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# CHEMISTRY EDUCATION IN ITALY: FOCUS ON ICT RESOURCES TO ENHANCE STUDENTS' MOTIVATION

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# Context

In Italy, among the scientific fields, chemistry is identified as an exemplary case study as it is recognised as one of the most difficult subjects.

In order to enhance chemistry education, a key objective, is to motivate students, to raise their interest in science subjects, thus making their learning process more effective.

For this purpose, M.I.U.R (Ministry of Education, University and Research) has taken a number of actions during the last years, with particular attention to the use of information technologies as educational tool for the new generations, those of 'digital natives'.

A database of related papers and documents is available on the portal of the project 'Chemistry Is All Around Us':

<http://www.chemistry-is.eu/>



## Focus on ICT tools for science education

Recently, M.I.U.R. supported the utilization of ICT technologies as tools for education, also because they are very familiar to the new generation of pupils, hence called 'digital natives'.

Unfortunately, the availability of national ICT teaching resources for science, chemistry in particular, is far to be rich. More fruitful is the research of resources for mathematics and much more for humanistic disciplines.

The ICT education sector in chemistry/science is still at an embryonic stage in our Country: valuable resources are being developed, also thanks to projects funded by M.I.U.R., but they are not yet sufficiently shared, thus difficult to be found.

The main risk, surfing in Internet without appropriate references, is to find free but low quality resources, due to the poverty of interactive material or even to the inaccurate/trivial contents.

## Preliminary testing on ICT resources to improve student motivation

Few worth ICT resources to teach chemistry have been selected and are now available on the portal of the project ‘Chemistry Is All Around Network’:

<http://www.chemistryisnetwork.eu>



An exploratory study has just started, aiming at evaluating the impact of the selected tools on pupils of different ages and schools.

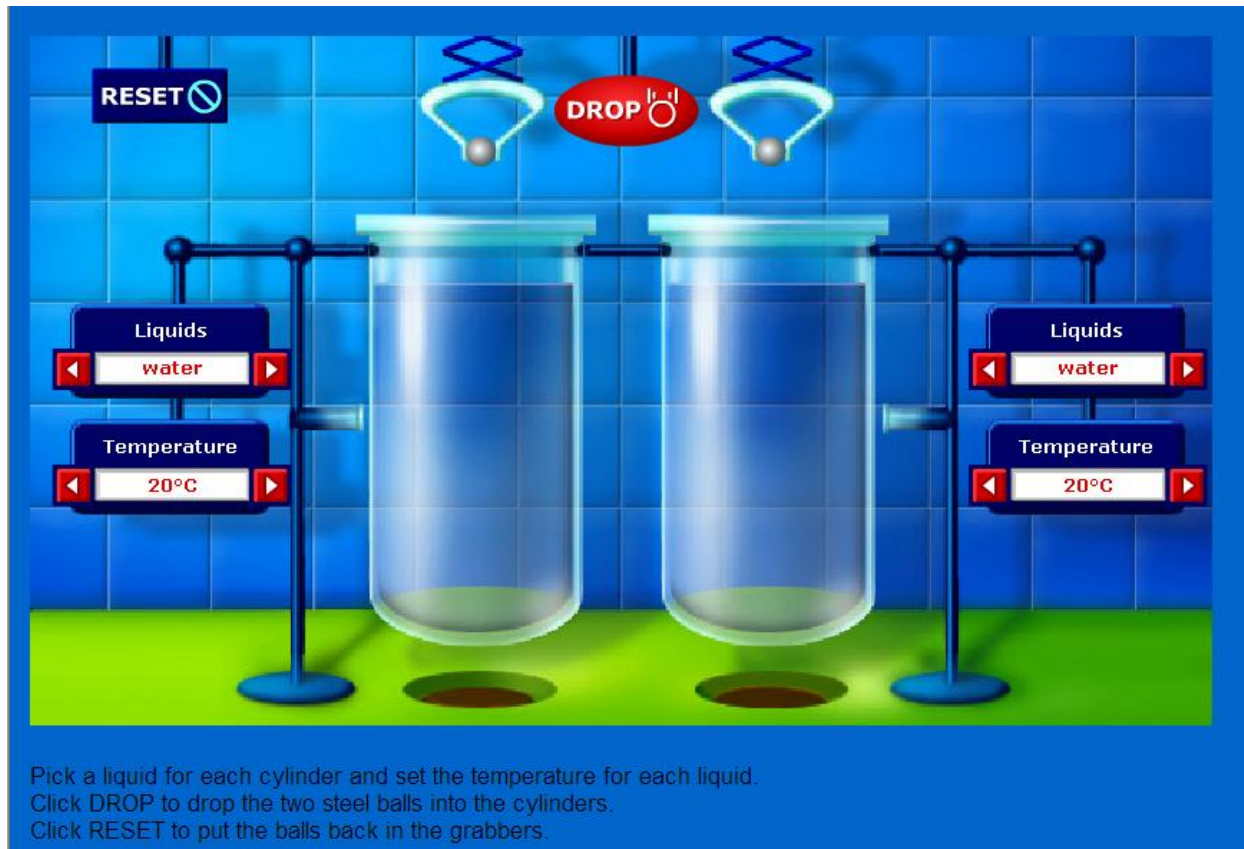
The preliminary testing is aiming at highlighting the ideas that an interactive resource arouses on students non-used to this kind of scientific tutorial, that is mainly the emotional impact and the instinctive reaction.

