"VccSSe: VIRTUAL COMMUNITY COLLABORATING SPACE FOR SCIENCE EDUCATION" - AN EUROPEAN PROJECT EXPERIENCE UNDER SOCRATES COMENIUS 2.1 ACTION

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Abstract:
Started in 2006, the European Socrates Comenius 2.1 Project "*VccSSe - Virtual Community Collaborating Space for Science Education*" (128989-CP-1-2006-1-RO-COMENIUS-C21) - http://www.vccsse.ssai.valahia.ro - answered to a clear need related to finding new ways to provide in-service teacher training in the area of Mathematics and Science. In this respect, the project tried to promote the use of virtual instrumentation and virtual experiments as new teaching methods for the Sciences in-service teachers. In addition, the pupils took contact with the virtual experiments and had a good alternative when - due to the objective factors - it is impossible to manage the real ones.
The paper offers an image on the VccSSe project and its results as this was collected very near to its ending. Of course, most of the results are presented in brief, remaining that for the interested readers to explore the project webpage and its resources in details.

Keywords: Virtual Instrumentation; Virtual Experiment; in-service teacher training; e-learning; e-Space; Moodle; Comenius 2.1 project

1. Introduction

Eight years ago, the Education Council of the European Union presented a Report addressed to the European Council entitled "The concrete future objectives of education and training systems" (5980/01) [1]. This Report indicated as first strategic objective for the coming 10 years: "*to increase the quality and effectiveness of education and training systems in the European Union*". As a main direction, the document stipulates the necessity of *ensuring access to ICTs for everyone*. The developing use of ICT within society has meant a revolution in the way that schools, training institutions and other learning centers could work, as indeed it has changed the way in which many people in Europe work. ICT is also of increasing importance in *open learning environments* and in

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virtual teaching. "As far as the education and training systems are concerned, the ability to respond to the rapid developments and the need to stay competitive will continue to play an important role. In addition, flexibility will be needed for individuals to acquire ICT skills throughout their lives." [1]

At the same time, another direction was oriented on *increasing the recruitment to scientific and technical studies*, "Europe needing 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 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." [1]

In the respect of the first priority and related directions mentioned by the Education Council, the partnership of Socrates Comenius 2.1. Project "*Think, Construct and Communicate: ICT as A Virtual Learning Environment*" (106469-CP-1-2002-1-ES-COMENIUS-C21) explored and found a common interest and urgent need in their countries for new ways to provide in-service teacher training in the area of Sciences. It was concluded that one of the best solutions to increase the participation in Mathematics and Science studies was represented by the promoting of the virtual instrumentation and virtual experiments as new methods and educational resources for the Science in-service teachers.

On the other hand it was real evidence that most of the projects which promoted the use of virtual instrumentation were addressed to the University level (focusing on engineering) and just very few were dedicated to the Science in-service teacher training.

In this way, a new transnational European Socrates Comenius 2.1 was born ("*VccSSe - Virtual Community Collaborating Space for Science Education*" (128989-CP-1-2006-1-RO-COMENIUS-C21)), its approval (in summer 2006) offering a chance for the partnership to put in practice their ideas and knowledge with a view to make known the great potential given by virtual experiments for Science education.

2. The VccSSe Project

The three years VccSSe Project has as declared objective to adapt, develop, test, implement and disseminate training modules, teaching methodologies and pedagogical strategies based on the use of Virtual Instruments, with the view to their implementation in the classroom, through ICT tools [2]. The main goals of the project have been achieved taking into account the specific particularities of different countries involved in the partnership.

The partnership of the project consisted in 9 institutions coming from 5 different European countries: *Valahia University Targoviste* (Romania) - the coordinating institution, *Centro de Formación del Profesorado e Innovación Educativa Valladolid II* (Spain), *Centro del Profesorado y de Recursos de Gijón* (Spain), *Centro de Profesores y Recursos de Zaragoza I* (Spain), *Politechnika Warszawska* (Poland), *Regionalny Ośrodek*

Doskonalenia Nauczycieli "WOM" w Bielsku-Białej (Poland), *Joensuun Yliopisto* (Finland), *Babes Bolyai University Cluj Napoca* (Romania) and *University of Patras* (Greece).

