Use of Web 2.0 Tools for Teaching Physics in Secondary Education

John D. Garofalakis, Eirini V. Lagiou, and Athanasios P. Plessas

***Abstract*—During the last years, many Web 2.0 technologies are adopted in various aspects of education. We present a detailed study of the integration of Web 2.0 tools in education and attempt to evaluate their contribution in the educational process. For the assessment of the suitability and effectiveness of web 2.0 tools in education, we have designed, implemented, and evaluated a pilot case study for Secondary Education.**

Specifically, the study presents the application of a Learning Management System (LMS), called ePhysics that combines Web 2.0 tools such as Blog, Wiki, Social Bookmarking etc. for teaching physics in secondary education.

This implementation was applied in an authentic educational activity in order to support the collaboration between students. The results of this study show that, under appropriate planning, Web 2.0 tools can be used with great success to support real educational activities and provide a very flexible and efficient form of collaborative learning in Secondary Education.

***Index Terms*—E-learning, learning platforms, secondary education, teaching tools, web 2.0.**

I. Introduction

With the integration of Information and Communication Technologies (ICT) in education, a growing interest is indicated in the educational use of the World Wide Web, implementing activities that support collaborative learning [1]. Learning by conditions of cooperation has been proposed by many educators (Piaget, Vygotsky etc). During the interaction of students different cognitive experiences, attitudes and perceptions are manifested in the group, offering its members a rich socio-cognitive environment that works both ways to and from each student - team member [2], [3]. Cooperation with the use of the computer and the collective work with computer are terms introduced for the description of collaborative learning processes through the use of ICT. Learning collaborative systems are systems that are designed primarily for students to enable and support cooperation at a distance via the Internet during uniform activities, such as composition of texts, data analysis, etc [4].

This work focuses on studying the impact of Web 2.0 in education and the degree of effectiveness in the enhancing of learning. The tools offered by Web 2.0 are able to complement and enrich the educational process and, more generally, to add to it new interesting collaborative dimensions [5]. Web 2.0 technologies such as blogs, wikis, podcasts, social bookmarking, RSS feeds and social networks are generally referred to as "social software" and allow users to develop collaborative content and to notify the public [6].

The multiplicity of modes of introduction and integration of ICT in the educational process and especially the various categories of educational software must be considered from the perspective of different theories and models of human knowledge and learning. In this context, there are three main psychological theories that influenced and influence the development of educational software and therefore the position of ICT in the teaching and learning process:

- The **behaviorism** which maintains that there is no access to the mental states of students so the only important thing to do is to describe the behavior and not to explain it.
- The **constructivism** that focuses inside the cognitive system, especially on the structure and function. Learning in this context is to modify knowledge and therefore it directly depends on prior knowledge [7].
- **Socio-cultural approaches**, whose fundamental assumption is that when a person participates in a social system, the culture of this system and the tools used for communication form his/her own sensibleness and constitute a source of learning and evolution [8].

However it should be emphasized that many educational applications using ICT are mainly designed and led by the advancement of technology rather than the progress achieved in the psychology of learning.

The objective of this research was to investigate to what extent the use of Web 2.0 tools can be used to enhance learning through the cooperation and communication among students with the common goal of completing a task. Also, the aim of the activity was to export quality results on the communication of students through an educational platform. It is studied whether a blog can support and enhance the communication and collaboration of students inside and outside class, as well as the other tools included.

The research was carried out in the Experimental high school of the University of Patras, in the first class of high school students for the lesson of physics.

Despite the interest on web 2.0 tools, there is a significant gap in the literature regarding their application in education. In general, research works show that effective integration of tools in the learning process would require a radical redesign of the course and support from students (e.g. for wikis [9]-[10]). More specifically, the previous studies show that the use of web 2.0 tools (e.g. blogs, wikis, etc) by students in the course is small. Furthermore, we would like to emphasize that there are different effects for achieving cooperation with the use of tools, for example in the case of wiki the

Manuscript received September 14, 2012; revised December 12, 2012.

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collaboration between students is limited [11], while in the case of blog students are in favor of the continued use of blogs as an effective aid to teaching and learning [12].

The research has been limited to the use of a single web 2.0 tool (and not the combination of different tools) and most applications concern higher education rather than secondary education. This is the reason why we decided to use one platform which combines more tools use it in Secondary Education.

II. EPHYSICS

The Open eClass platform is a complete Learning Management System (LMS). It is the solution offered by the Greek Academic Network GUnet to support Asynchronous eLearning Services.

The teacher can use it in cooperation with the students who are organized in groups to share information, updates, learning material, task assignments and communicate through the tools provided. Moreover, the teacher can organize groups of parents to communicate with them and to look for other educators engaged in the respective platform.