## Method, instrument and procedure of preliminary testing

The setting is the computer lab and the procedure foresees four steps:

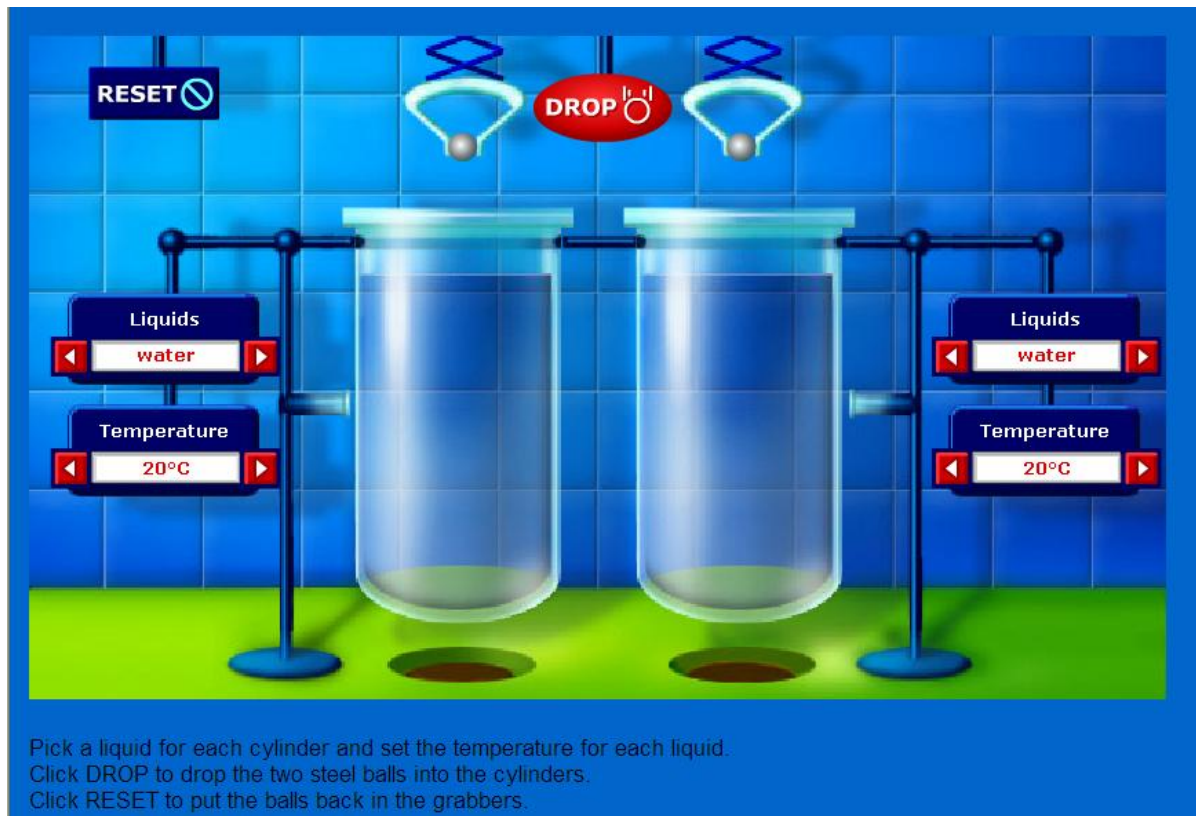
1. At the beginning, the pupils, grouped in pairs, surf the resource (website or simulation) freely and without teacher guidance.
2. Then, the teacher indicates some website sections considered important (e.g. simulation, evaluation test, video, etc.) to be sure that pupils can arise an opinion about them.
3. Finally, pupils surf autonomously again, discussing each over about the website features.
4. At the end they are requested to answer an interview focused on the following progressive key points: interesting, learning, interacting, critical thinking.

As first ICT resource, a virtual experiment on viscosity has been tested on kids attending the fourth year of primary school (24 kids, 9 years old).



[http://www.planetseed.com/flash/science/lab/liquids/visco\\_exp/en/viscosity.htm?width=620&height=500&popup=true](http://www.planetseed.com/flash/science/lab/liquids/visco_exp/en/viscosity.htm?width=620&height=500&popup=true)





The experiment consists in dropping a ball through different liquids (water, oil, honey...) then observing its speed; it is possible to change liquid temperature by heating with a flame or cooling. Two simultaneous droppings are carried out, after choosing the liquid and the temperature, thus comparing viscosities as function of temperature and substance.