All the work made in the project was organized in four clear project stages [3]:

a) *Creation Stage* - its activities were oriented on identifying, analyzing and selecting of the suitable virtual instrumentation environments, creating the training modules "*Virtual Instrumentation in Science Education*", implementing an e-learning platform (*Moodle*) to support the course activities and developing the *Virtual experiment space* (*e-Space*) - a repository of virtual instruments that were used like examples during the training sessions.

b) *Training Stage* - the main activities were focused on in-service teacher training using the materials and instruments developed in the first stage.

c) *Implementation Stage* - its activities consisted of designing and introducing by the teachers of the virtual experiments in their lessons. Assessment tools for evaluating the quality of the in-service teacher training process were also developed.

d) *Evaluation & Dissemination Stage* - the main activities were oriented on evaluating the project activities and its outputs and also on disseminating the project results through different channels: webpage, posters, articles, exhibition, DVD edition, web / external dissemination etc.

The project activities have been designed on targeting on three groups [4]:

a) *leading staff*: local coordinators (which were act also as tutors), tutors, researchers and educational local authorities - even that in the proposal phase the number of tutors and researchers has been approximated at 27, it reached 32 finally. Along with the 18 representatives of local authorities in education, this group comprised of 50 people.

b) *in-service teachers* from primary and secondary schools involved in Sciences teaching areas - the initial target group was estimated at 180 teachers but 363 teachers started the training modules proposed by the project.

c) *pupils* - they participated actively to the lessons proposed by the teachers involved in the project, based on the developed pedagogical methods and strategies. Even the initial number of pupils was approximated around 3500, the final number was under 3000 due to the limited number of pupils which formed a study group during the Sciences lessons (Mathematics, Physics, Chemistry).

3. Project Results

3.1 The VccSSe *e-Space*

The VccSSe *e-Space* - a repository of virtual experiments that were used as examples in the context of training - represents in fact a valuable database with a specific web interface which can be accessed from the project website. The database contains virtual experiments offered as examples for the teachers who participated to the Training Modules, and also for any person who is interested in using of virtual experiments. The e-Space is structured per

areas (Mathematics, Physics, Chemistry and Technology) and related categories and proposed a very simple way for the navigation inside. It provided also a search engine which allows searching VI examples by: description, author, keyword and language (partners' languages: English, Romanian, Spanish, Polish, Finnish and Greek) [5].

All the examples provided within the e-Space were useful to give to the teachers an idea of what topics can be better taught using virtual instruments and help them to create the learning objects (final products). Figure 1 illustrates an e-Space snapshot presenting the interface of Chemistry area, category: Solutions.

Fig. 1 *Solutions category interface - 8 experiments - presented in the VccSSe e-Space.*

3.2 Training Modules and Training Materials

Creating and developing specific materials for training on using *Virtual Instrumentation in Science Education* represented an important project outcome. The preparation of the *VccSSe* training modules was realized in the respect of two clear directions: the first one targeted on the creation of the content of the training modules, related training materials and assessment tools; the second one used a strong technical background to develop and implement the ICT instruments that support the training [6]. Beside the *e-Space*, the project team used an e-learning platform (*Moodle*) for supporting all the related activities. The training modules introduced specific concepts of virtual instruments, available software packages and web examples, pedagogical methods and also particular and didactical elements for the selected educational platforms: *Cabri Geometry II Plus*, *Crocodile Clips*, *LabView* and *GeoGebra*. All the materials produced for training were initially designed in English and then translated in partner's national languages: Romanian, Spanish, Polish, Finnish and Greek. For each selected educational platform, video-training materials (in English) were provided and uploaded in the *Outcomes* section of the project webpage.

The duration of the training sessions covered approximately 42 hours, including the web evaluation. Each unit of the training modules - the modules consisting on 3 seminars and 3 practical laboratories - included particular tasks and their solving required also the uploading of the results in the *Moodle* space. Like an example, Figure 2 illustrates the organization of the *Training Modules* inside the particular space of *Moodle* e-learning platform.

