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e -Teaching Today

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Use of computer has enhanced meaningful chemistry learning and developed learning environment. Despite successful computer utilization in classroom, practices are still relatively rare. Few teachers use computer in classroom practice, software often does not fit textbook and the curriculum pattern is poor (Kargiban and Siraj, 2009).
Research has shown that chemistry teaching is unpopular and irrelevant in the eyes of students, does not promote higher order cognitive skills, leads to gaps between students wishes and teachers teaching and, most important, is not changing, because teachers are afraid of change and need guidance.
Given these realities, the Centre for Technology Transfer in the Process Industries from the University POLITEHNICA of Bucharest together with SIVECO S.A. and the University POLITEHNICA of Timisoara built a project intended to form and develop the competences of the chemistry teaching staff for using interactive teaching methods.
The project aims to introduce ICT tools in the teaching staff professional development and enhance its knowledge in the domain of information and communication technologies through innovative training instruments (e-learning methods). It also creates a collaborative virtual network between the chemistry teachers involved in the project.

1. Introduction

The engineering, design and planning professions will play a significant part in moving society to a more sustainable way of life. The current society, dynamic and competitive, is in need of specialists and engineers with a thorough scientific training, capable to cope with present challenges.
Demand for students with a solid foundation in science continues to grow. In the next years jobs in science and engineering are expected to increase by several millions. Equally important, science education needs to ready people who do not pursue careers in science to handle dilemmas they will face in their lives, such as selecting treatments for diseases, evaluating messages about climate change, or using new technologies.
This is the reason of the importance that must be given in finding new teaching methods in order to attract students and interest them in the study of sciences.

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Use of computer has enhanced meaningful chemistry learning and developed learning environments (Josceanu et al., 2010, Perry and Bulatov, 2010). Despite successful computer utilization in classroom, practices are still relatively rare. Few teachers use computer in classroom, software often does not fit textbook and the curriculum pattern is poor (Kargiban and Siraj, 2009).
Given these realities, the Centre for Technology Transfer in the Process Industries from the University POLITEHNICA of Bucharest built a project intended to form and develop the competences of the chemistry teaching staff for using interactive teaching methods.
In order to improve the way chemistry is seen by the students, the project needs to ensure: a chemistry education philosophy, a relevant curriculum, teaching approaches focused on the teaching of chemistry in schools using ICT tools, advanced assessment and evaluation strategies, positive professional development for teachers.
It will provide feedback surveys, a schedule for organizing and developing the programs for the professional development of teachers and a portal for educational training and management containing the lectures in a multimedia format.

2. ITC Application for studying titration curves

In high school chemistry classrooms, laboratory experiences are essential for students to increase their analytical skills and understanding of chemical concepts. However, traditional lab activities are often taught as "cookbook" labs meaning students in lab strictly follow written directions often with little thought about what they are learning or how the lab connects to real world applications. The necessity to follow strict directions are factors of limited time, large numbers of students, cost restrictions, and the need to ensure the safety of all students in the laboratory (Woodfield et al., 2004). Laboratories should not only provide students with the opportunity to increase their analytical skills but also to provide active student engagement while learning.

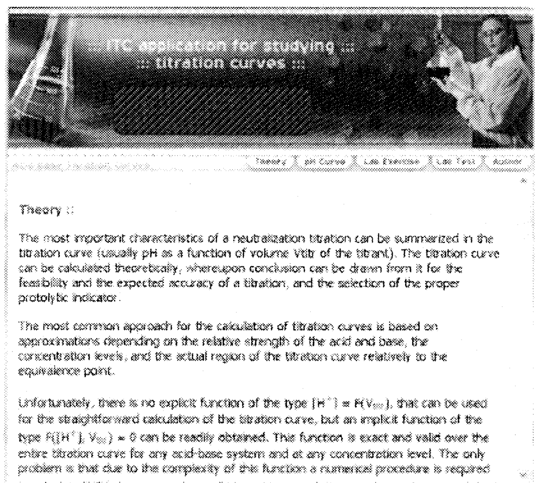

Figure 1: The application structure - Theory section

One alternative to traditional laboratory are virtual labs which can provide an interactive learning environment and connections to real world scenarios. Virtual laboratories should be used in conjunction with traditional laboratories. Virtual laboratories can be used as pre-lab to traditional laboratories, as follow-ups for further exploration, or as a substitute to traditional labs every now and then. The user-friendly application proposed, has a modular and interactive design and is structured in five sections, each one in a different tab: Theory (Figure 1), pH Curve (Figure 2), Laboratory Exercise, Laboratory test and Author.
In the first section is presented the theoretical background of neutralization and the equations used in the calculation of titration curves.