## 1. Website interest

- a. Is the website interesting?*
- b. Which sections are more interesting?*
- c. Which parts (texts, pictures, video, ...) are more interesting?*

## 2. Contents learning

- a. Do the site help you in remembering the contents or it would be similar with a book?*
- b. Is the website structured in an easy way for your understanding?*
- c. Which parts (simulation, video, pictures,...) support your learning better?*

## 3. Meaningful interaction

- a. Does the website stimulate interaction with your schoolmate?*
- b. Which parts stimulate more discussion with your schoolmate?*
- c. The discussion has been concentrated on the chemistry topics or not?*

## 4. Critical thinking

- a. Does the website help you in understanding the real world?*
- b. Which are the parts that suggest you critical issues?*
- c. Do you think that you will be able to explain the chemistry contents better after surfing this website (argumentation)?*



# 1. Website interest

## a. Is the website interesting?

- Yes, because it helps to learn
- Yes because it teaches interesting things
- Yes because it helps to understand science
- Yes because it makes you understand because when the ball drops in the honey it goes slower than in another liquid
- Yes because we experienced liquids at different temperatures.

# 1. Website interest

## b. Which sections are more interesting?

- To watch the speed of the ball
- Honey, because when it is cool the ball drops slowly, but it is also interesting to watch what happens after changing liquids
- Video
- Two different substances at different temperature that drop with the same speed
- The behaviour of substances at different temperature
- The ball dropping
- The flame that changes liquid temperature because raises or lowers the ball speed.

# 1. Website interest

## c. Which parts (texts, pictures, video, ...) are more interesting?

- To change temperature
- To change liquids
- To drop the ball, because it shows the behaviour of liquids
- The experiment is like a game, that makes you learn the behaviour of substances when you change their state
- The ball, the flame, the liquids
- The reset function, because you can repeat the experiment at different conditions
- Oil with oil, or the same liquid at different temperatures, or different liquids at the same temperature.

## 2. Contents learning

### a. Does the site help you in remembering the contents or it would be similar with a book?

- The site is better because it shows the motion, the book shows pictures only
- The site helps more because I see images
- Books are more accurate
- The site helps to remember topics already studied
- A book states that liquid viscosity changes when you change temperature but the site shows me that the ball drops slower or faster.

## 2. Contents learning

### **b. Is the website structured in an easy way for your understanding?**

- Yes because it has many options
- Yes because it helps us to understand the behaviour of liquids
- Yes because it says what to do
- Yes because you can understand well what to do e you can do many things
- Yes because of pictures – Yes because it has a few things to do.

## 2. Contents learning

### c. Which parts (simulation, video, pictures,...) support your learning better?

- The ball, because when it drops you understand the behaviour of liquids at different temperatures
- The video
- Pictures in motion
- Liquids
- The possibility of select the same temperature but different liquids, thus observing the different speed of the balls
- Oil compared with oil at different temperatures.



### 3. Meaningful interaction

#### **a. Does the website stimulate interaction with your schoolmate?**

- So and so because they are distracted by the experiments
- Yes because it helps us to agree
- Only when you have to decide what to change
- Yes because we help each other when we decide to change something
- Yes because we find it very interesting.

### 3. Meaningful interaction

#### **b. Which parts stimulate more discussion with your schoolmate?**

- The ball, because it drops many times
- The video
- Chemistry, because there are many substances
- To change temperature and substances thus observing differences
- The liquids and the temperature
- To see oil at 100°C and at 0°C
- The ball dropping makes you understand temperature.

### 3. Meaningful interaction

**c. The discussion has been concentrated on the chemistry topics or not?**

- Yes because substances are chemistry
- Yes, about liquids and temperature

## 4. Critical thinking

### **a. Does the website help you in understanding the real world?**

- Yes, because it shows the behaviour of substances
- Yes, because it deals with things of the world
- No
- I don't know
- Yes, because you discover new things.

## 4. Critical thinking

### **b. Which are the parts that suggest you critical issues?**

- None
- Texts, video and pictures
- The ball in motion through the liquid
- The liquids, because they are different
- The video, that makes you discover the behaviour of substances.

## 4. Critical thinking

**c. Do you think that you will be able to explain the chemistry contents better after surfing this website (argumentation)?**

Yes

Yes, because now we know more about chemistry and about the behaviour of liquids when temperature changes

Yes, because we learn more things

Yes, because we consulted it with attention.



## Discussion

How to use an Internet resource? If a teacher uses a digital tool, learning does not improve automatically; it is convenient to identify the most suitable sections so the students can use them, at least initially, with a good guidance by the teachers.

The meaningful discussion among the students does not start immediately; also in this case, the teachers should arrange some leading questions that helps the students in developing critical issues and discussion.

Further key point is related with the teacher education: we should consider the opportunity to educate teachers in using the internet resources in the classroom.

## Conclusions

This first testing gives the possibility to prepare an outline of work to be used by the schools that will try to integrate chemistry teaching with some selected simulations and interactive tools .

The outline has to take in consideration the resources of schools (i.e. limited availability of computers) together with the needs of the testing