modelling a building and parts of its automation system
- Sensor interface and component control by lacksquaremicrocontroller "Arduino"
- Study group of "MinteX" (plus support for gifted students)





Vincenzo Favale, Pietro Cerreta | Associazione ScienzaViva | Calitri | Italy

## **The Tusi Couple** Persian Science, Italian Project

Build two circumferences, one having the twice the radius of the other. If you rotate the smaller one in the bigger with a uniform angular speed, each point of it will move in a rectilinear harmonic motion. Conversely, using the same device, linear harmonic oscillations can be transformed into rotational motions.

The Tusi Couple, designed eight centuries ago by a Persian mathematician to explain stars movements, may be applied today to modern mechanical technology.







May it be better to change the traditional connecting rod-crank mechanism with a Tusi Couple device?

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THE EUROPEAN NETWORK FOR SCIENCE TEACHERS

Inese Siņavska | Daugavpils Secondary School | Daugavpils | Latvia

## The use of geometric transformations in cook's profession "Kitchen mathematical mosaic"

The goal: to improve the understanding of mathematics in daily life and the role of mathematics in other sciences, society and individuals by using the examples from the cook's profession.

Project helped students to understand the practical significance of mathematical knowledge.

Students of the 11th grade, who are also the Trade School 2nd year students learning the profession of a cook.

The students were given the task to prepare food, in line with the principles of a healthy diet and were asked to use the geometric elements in their food presentation. Correlation was shown between the acquired profession and the mathematical theories. The knowledge of the subject, knowledge about healthy life, and an introduction to the profession of the chef helped students to understand what they are learning and why.



The progress of the project contributed to the students' creativity and responsibility for assigned tasks. The given project is an example of how mathematics can be taught with non-standard approach.



### Jennie Hargreaves | Lockerbie Academy/Police Scotland | Lockerbie | Scotland | UK **The Physics of Road Safety Teaching Mechanics and Dynamics through Road Safety**

Crash investigation looks at the way vehicles behave before, during and after a collision.

Our students worked with crash investigators from Police Scotland to investigate scaleddown reproductions of real crashes. They used mathematics and physics principles to investigate and discover what had really happened

An example reproduction crash undertaken:





Tyre skid marks from the scene are measured by the students and scaled to the "real world".



**Skid tests** are used by the Police to determine a value for friction between the sliding tyres of the car(s) and the road. This provides a value for deceleration.



Scenario: A car skids, collides with a pedestrian and comes to a stop. Was the car speeding or was the pedestrian at fault? **Observation:** Students make a detailed examination of the scene. Witness statements are examined and marks on the car bodywork are matched with injuries to the pedestrian. **Hypotheses** are proposed by the students to explain the accident.





**Calculations** are used by the students to calculate the speed of the car at the start of the skid using  $v^2 = u^2 + 2as$  $v = final velocity = 0 m s^{-1}$ u = initial velocity a = acceleration =  $-6.80 \text{ m s}^{-2}$ s = displacement = 24.45 m (total length of the tyre skid mark).

**Evidence verdict:** The car was travelling at 41 mph in a 30 mph limit. If the speed limit had been obeyed the pedestrian would not have been hit.

Conclusion: When Physics is seen as relevant, students engage more with the subject, especially girls.





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