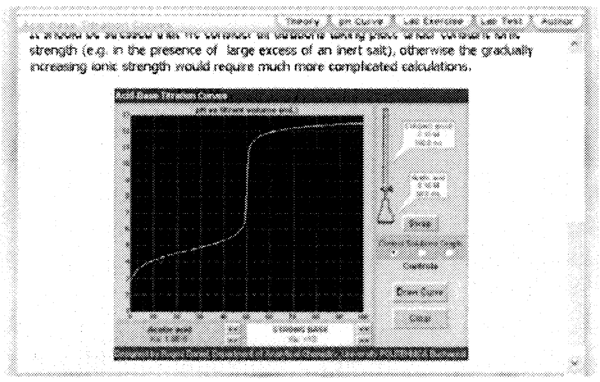

Figure 2: Applet for drawing titration curves

The theory section is followed by an evaluation (Figure 3) in order to expound how much of the presented theory was understood and learned.

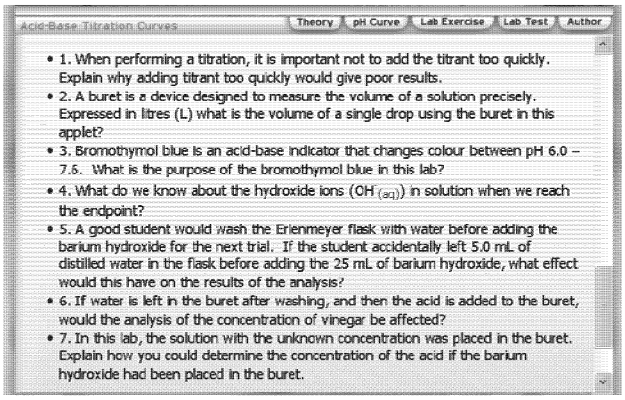

Figure .3: Evaluation

The virtual titrator makes the simulation of the titration curve of any acid, base or mixture a breeze; flexibility in the selection of sample size, concentration of ingredients, titration range, type, size and speed of titrant addition (Figure 4). Figure 5 presents a virtual titration where $Sr(OH)_2$ is chosen as base (Figure 5 left). The final volume of base required in this titration is mentioned in Figure 5 (right).

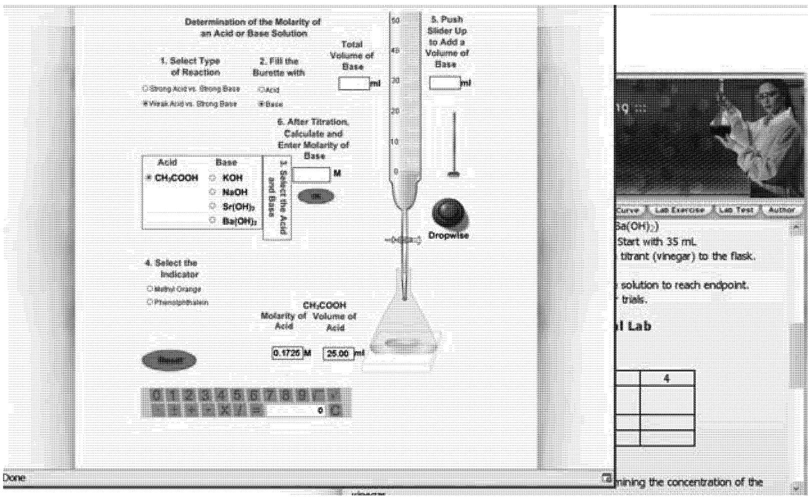

Figure 4: Laboratory case

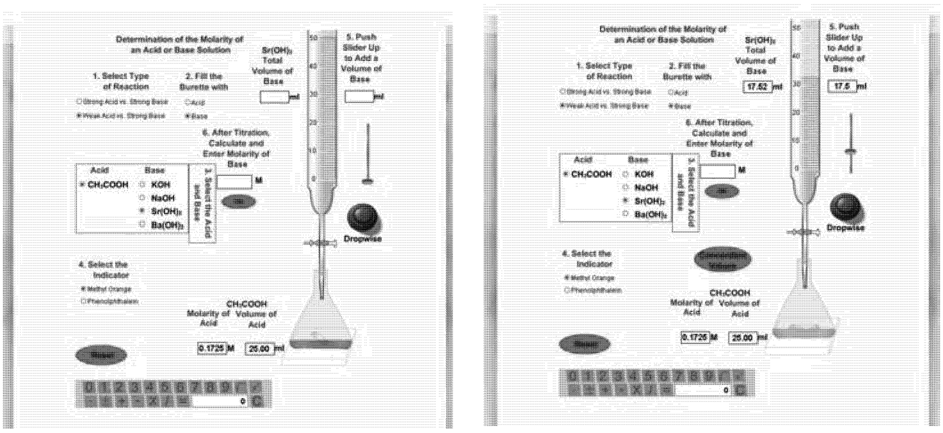

Figure 5: Choice of conditions and performing virtual titration

Teachers should be familiar with the technology before implementing it within the classroom. This will aid in helping students as they begin to use virtual lab programs. After familiarizing with the virtual titrator students receive an assignment. The assignment is tailored for each student. For individual work, students are allowed enough time to explore the virtual labs. They must enter their name at the beginning of the laboratory test.

The initial conditions that must be settled are data and variables tested: the acid (strong or weak), the base (strong or weak), the concentration of the solution, the volume of the solution and the indicator (Figure 6).

