1. Introduction

At present times, the educational process includes many ICT based methods for teaching and learning. Virtual instrumentation is not an exception - it is completing or replacing the experimental part in various cases. Many instruments not only allow users to conduct measurements but also present briefly fundamental theory of the phenomena on and provide full information concerning the experiments (e.g. how to switch on instruments, make connections, set parameter ranges and parameters; how to collect and analyse data and data processing results etc). In general, the virtual experiments are equipped with applications that simulate phenomena and processes, and also model instruments and experimental measurement systems. The educational virtual experiment must be well framed in the lesson context. Thus, a lesson plan has to be designed carefully, well-structured and guided to capture and maintain the interest of the student - for this reason, the interactive components in a lesson are acquiring more and more importance. The interaction mechanisms are based on several aspects according to the specific educational goal: simulations of selected live simulations and experimentations (Fig. 1).  

As a general rule, the execution of web-based experiments requires the creation of specific interfaces which, in the case of Science applications, consist of a multimedia simulation for the communication between the learners’ commands and the target system. For this purpose, specific software was designed by different companies for covering specific Science Education teaching areas. In the context of the VccSSe project, specific VIs software was developed by the partnership to be used in the training process of in-service teachers who are involved in Science teaching.

2. The Training Steps

Following the “Virtual Instrumentation in Science Education” training modules, the teachers learn to develop at least one virtual experiment which they can use in the classroom. This experiment represents the main product of the training activity. Together with the lesson plan, the experiment was uploaded in a special Products Matrix, a database especially designed for hosting the in-service teachers work and results on using virtual instruments for educational purposes. The VccSSe Products Matrix is accessible from the project website and its content is available to any project website visitor. The first page of the Matrix offers information of the number of the products - per partner institution - uploaded to the Matrix, in each course edition. Beside the final products of each participant, there are provided also information related to the lesson name, students level, area/category, teacher's name, school, keywords. At the end of the second year of the project, over 180 teachers had created their products and most of them also implemented the learnt methodologies in their classrooms. The lesson topics are selected by the teachers from different scientific areas (Mathematics, Physics and Chemistry) and different style of approaches (Fig. 1). In Târgovişte, 13 in-service teachers attended the first edition of the course and other 11 finalised the second one. 7 products were designed for primary schools (most of them for Mathematics lessons, using Cabri Geometry II Plus, 11 products were created for secondary schools and other 6 for upper secondary schools.  

Trying to assess the pedagogical use of virtual experiments, those 24 Romanian in-service teachers involved in teaching activities in Dâmboviţa County (Romania) who attended the “Virtual Instrumentation in Science Education” training modules expressed their feed-back in three specific web-experiments evaluation form (the first one before the course started; the second one after the lecture and the third one after the project). The questionnaires had particularly questions dedicated for evaluating the level of their knowledge acquisition on creating and using virtual experiments in the classroom, achieving the goals and purposes of the training modules and rating the presented virtual instrumentation software (Cabri Geometry II, LabPHYS, ChemSketch Clip and Graphics). At the same time, the teachers were asked to assess how important became the virtual instrumentation for them (as teachers), which were the qualitative aspects improved in the teaching process and what is the main advantage of using virtual experiments in the teaching process. The data and disseminating training materials, teaching methodologies and pedagogies are set based on the use of virtual instruments, having as target their implementation in the classroom through ICT tools.

3. Results and Discussion

The VccSSe project - carried out by 9 partner institutions from 5 different European countries (Romania, Spain, Poland, Finland and Greece) - was design with the declared aim of adapting, developing, testing, implementing and disseminating training materials, teaching methodologies and pedagogies, as a general rule, based on the use of virtual instruments, having as target their implementation in the classroom through ICT tools. Considering the main objectives of the project was to create and develop specific materials for training on using Virtual Instrumentation in Science Education. The training materials were dedicated to in-service Science teachers from all the educational levels in the partners’ countries. The preparation of the VccSSe training modules was made followed two directions, simultaneously: the first one targeted on the creation of the content of the modules, related training materials and assessment tools, the second one used a strong team to design and implement ICT instruments that support the training. In this sense, the project team have implemented an e-learning platform for supporting the related activities and developed the e-Space, a repository of virtual experiments that were used as examples in the context of training. The training modules introduce specific concepts of virtual instruments, available software packages and web examples, pedagogical methods and also particular didactical elements for the selected educational platforms. Cabri Geometry II Plus, ChemSketch Clip and Graphics. The in-service teachers work is function of their background and goals - were required to choose one of the software environments for understanding its main functions and creating at least one learning object that has to include a VI application. Their lesson plan - designed under a specific, well-structured and guided methodology - focused on the concepts to be learnt and also promoted a VI experiment for students with a significant level of interaction.

4. Conclusion

The traditional teaching methodologies and didactic strategies used for Science area teaching and learning can be easier integrated with those oriented on ICT. In this way, the efficiency and benefits of virtual experiments and related software which allow the creation of virtual experiments by teachers themselves was clearly demonstrable. Teachers who attended the “Virtual Instrumentation in Science Education” training modules organized in the frame of VccSSe project. As a general conclusion, the Romanian teachers emphasized their strong opinion that the introduction of the virtual experiments in the Science lessons was a real success besides the discovering of new channels for introducing ICT in their work with the view of helping the students to build their knowledge and to be creative in their learning.

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