The course covered Physics for the first grade of high school. The educational scenario was created after careful study and planning. In the application, the following tools – subsystems have been selected:

- Wiki: it consists a dictionary with definitions of the concepts used in this physics lesson. Students milled the corresponding texts that have already been entered for each chapter.
- Blog: there were four entries, two for physics, one for the scientific Workshop held in The Experimental School, and finally one for the Day of museums.
- Links: bookmarking enables access to useful online resources grouped into categories related to the lesson.
- Telecooperation: this tool includes the functionality of text messaging.
- E-book: an e-book identical to the printed book students are using.
- Exercises: self-assessment exercises (true or false type, multiple choices) for four chapters have been published.
- Announcements: a message board for informing students about important announcements.
- Agenda: a calendar with the announced presentations of the platform.
- Documents: posted online, the usage instructions of the platform and the educational material the students had to study for the final exams.
- Questionnaire: the questionnaire that was used at the end of the process and the students could complete electronically.

III. PROCESS OF EVALUATION

As it has already been mentioned, the research was conducted at the Experimental Lyceum of the University of Patras in the first grade for the lesson of physics. The class had 20 students, but in the research participated 10. The participation was only 50% because (as the students said) they don't have time to include it in their daily life as they focused on studying for the exams. Another reason was (in our opinion) that the students were accustomed to using another similar platform during the school year and didn't want to deal with something else.

Two school hours (45 minutes each) were used:

- During the first hour, as shown in the description of the educational scenario, the use of the platform and its subsystems was explained, with a short presentation with a projector in the Physics lab. (Phases 1 and 2)
- During the second hour, there was a discussion with the students, to express their opinion about the platform and suggestions for improvement. (Phase 3)

Description of the phases of the preparation and implementation of educational scenario.

Preparation: Each student should have access to the internet and an account in ePhysics (given to them). After dealing with the online course, they had to respond to the electronic questionnaire for assessing ePhysics, certainly after having used it.

- **Phase 1**: Introduction - Presentation of ePhysics: Brief presentation by the teacher to introduce students to the platform and its use inside and outside the classroom.
- **Phase 2**: Using ePhysics: The teacher with a brief presentation demonstrates the ease of use ePhysics for introducing students to the platform. Demonstrating the platform and tools.
- **Phase 3**: Discussion - Conclusions: After the presentation by the teacher, a discussion is developed about the advantages and disadvantages of using ePhysics in class and students are invited to submit their experiences.
- **Phase 4**: Questionnaire Answer: After using ePhysics, the students are invited to respond to the electronic questionnaire for the evaluation of the platform.

A. Target Skills

After the end of the training scenario, the students were expected to be able to use the ePhysics as well as any similar platform of Asynchronous eLearning. After having understood the use of web 2.0 tools, they were expected to comment on Blogs, publish and edit text in the Wiki and other similar type tools with clear-thinking and correct use, to search for online multimedia material related to the lesson, to cooperate and mutually assist each other.

B. Objective Attitudes

After using this platform of asynchronous learning, students were expected to understand the advantages and disadvantages of the use of innovative online tools, such as web 2.0 tools to publish the results of their intellectual work. They were also expected to comment on the blog with conscience, not to delete unnecessarily and without documentation content from the wiki pages and also to respect the intellectual work of others, including their classmates.

C. The Results

Classroom observation and discussion with students demonstrates that the web 2.0 tools are acceptable, since the majority of the students expressed their desire to be able to use the platform from the beginning of the school year, as a key tool for the classroom in Physics and other lessons.

To evaluate the activity, the students answered an online questionnaire in order to extract additional conclusions.

Overall, the pilot study includes a sample of 10 students

who were involved with the application and responded to the questionnaire, of whom 5 were male (50%) and 5 were female (50%).

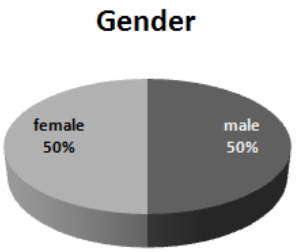

Fig. 1. Gender

Initially, it should be noted that all students have had some experience with relevant e-learning platforms. Specifically, 50% of students had much or fairly experience while the other 50% were students who had little or minimum experience (Fig. 2).

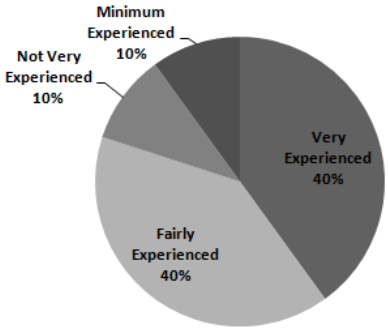

Fig. 2. Before using ePhysics, I had previous experience with similar platforms.

For this reason, all students confirm the ease of learning and handling ePhysics. Another expected result is that most students said they did not need much support to use ePhysics and in total the structure of the navigation and information was appropriate and comprehensible (Fig. 3).

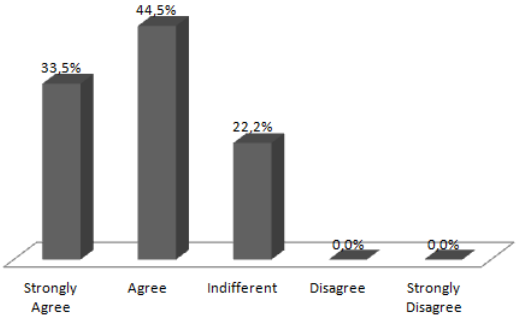

Fig. 3. As a new user, I did not need much support to use this collaborative environment.