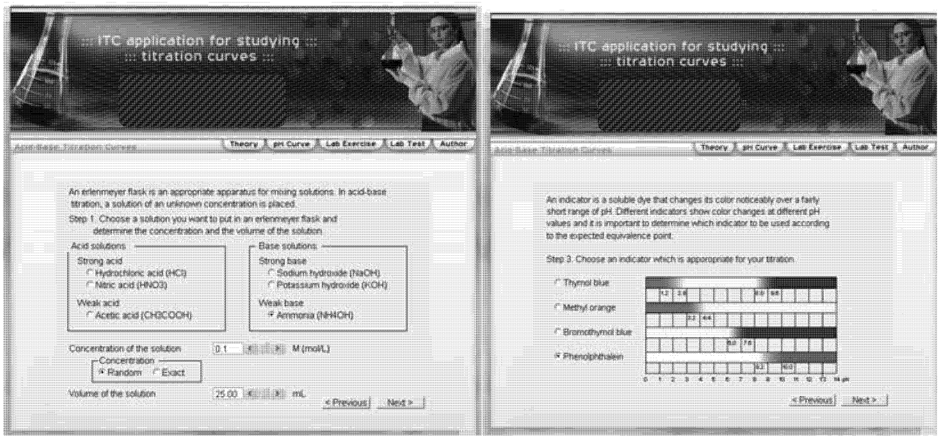

Figure 6: Setting initial titration conditions

After the initial conditions are agreed the student can visualize the titration and see the change in the color of the indicator after equivalence (Figure 7). The next step is drawing the titration curve and the calculation of the concentration and volume of the acid (Figure 8).

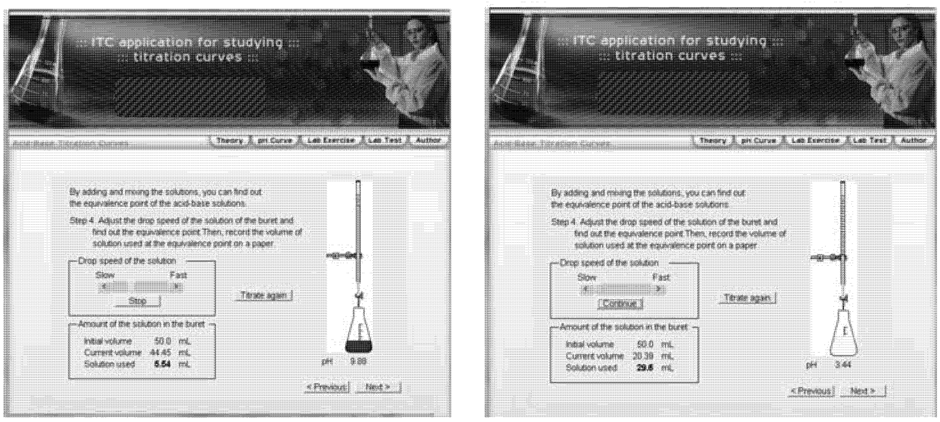

Figure 7: During the weak base titration and after equivalence

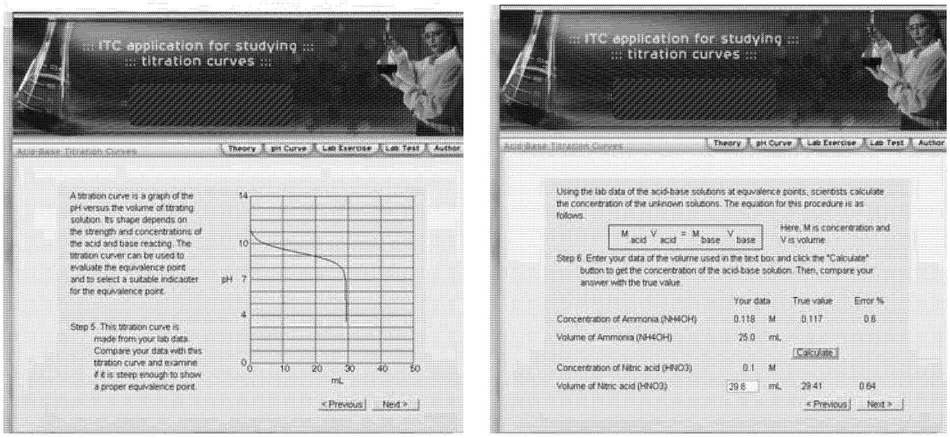

Figure 8: Corresponding titration curve and results calculation

After finishing the assignment the students receive a certificate confirming the quality of their work.

The benefits of using a virtual lab program within a high school chemistry classroom include providing students with an opportunity to explore their own laboratory experiment, relate chemistry to real-life scenarios, and increase student's abilities to make decisions.

3. Conclusions

The use of ITC tools in teaching chemistry can help students to understand theoretical concepts easier and make chemistry a more attractive subject. The project aiming to make ITC tools familiar for a large number of high school teachers will increase the quality of education and will make young people more interested in jobs in science and engineering.

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