Considerations Related to the Added Values Achieved in the VccSSe Comenius 2.1 European Project

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Abstract

The paper emphasizes on several added values registered during the life of the three years European Socrates-Comenius 2.1 project “VccSSe - Virtual Community Collaborating Space for Science Education” related to the gains attained by the trainers / tutors during the training sessions of “Virtual Instrumentation in Science Education” course, knowledge achieved by the trained teachers and general practice and experience acquired. In addition, the project offered the proper frame to make known and to update the knowledge related to the actual status of using virtual experiments in Science education.

On the other hand, a real need for teachers’ guidance was met during the training process. The main aim of the guidance was to make clear the teacher training requirements and to assure a general understanding among all trainers, tutors and partners. Face-to-face training sessions have been accompanied by specific guidance interventions, but also the platform used for on-line training offered the possibility to produce a real interaction tutor - trainer.

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1. Introduction

New technologies - as main agents of the knowledge or information society - play a central role in the actual education. As a consequence, in a very short period, new technologies transformed science “from canned labs and the passive memorization of content to a dynamic, hands-on, authentic process of investigation and discovery” (Barstow, 2001). Several methodologies based on ICT have been introduced in Science education with the view to raise the quality of the educational act but also to increase the recruitment to scientific and technical studies.

As a definite priority in Europe, in 2001, the Education Council mentioned in its Report to the European Council that “Europe needs an adequate throughput of mathematics and scientific specialists in order to maintain its competitiveness. In many countries interest in mathematics and science studies is falling or not developing as fast as it should. This can be seen at school, where the uptake of these subjects by pupils is lower than what could be expected; in the attitude of young people and parents to these subjects and later in the level of new recruitment to research and related professions.” (Report from the Education Council to the European Council: “The concrete future objectives of education and training systems”, 2001)
One of the most efficient methodologies introduced in the process of Science teaching is based on the use of virtual experiments. Their power on creating simulation-based learning environments is well-known and many teachers have already adopted the virtual experiments to be used in their classes (Suduc et al., 2009), simulations and physical investigations being traditionally treated as competing methods for Science learning (Jaakkola & Nurmi, 2008). But a series of research analyzed also the case where physical and virtual experiments are mixed in the same lesson. In those cases, the results are positive: the combination physical experiment - virtual experiment led to better results (Zacharia, 2007; Jaakkola & Nurmi, 2008) or at least equivalent to (Zacharia & Olympiou, 2010) physical or virtual alone.

Several European projects had as objective to develop and test new methods and educational resources for the in-service teachers involved in the educational process, to enable them to update their teaching methods and knowledge. But most of the projects that proposed methodologies based on the use of virtual experiments were addressed to the University level (especially engineering) and just few were dedicated to school education. In that direction, the three years Socrates-Comenius 2.1 project “VccSSe - Virtual Community Collaborating Space for Science Education” - code 128989-CP-1-2006-1-RO-COMENIUS-C21 - was proposed and financed, bringing a real added-value potential to its participants.

2. Method

As main outputs, the VccSSe project produced training modules that promoted new teaching methodologies and pedagogical strategies based on the use of virtual experiments dedicated for Science Education (Gorghiu, 2009). Nine institutions from five countries (Romania, Spain, Poland, Finland and Greece) designed and produced training materials that represented the main-core for the training modules called “Virtual Instrumentation in Science Education”, with a total duration of 40 hours. At the final point, the participants prepared virtual experiments (defined as learning objects) for various educational levels (Gorghiu et al., 2010). In this way, the project represented an important opportunity for exploring the educational use of virtual experiments in the classrooms, in different Science learning contexts. Several software application environments (which offer the possibility to explore the potential of virtual experiments) were chosen to be used in the frame of the project, after an analysis phase, due to their educational features and facilities and also to the wide experience proved by the project partnership in their using: Cabri Geometry, Crocodile Clips, LabVIEW, GeoGebra (Suduc, Bîzoi & Gorghiu, 2008).

The quality of the training process was evaluated using specific sets of assessment tools. In this respect, in order to evaluate the formative impact of the training, an experimental design was associated with the training process which included an initial and a final survey based on questionnaires (Gorghiu, Gorghiu & Glava, 2011). More, after the ending of training sessions and implementing in classrooms of learning objects, the proposed software environments were evaluated in report with their added-value in the educational process, taking into consideration 10 criteria - (1) usability; (2) collaboration; (3) active learning; (4) expression of students’ knowledge; (5) holistic approaches in learning; (6) interesting activities; (7) promoting pupils’ reflection; (8) providing appropriate feedback; (9) designing various activities and (10) concept / content (Suduc, Bîzoi & Gorghiu, 2008) -, but also taking into consideration the end users (in-service teachers and students) feedback (Dumitrescu et al., 2009).

3. Results and Discussions

Several added values must be emphasized at the end of the VccSSe project, as they are underlined by the project members (trainers, tutors) and trained teachers. First, some of the arguments - that strongly strengthen the idea that a European project represents an important source of added-values - are presented below:

(a) as teacher trainers, the tutors had the opportunity to learn about other educational institutions’ manner of approaching scientific and action research. At the same time, it was clear also the opportunity on analyzing the level reached by each partner country on educational use of ICT and virtual instrumentation. All those investigations and products - designed in the frame of the project - were made within an international and interdisciplinary project team - a fact that created the opportunity for growing the expertise and national experience transfer. In this sense, the project has been proved like a suitable occasion for each participant to be part of an international team and to
exchange professional ideas, improve his/her cooperative skills, work systematically according to an agreed plan and put ideas and contributions in an internationally accepted form.