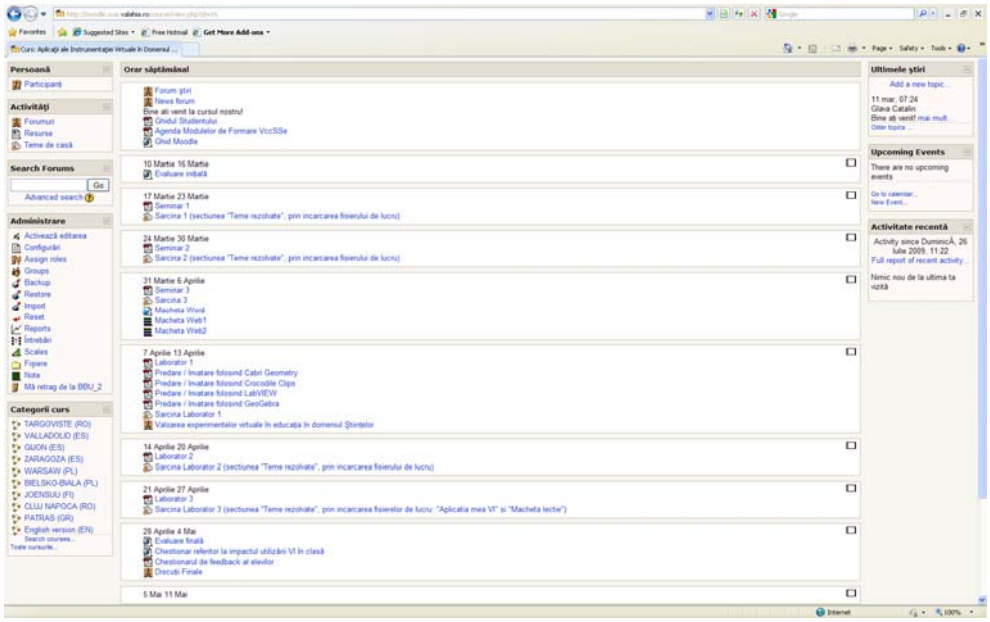

Fig. 2 *Moodle space organization for the Training Modules "Virtual Instrumentation in Science Education" (Cluj Napoca category - edition II).*

A number of 363 teachers started the training modules and working inside the *Moodle* platform. In the end of the modules, depending on their background and goals, the in-service teachers were asked 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 plans - designed under a specific *Template* - proposed explanations on the concepts to be learnt and also promoted a *VI* experiment for students with a significant level of interaction.

The *Training Modules* developed in the frame of the VccSSe project aimed also to achieve transversal skills for the teachers who are taking part in the training session. Teachers learnt to use an e-learning platform (*Moodle*) and, given the fact that most of

these platforms respect the same usability principles, it is expected that they are able to transfer the skills acquired in this context, in future e-learning situations.

Teachers also learnt to communicate in a professional group animated by similar learning aims. In addition, the *Training Modules* included Internet searching exercises, as well as other different pedagogical exercises, such as creating complex evaluation rubrics, or designing different teaching and learning situations that allowed the use of virtual experiments and demonstrations.

3.3 Database for Virtual Experiments (Teachers' Products Matrix)

Following the *Virtual Instrumentation in Science Education* training modules, 206 teachers finalized the training sessions and prepared the learning object composed by a lesson plan and (at least) one virtual experiment. Almost 150 implementations in the classrooms were also declared. The learning objects were uploaded in a database entitled VccSSe *Products Matrix*. The Matrix is accessible from the project website and its content is available to any project website visitor.

The first page of the Products Matrix offers information related to the number of the products - per partner institution - which are uploaded to the Matrix, in each course edition. Finally, 218 final products created in the first and second editions of the training modules can be consulted and free to be used in the classrooms. Beside the final products of each course participant, there are also provided information concerning the lesson name, student's level, area/category, teacher's name, school, keywords.

Figure 3 presents the Products Matrix interface where the learning objects created by the teachers are classified per institution and training modules edition.

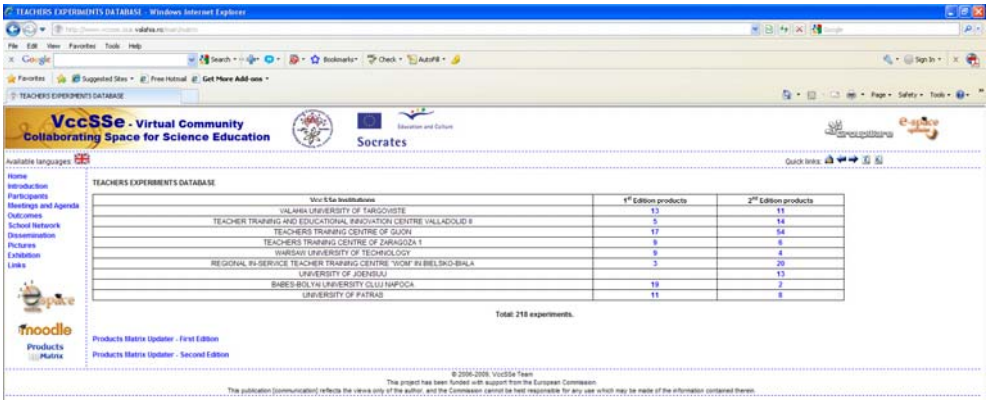

Fig. 3 *The Products Matrix interface*.

