



THE “BEYOND THE WATER!” PROJECT

• Introduction

Welcome everybody,

I am prof. **Federico Andreoletti**, from Brescia (Italy). I teach physics in a secondary school and I'm a science communicator as well. Through the scientific association called “AGHI MAGNETICI” I lead STEM labs, especially in the primary school.

I would like to thank you all for the opportunity you have given me, and I would like to extend a special thanks to Ana and her staff for organizing this seminar and for planning lots of activities.

Now let's start. What is a STEM (Science, Technology, Engineering and Math) activity?

First, I would like to introduce you my teaching experience, my own point of view; I hope you will find out something interesting and useful.

Studying science means gaining **knowledge** and improving **skills**; in some countries (Italy for example) teachers work mostly on knowledge: laws, exercises, data, studying off by heart. In other countries (northern Europe) teachers work mainly on skills: practical approach, experiments, outdoor experiences, real life situations, problem solving, ...

Surely we need to achieve both knowledge and skills, and the STEM activity is the way to do this.

Here are the most important characteristics of a STEM activity:

- Teacher leads the inquiry and provokes the students and encourage them to think critically and challenge assumptions.



- The activity is an **exploration**, not a demonstration
- There are unknown (and mysterious) ways of learning, so don't worry about **funny questions!**
- “**Gaming**” is essential: playing with challenges, competition, record, ... learning is the most prestigious award.
- Teacher build confidence in students' own learning
- Finally, the STEM activity is often a way to understand **things we didn't plan** (Galileo, Newton, ...)

• **WHERE DID THE IDEA COME FROM**

I often wonder about Newton and the apple. The apple is not important in itself, however it is important because Newton understood what gravity is through the apple. Therefore in the experiments I use with water the aim is to encourage the students' interest in scientific laws by using light and colours, gravity, meteorology, chemistry, life science, ...

It's the scientific approach to life that really matters: and that is why the project is called "Beyond the water".

• **PROJECT DESIGN**

I carry out no more than 4 or 5 experiments in the class (a total of 6 classes with students 9 and 12 years old).

Description of some of the experiments.

OIL DROP

How does oil (petroleum, plastic fluids, ...) react with water?

We can reproduce the situation with a plastic jar and a drop of nail polish.

- ✓ Pollution (breathing)



- ✓ Colours and light
- ✓ Thickness
- ✓ More than a drop

STATIC SOAP BUBBLE

Mix ½ L of water in a jar, 50 g brown sugar, 130 g washing-up soap (better with glycerine)

Studying static bubble is easy.

- ✓ Shape of water (sphere, vertical plane, ...)
- ✓ Colors and light
- ✓ Inner motion of the water, coloured paths
- ✓ Multiple bubbles, shapes, ...

WATER BEADS

Find them on the internet or at the florist's.

- ✓ They are polymers that grow in water and become transparent
- ✓ The model of the human eye
- ✓ Light refraction
- ✓ Water lens

NON NEWTONIAN FLUIDS

It's an old theory! Think about water: it's weak and fluid as you stir it slowly, it becomes hard and solid if you stir it more quickly. Scientists created polymers which have both the characteristics at a low velocity: the non Newtonian fluid (something like "slime").

Mix glue (3 dessert spoons), backing soda (1 teaspoon), saline solution (1 teaspoon)



- ✓ Fluid + solid properties
- ✓ D3O
- ✓ As an example, biker jacket and bulletproof jacket
- ✓ cleaning mechanical equipment, ...

CARTESIAN DIVER

A new version of the experiment by Cartesio, with an Italian folk tale as a backdrop; just put together straws and paper clips!

- ✓ Floating test
- ✓ Floating conditions
- ✓ Pressure, air, weight force, ...

MATRACCIO DI PASCAL; WATER STREAMS; INTO THE WATER; WATER ROCKET; ...

• CONCLUSION

I really believe that a STEM activity will spark students' interest in science: therefore I hope you will find the way to enter their world.

Thank you for your attention, please keep trying new activities and improving them. For information and sharing ideas please contact me:

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