SOME ASPECTS CONCERNING THE USE OF VIRTUAL EXPERIMENTS IN THE TEACHING/LEARNING PROCESS

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Abstract:
The paper illustrates some aspects concerning the impact of virtual experiments implementation in the teaching/learning process on different topics of the Sciences area in Dambovita County (Romania). The study was made in the frame of the three years Socrates-Comenius 2.1 project "*VccSSe - Virtual Community Collaborating Space for Science Education*" (no. 128989-CP-1-2006-1-RO-Comenius-C21), co-funded by the European Commission, Education and Training, School Education: Socrates: Comenius.

Keywords: Virtual Instruments; science experiment; pupils' feedback; teachers' feedback; teaching process; learning process

1. Introduction

Virtual instruments (VI) represent a fundamental shift from traditional hardware-centred instrumentation systems to software-centred systems that exploit the computing power, productivity, display, and connectivity capabilities of popular desktop computers and workstations.

Many courses have already begun incorporating computer-based educational tools for student use, either in the lectures or in the laboratory practices or both.

Certainly, experiments are necessary for the advancement of the scientific knowledge. However, experiments are equally important in Science subjects teaching because they allow the students to enter in direct contact with natural phenomena. One of the main advantages of virtual instruments is the fact that students are able to define instruments inside the software [1].

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Virtual experiments provide pupils/students the opportunity to repeat measurements many times and run experiments at convenient time. Essential properties of the home virtual laboratory – and also of virtual laboratories for secondary schools – are that they are costless and can be performed at any time using computers and presented software [1, 2].

The main purpose of the "*VccSSe - Virtual Community Collaborating Space for Science Education*" project is to adapt, develop, test, implement and disseminate training modules, teaching methodologies and pedagogical strategies based on the use of Virtual Instrumentation and to promote the cooperation between different European teaching and educational institutions to produce and disseminate training materials that will assure the technical and pedagogical elements with the view of implementing in the classroom of the virtual applications through Information and Communication Technology tools [3].

Presented paper try to point out some examples of using a Virtual Instrument tool in the teaching/learning process on different topics of the Sciences area in Dambovita County (Romania) schools.

2. Description of the procedure

In the frame of the project, the partnership developed the materials for the "*Virtual Instrumentation in Science Education"* course. The course was created for in-service teachers from primary and secondary schools involved in Sciences subjects in the partners' countries. The course was structured in 3 seminars and 3 laboratories.

For achieving the project objectives the following virtual instrumentation environments were used: LabView, Crocodile Clips (Crocodile Chemistry, Crocodile Physics), Cabri Geometry II Plus, GeoGebra [4].

The course was developed so the participants to be able, at the end of the course, to create their own virtual instruments which can be used with the pupils.

The final products made by the trained teachers, involved in the "*VccSSe - Virtual Community Collaborating Space for Science Education*" project have been implemented in the classroom.

3. Results and discussion

The study was realized on the base of the analysis of the teachers' answers collected from the "Impact Questionnaire (using VI experiments in classrooms)" and pupils' answers collected from the "Pupils' Feedback Questionnaire" designed by the Evaluation Group of the partnership after the implementation process. The analysis was performed on a sample of 24 teachers and 585 pupils at different educational level (presented in table 1).

The virtual experiments designed by the teachers at the end of the training modules have been implemented in different areas, like Mathematics (56%), Physics (5%), Chemistry (32%) and Technology (7%) [5].

Table 1. The Pupils' and Teachers' Feedback on implementation

No.	Software Used for Experiment Designing	Area	Educational Level	Number of Teacher/Number of Pupils
1.	Crocodile Chemistry	Chemistry	Lower School	2/87
			Upper School	2/101
2.	Crocodile Physics	Physics	Lower School	1/40
		Technology (Physics)	Primary School	1/17
3.	LabView	Physics	Upper School	1/20
4.	Cabri Geometry II Plus	Physics	Lower School	1/12
		Mathematics	Lower School	7/121
			Upper School	2/50
		Primary Education	Primary School	5/93
5.	GeoGebra	Primary Education	Primary School	1/18
		Mathematics	Upper School	1/26

Virtual Instruments applied in the experiments in the teaching/learning process are very important for the teachers as source of inspiration, as an effective learning environment and as a means for improving students' conceptual understanding (figure 1).

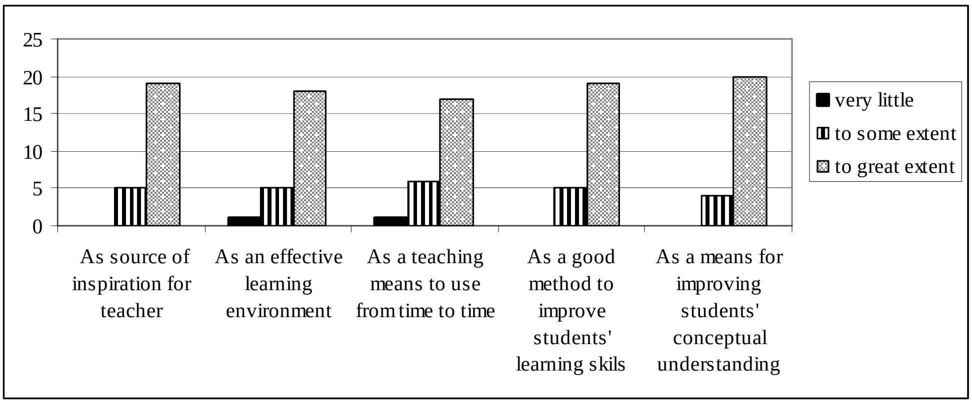

Fig. 1 *The meaning to use the virtual instrumentation in the teaching/learning process*

After the implementation of their own virtual experiments in the classroom, the involved teachers considered the practices they had developed to be largely successful in terms of enhancing pupils' learning. The increasing of pupils' motivation, the deeper understanding of the theoretical concepts and the easier confirmation of a model or a hypothesis by them have been identified after the using of virtual experiments in teaching of different Science areas.