3.4 Virtual Experiments Exhibition

The *Virtual Experiments Exhibition* is a web interface which contains the best virtual experiments produced by the in-service teachers who finalized the *Virtual Instrumentation in Science Education* training modules. In this sense, 50 representative experiments (included also in the *Products Matrix*) were selected and presented as educational video-files, assuring a clear representation of the Sciences categories, together with 9 *On-line / Remote Simulating Laboratories* (produced by the project partnership) that allows teachers and students to work directly inside the experiment.

The video-clips include also details concerning the pedagogical aspects of virtual experiments implementation in the classrooms. On the other hand, the teachers have chosen different approaches for the educational video-clips: part of them described the realization of the experiment and the possibilities of creating a new experiment to be used in the classroom, others described the experiment itself and how it can be used with the students [5]. Figure 4 illustrates a part of the proposed educational video-clips uploaded in the Exhibition.

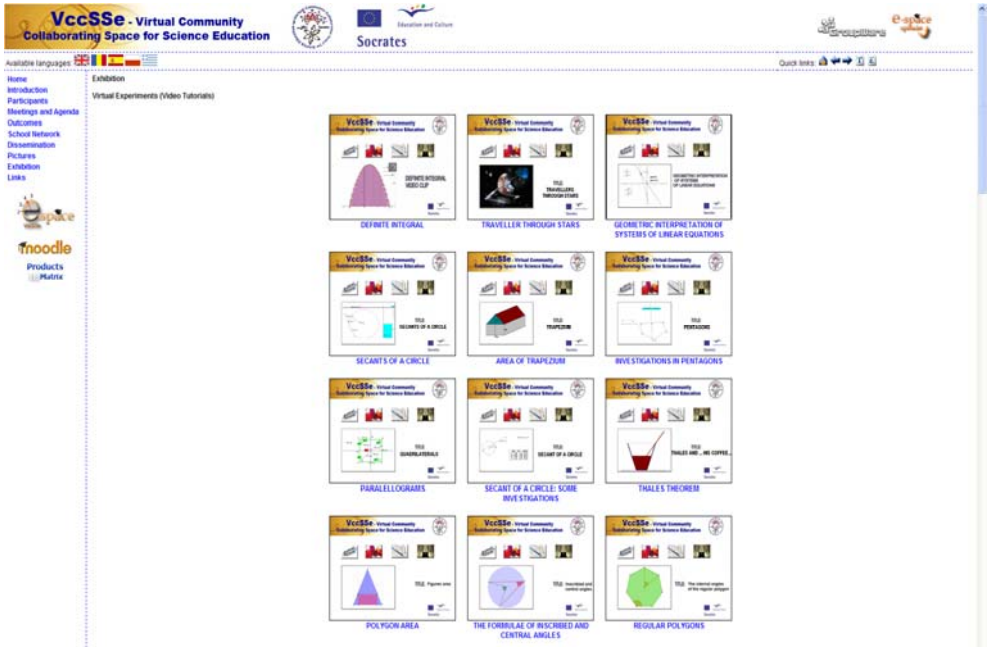

Fig. 4 *The Virtual Experiments Exhibition realized in the frame of the VccSSe project.*

3.5 Assessment Tools

The *Assessment Tools* included instruments in order to evaluate the quality of the in-service teacher training process (*Initial Evaluation* and *Final Evaluation*) and the impact of the implementation in the classroom of the virtual experiments (*Questionnaire about the Use of VI Impact in Classroom* and *Pupil's Feedback Questionnaire*). A *database* collected the answers of the *on-line questionnaires*, becoming in this way an important source of information for various statistics.

At the same time, in order to evaluate the project activities, the partnership was asked to fill in a yearly *Evaluation Questionnaire*. Based on those questionnaires, consequently, *Evaluation Reports* were provided.

The tools are completed with the evaluation of the pedagogical aspects of the proposed educational software [7] and the evaluation of the Meeting with European Sciences teachers, using sharing and videoconference tools.

3.6 Guidelines for Best Practices in Educational Use of Virtual Instrumentation

The *Guidelines for Best Practices in Educational Use of Virtual Instrumentation* was designed in order to offer to the teachers an instrument that assists them during the implementation of the Virtual Experiments in the classrooms. The Guidelines consists of five different sections:

1. Country requirements, traditions and issues in use of ICT for Science teaching and learning;
2. Social and constructivist learning theories in the context of educational use of virtual instrumentation;
3. Virtual instrumentation existing options and VI selection criteria. Lessons learned in VccSSe project;
4. Virtual instrumentation software explored within the European project Virtual Community Collaborating Space for Science Education;
5. Comparative reflections regarding the educational use of different VI instruments.

