VIRTUAL EXPERIMENTS FOR SUPPORTING CHEMISTRY LESSONS AND DEMONSTRATIONS

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1. Introduction

At present, the educational process has introduced step-by-step ICT based methods of teaching and learning. It is well-known that one of the most common methods is represented by blended learning which combines traditional face-to-face education with e-learning. In this sense, in the frame of the three years Socrates Comenius 2.1 European Project *VccSSe - Virtual Community Collaborating Space for Science Education* (http://vccsse.ssai.valahia.ro, project nr. 128989-CP-1-2006-1-RO-COMENIUS-C21), special training sessions took place (oriented on blended learning) with a view to promote the using of virtual instrumentation in *Science education*. One of the dedicated software chosen for designing virtual experiments, (***Crocodile Chemistry***) allow students and teachers to recreate experiments, model mathematical theories or simulate real life quickly and easy. Crocodile simulators let students experiment in a safe, accurate environment, and come with a wealth of ready-made simulations and models (Keith-Lucas 2000).

2. The VccSSe Project

The three years **VccSSe** project (**Virtual Community Collaborating Space for Science Education**) has as main declared aim to adapt, develop, test, implement and disseminate training modules, teaching methodologies and pedagogical strategies based on the use of *Virtual Instruments*, having as target their implementation in the classroom through ICT tools. For achieving the project objectives, four virtual instrumentation environments were proposed and used: *Cabri Geometry*, *LabView*, *Crocodile Clips*, *GeoGebra*. The mentioned *Virtual Instrumentation environments* were used in relation to three main complementary activities: the development of a *Database with examples of virtual experiments / instruments* (*VccSSe e-Space*), the creation of a *Training Module* package for in-service Science teachers (*Virtual Instrumentation in Science Education* – versions in 6 languages: English, Romanian, Spanish, Polish, Finnish and Greek) and the development of a database with the participants (teachers) products (*VccSSe Products Matrix*). The *Training Modules* were organized mainly as web-based learning through *VccSSe Moodle* e-learning platform, but special face-to-face learning sessions were held for given supplementary information and presentation when necessary.

3. Virtual Experiments in Chemistry lessons

The virtual experiments proposed for Chemistry lessons had in view the teaching of the chemical character of the solutions on the one hand and the substitution reaction on the other hand. The level of teaching of the chemical concepts was adapted to the Chemistry curricula for the 7th grade. As *Crocodile Chemistry* software allows the achieving of many practical applications in the frame of the same virtual experiment, the experiments had in view the emphasizing of the chemical character of the solutions by using chemical indicators and also the presentation of the substitution reaction through examples which involve different reactions of the metals with chemical reagents (Gorghiu et all. 2008). The experiments are presented step-by-step for an easier understanding of the chemical concepts. One of the advantages of the software is given by the fact that in the frame of the same sequence the teacher can create different successive steps, with gradual difficulty levels. In addition, the pupils have the possibility to design new experiments on their own as a complementary step of the lesson.

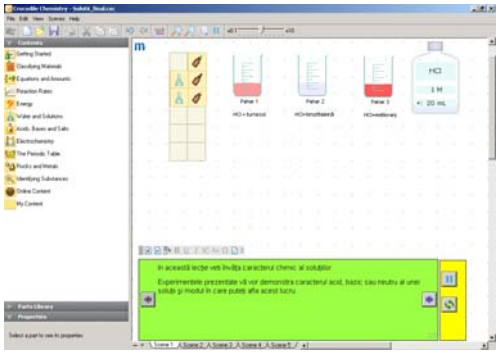

Fig. 1 The virtual application interface for establishing the chemical character of HCl solution with the help of chemical indicators

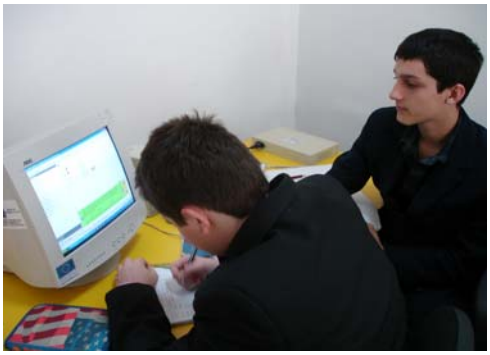

Fig. 2 Students working with the Crocodile Chemistry application for determining the chemical character of several solutions

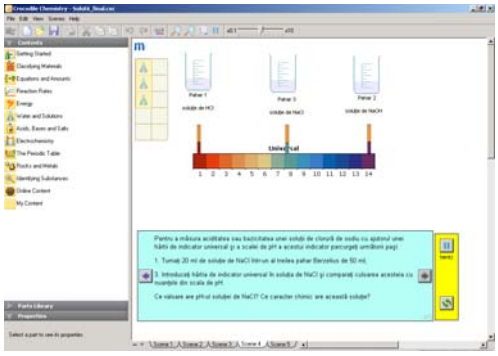

Fig. 3 The virtual application interface for Establishing the chemical character and the pH of HCl, NaOH and NaCl solutions

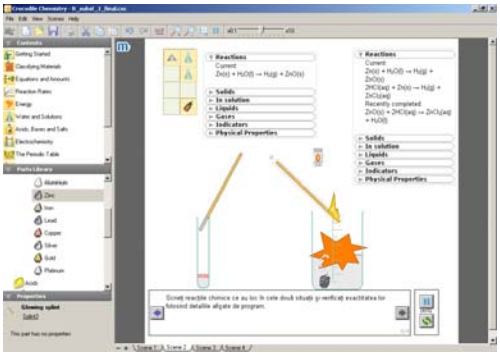

Fig. 4 The virtual application interface for establishing the processes that take place during the chemical reaction between Zn (powder/lump) and HCl solution (in the presence of litmus indicator)

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4. Conclusions

Using of the virtual instrumentation for designing specific virtual experiments to Chemistry lessons presents the following advantages:

- ❑ Offers to teachers/students the possibility of designing quickly, easy and safely the virtual experiments necessary to a proper understanding of chemical phenomena;
- ❑ During the using of virtual experiments no chemical reagents are consumed and no equipment damages are produced;
- ❑ The accidents which can take place during the dangerous experiments are avoided;
- ❑ The teacher and students are not working in a toxic environment like in the real Chemistry laboratory;
- ❑ The virtual experiments can successfully replace the real experiments when the teacher has not sufficient resources in terms of chemical reagents, equipment or glassware.

However, the excessive using of virtual experiments in detriment of real Chemistry experiments presents the risk of decreasing of students' abilities to work with chemical reagents, glassware and necessary equipments. Taking into account the mentioned aspects, the teacher becomes the person who decides the time and the way to combine the virtual experiments with the real ones, for obtaining the best results in the teaching/learning/evaluating process.

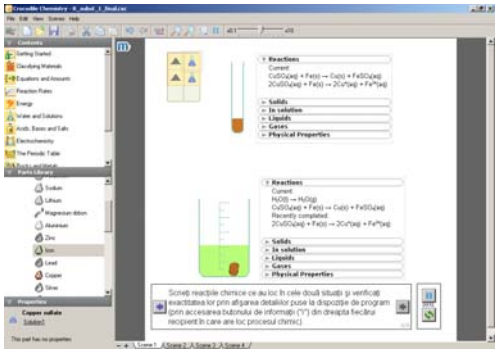

Fig. 5 The virtual application interface for establishing the processes that take place during the chemical reaction between Fe (powder/lump) and $CuSO_4$ solution

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