Figure 2 shows the distribution of the teachers' opinions concerning their perception (positive aspects and difficulties) of the VI experiments implementation in the classroom.

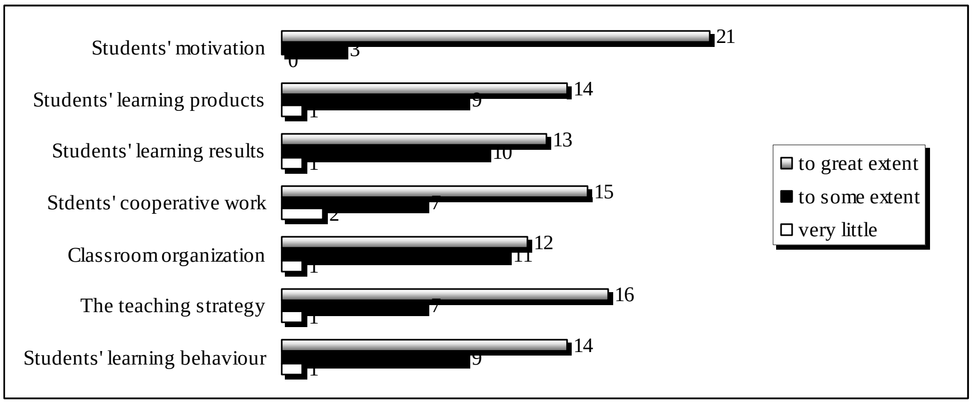

Fig. 2 *The distribution of the teachers' opinions on some positive aspects concerning the VI experiments implementation in the classroom*

The created experiments was successfully in terms of clearly presentation of the lesson objectives and, at the same time, having the following advantages: easy access of each pupil to experiment, helping for the identification of cause-effect relationships through observation and interaction, underlying scientific models that are not easily percept from direct observation.

Virtual Instrument intermediate also an easy understanding of the lesson subjects. Pupils' comments emphasized that the successfully use VI tools requires a minimum of technical competences concerning the using of the software

Also related to VI implementation in the classroom most of the teachers point out that the using of the hardware, specific software, available resources and classroom management doesn't create difficulties. This aspect shows that the using of ICT in Romanian schools start to be an important issue in last period.

Figure 3 illustrates the distribution of the teachers' opinions concerning their perception (difficulties) of the VI experiments implementation in the classroom.

Concerning the negative aspects encountered in the implementation of virtual experiments in different lessons, the pupils' answers emphasized some things that affected the implementation process, like the low number of computers used, non-approaching of more complex subjects and the lack of time for understanding of all the aspects related to the teaching process and presenting the tasks results.

Related to the use of virtual experiments in future lessons, the distribution of teachers' and pupils' answers proves that most of the pupils are delighted to use the virtual instrumentation during the teaching/learning process, a great part of them even regularly.

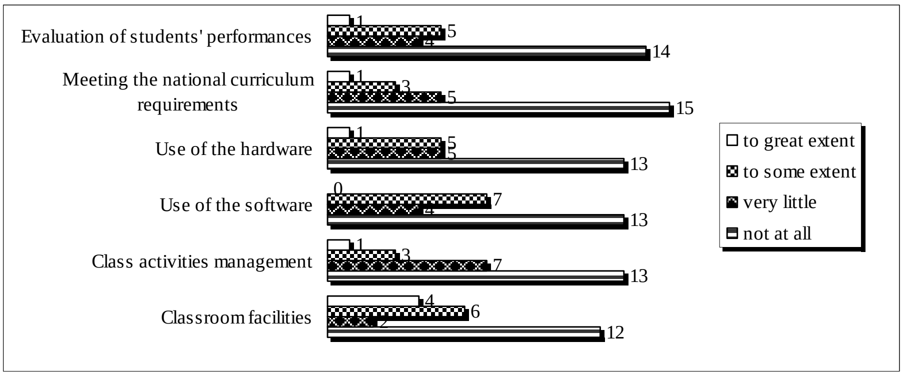

Fig. 3 *The distribution of the teachers' opinions on the difficulties met during the VI experiments implementation in the classroom*

4. Conclusions

The participation to the on-line course ''*Virtual Instrumentation in Science Education*'' offered to the teachers the possibility to discover new ways of using the ICT in the classroom.

Considering the enthusiasm of the in-service teachers who participate to the *Virtual Instrumentation in Science Education* course and also the pupils feed-back, we can conclude that the main project objective was reached and it opened a new window in science curricula development.

The same experiment may be used differently, function of the desired outcome: motivation, understanding or confirmation of a model or hypothesis. It can be remarked that the use of VI tools in the teaching process specific disciplines from Sciences area leads to an important increasing of pupils' motivation. In fact this could be a way for having them more interested in those topics.

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