(b) the VccSSe project offered a proper frame to set a cascading process: a number of Science teachers were trained to use virtual experiments for Science lessons, and, as a result, they used the knowledge to prepare new lessons (learning objects) for their students and applied it to the classroom. The trained teachers shared their knowledge also with their colleagues during Science teachers’ weekly meetings. Besides the trained teachers, the people who wanted to access the project webpage have access to a wide number of Virtual experiments examples and products. The examples and products are delivered in an accessible format (as specific application file formats but also as video-clips) in order to be understandable by people of any age, education, and cultural level.

(c) other added values are strongly related to practice and experience. But, the systematic evaluation of the project results and products opened new themes and reflection topics on how to increase the pedagogical use of virtual experiments in the future and create the opportunity to develop different research studies. In this way, a strong research component of the project has been added to the initial targets. More, a strong basis for planning the future co-operation within the partnership has been assured.

The experience obtained during the project development proved that the chosen software applications help on the development of specific learning settings (Glava, Bocoş-Bintinţan & Glava, 2009):

(1) demonstrations - in Mathematics, Physics and Chemistry - demonstration based on intuitive stimuli support logic understanding of abstract concepts, functions, relations and processes.

(2) investigation and discovery based learning situations - possibilities of variables manipulation included in all the explored software applications, doubled by heuristic questions and instructions, create a favourable environment for deductions, generalization, conceptualization, formulation of laws and theories;

(3) problems - there may be organized around concrete, contextualized data. There were emphasized the main methods provided by the presented software applications for creating virtual interfaces where students can manipulate variables with the view to find the solution.

(4) repetitive exercises that lead to knowledge transfer - by requiring students to modulate variables of a situation, repetitive exercising can be created, situations that support generalization and transfer of knowledge.

(5) explanatory situations - explanations are supported by intuitive stimuli, thus students understanding of abstract processes being enhanced. Visual stimuli offer anchors for retrieval of knowledge and relations.

During the training sessions the tutors offered constant pedagogical counseling and guidance regarding the types of learning situations that teachers developed. The guidance went into the direction of supporting teachers to identify learning contexts that insure deep understanding and flexible application of knowledge for the students. Direct and on-line discussions about the meanings of active learning, transversal skills, deep learning, and critical thinking were encouraged and Science teachers identified the particular significations of these terms in their teaching field. The concrete and contextualized pedagogical guidance offered by the trainers was an opportunity for reflecting about the effective learning in Sciences and on the means for developing in students the specialty thinking which is so important for the future professional life.

As main objective, the VccSSe project offered to the partnership an extremely valuable opportunity to update the knowledge related to the actual status of using virtual experiments in education. Consequently, when using hardware/software applications during the training and implementation process, the partnership found out some differences between various aspects within the participation countries, namely: (a) policies on privacy and security (which affects the ability and willingness in collaborative projects across Europe, both in terms of data protection and connectivity - through firewalls); (b) policies on hardware and software (which affect the possibility of partners to participate in a project which relies on particular software and/or hardware).

However all the training activities claimed guiding that was offered by trainers and tutors, permanently. In the beginning, the guidance was oriented to make clear the teacher training requirements and to assure the proper understanding of the whole process among trainers, tutors and partners. Specific guidance interventions were provided during face-to-face training sessions. Moreover, as an important part of activities was sustained by an electronic platform (Moodle), guidance interventions were addressed to trained teachers through the platform itself. By using Moodle, the students had the opportunity to consult the calendar that displays the activities planned for specific days, access learning materials, interact with teachers and colleagues, receive specific tasks as homework and get the necessary guidance. The training sessions were structured and framed in weekly periods, this mode of scheduling being very practical due to the fact that is based on the distribution of the materials in the static format
(doc, pdf) in direct relation to setting of important dates for trainees. But even mostly tutors and teachers took contact with Moodle for the first time, they experienced the Moodle’s organization and features with great interest and expressed their opinions in related discussions (Gorghiu et al., 2009). Figure 1(a) illustrates the specific organization of the training modules inside the Moodle space.

On the other hand, the chosen platform for supporting the project team work was the phpGroupWare platform. This environment was selected to be used due to its richness and flexibility and due to the fact that it is offered free of charge (Bîzoi et al., 2009). Figure 1(b) presents the organization of work inside phpGroupWare at the moment of designing the training modules by the project trainers.

4. Conclusions

The paper presents the added values of the VccSSe three years European project on using virtual experiments in Sciences teaching. The training programme designed and implemented during the project was a complex learning situation for all the professionals involved.

The benefits of the programme could be grouped in several categories: team working in an international professional environment, experiencing blended learning, and reconsidering the teaching contents in order to adapt them to the virtual instrumentation and for insuring the Science contents deep learning. The constant administrative, pedagogical and professional development guidance and counseling offered by the trainers was a vector for identifying the training needs, level of professionalization and tendencies in Science teaching field.
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