There were also questions concerning the tools in order to evaluate their use. The results of the research indicate that the majority of students did not know how to use the wiki and what the advantages of this tool are and ePhysics helped them to understand it (Fig. 4).

Furthermore, the ability of the Wiki to record revision history did not impress the students, since only 50% believe that it offers confidence and security. It is worth noting that a 30% of the students gave the answer "Neutral" to the respective question as shown in Fig. 5.

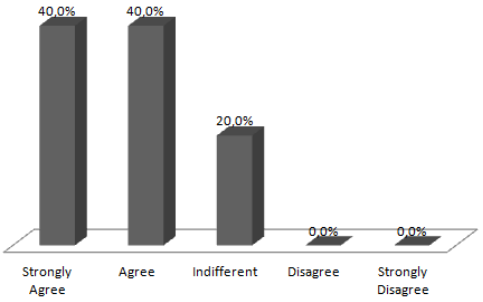

Fig. 4. The subsystem of wiki helped me understand the usefulness of the wiki on the web

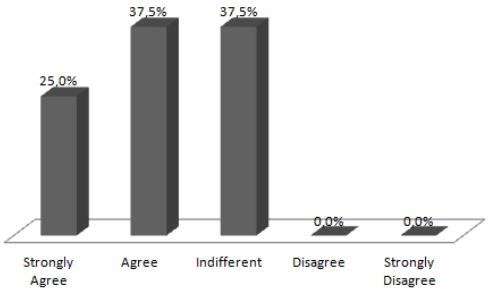

Fig. 5. The ability of wiki to keep history of changes I think that helps and provide confidence and security.

Still, the overwhelming majority of students (90%) believe that the structure of a blog helps them express their opinions, while a large proportion (70%) understood the usefulness of blogs through the application.

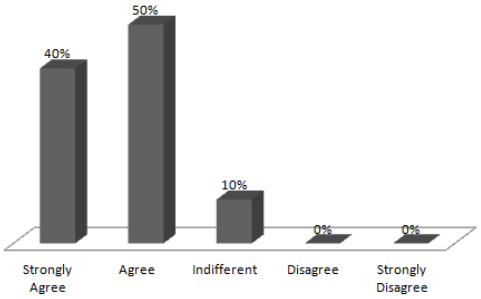

Fig. 6. The structure of blog helps me to tell my opinion on issues related to the lesson.

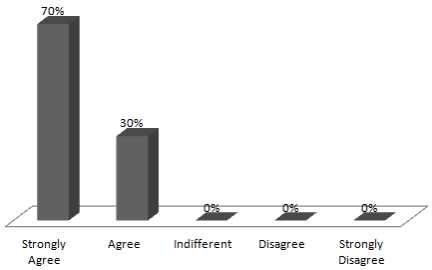

Fig. 7. I would like to be able to use the platform to the other courses.

Concerning other tools, such as bookmarking and telecooperation, the result for bookmarking is entirely positive, while for telecooperation a high proportion of students were undecided since they answered neutral.

Finally, another interesting result was that 100% of students would like to use a similar application with ePhysics and in the rest of the subjects because they find it fun, easy and an important tool for the school.

The students generally expressed positive comments about ePhysics and indicated that they would like to have access to it, from the beginning of the school year.

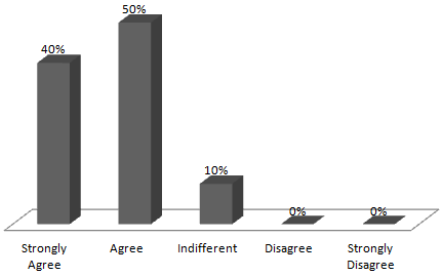

Fig. 8. The ePhysics are pleasant and easy to use and I consider is an important tool in school.

IV. Conclusion

This work was designed to present Web 2.0 tools in the classroom and to study closely their use in the educational process. That's why the asynchronous eLearning platform Open eClass was chosen, which combines this type of tools. The main aim was also to provide research evidence and draw conclusions about how effective the use of Web 2.0 tools can be.

The study, presented an application, ePhysics, which was used to support the collaboration of students in a course of physics. It was used more like a repetition for the students, since the period presented was the repetition period for the final exams. The research raised several and interesting results, which are presented in detail in the previous section.

A basic conclusion that is worth mentioning is the enthusiasm of the students and the dedication they have to learn more about these tools and their targeted queries. The results from the questionnaire were generally encouraging. The total of the responses showed that the students were in favor of using the tools in the classroom and few responses were neutral or negative. These responses lead us to the conclusion that there is positive contribution of participatory web tools in education.

For future work we intend to introduce such a platform from the beginning of the school year in order to assess student's communication through web 2.0 tools for a long period of time. In this research, we did not have much application time since the exams were approaching. The lesson should be designed and organized in such a way as to all the tools cover all the course contents.

Within such a framework, we could integrate the blog and other web 2.0 tools as a means of exchanging ideas and support for remote collaboration and communication between students, as well as the expansion of school time and space.

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