In fact, the Guidelines represents a justification and pleading for using the virtual instruments and experiments in the classrooms, a real help for imaging abstract processes, brings concepts into applicative, concrete concepts, favor cooperation, manipulation of reality and formulation of conclusions through own cognitive efforts [8].

3.7 Dissemination Activities

The project team has tried to promote the activities and results of the project by using of various dissemination channels.

For dissemination purposes the partnership agreed on designing / publishing of: leaflets, posters, newspaper articles, scientific articles, books. Web dissemination and external dissemination were also taken into consideration [2].

An important dissemination activity was represented by the meeting with European Sciences teachers, using sharing and videoconference tools, held in March 2009. An number of 100 participants were presented to this meeting where each project partner had an intervention for showing relevant virtual experiments for the Sciences area.

Another dissemination result is offered by the *project DVD edition*. It includes all the materials developed in the frame of the project, being seen as "a media" through which is possible to make the project and its results known in each partner country. It will be designed during the Evaluation & Dissemination Stage of the Project.

Finally, it is important to mention the big amount of scientific articles / communications presented to various conferences during project life time.

4. Conclusions

Basically, the idea of VccSSe project was structured for answering to some of the challenges of education and training systems that were identified in each of the participating countries but axed on the European directions oriented on increasing the recruitment to scientific and technical studies.

By sure, at this moment, the ICT tools decided to be explored during the project are part of recent trend in educational systems in Europe, as most of the countries have already approached this issue and have developed some solutions in this respect. One of the feedbacks collected from the in-service teachers who participated to the Training Modules indicates that teachers appreciate the flexible teaching and learning situations which could be created through implementation of the virtual instrumentation tools. In addition, the training through an e-learning platform (*Moodle*) represented also a real challenge for a great part of them but this fact makes them feeling as a part of the learning community which explores the same learning tools and their educational applicability.

The teachers' results and feedback, as well as the pupils' one, emphasized in a clear way that the project faced all its beneficiaries to various learning situations that offer to them transferable skills which can become useful for both their professional and private continuing instruction.

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References

[1] Report from the Education Council to the European Council: "The concrete future objectives of education and training systems", Council of the European Union, Brussels, 14 February, 2001, http://ec.europa.eu/education/policies/2010/doc/rep_fut_obj_en.pdf

[2] VccSSe - Virtual Community Collaborating Space for Science Education, http://www.vccsse.ssai.valahia.ro/

[3] G. Gorghiu, M. Bîzoi, L. M. Gorghiu, A. M. Suduc, The VccSSe Project - Promoting the European Cooperation with the View of Improving the Methodologies for Science Teaching and Learning Using Virtual Instrumentation, *PARSEL (Popularity and Relevance of Science Education for Science Literacy) Conference*, Berlin, Germany, March 1-4, 2009.

[4] G. Gorghiu, M. Bîzoi, L. M. Gorghiu, A. M. Suduc, An Overview of Tutors/Teachers Activities in the VccSSe Project, *PARSEL (Popularity and Relevance of Science Education for Science Literacy) Conference*, Berlin, Germany, March 1-4, 2009.

[5] A. M. Suduc, M. Bîzoi, G. Gorghiu, Virtual Instrumentation Environment Used in the VccSSe Project, *Postępy eedukacji* - Praca Zbiorowa Pod Redakcją Zespołu Ośrodka Kształcenia Na Odległość OKNO PW (Oficyna Wydawnicza Politechniki Warszawskiej), Warsawa, 2008, pp. 364-370

[6] G. Gorghiu, L. M. Gorghiu, A. M. Suduc, M. Bîzoi, C. Dumitrescu, R. L. Olteanu, Related Aspects to the Pedagogical Use of Virtual Experiments, *Research, Reflections and Innovations in Integrating ICT in Education (2009) - Proceedings of the Fifth International Conference on Multimedia & ICT's in Education*, Lisbon, Portugal, FORMATEX, Badajoz, Spain, vol. 2, 2009, pp. 809-813.

[7] A. M. Suduc, G. Gorghiu, M. Bîzoi, W. Masior, M. Łątka, A Comparative Analysis on Using Several Virtual Instrumentation Software in Education, *Proceedings of First International Conference on Computer Supported Education (CSEDU 2009)*, Lisbon, Portugal, vol. 1, 2009, pp. 435-438.

[8] A. Glava, C. Glava, M. Kordaki, Guidelines for Best Practices in Educational Use of Virtual Instrumentation, http://www.vccsse.ssai.valahia.ro/main/outcomes?lang=en