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TEACHING WITH INTERNET SUPPORT – A CASE EXAMPLE

Liliana B. Castro, Adriano Tavares, João L. Afonso
Department of Industrial Electronics, University of Minho, Portugal

Abstract. The evolution of Internet and all related technologies contributed, a lot, for the development of the e-learning. This paper discusses the advantages in using the new Technologies, namely the Internet, as an aid tool to teaching, and presents an example developed in the Degree of Industrial Electronics and Computer Engineering at University of Minho. It also discusses the motivations of the students on acquiring knowledge by an alternative method of teaching/learning.

1 INTRODUCTION

In the last 50 years, the technologies of information brought deep transformations, practically in all human activity areas. All but one: the teaching. In fact, the teaching that is made today is very similar to the one made 100 years ago, in other words, a room, a black board and a teacher that transmits information to a group of people that, essentially, are limited to work as receptors of information. In the last decades there were several attempts to use the computational power as an aid to the Teaching, but the results were always shy and restricted to well-defined areas of teaching. However, with the Internet phenomenon, it seems that all necessary conditions for the Teaching revolution are gathered.

Nowadays, in a society of information, each time and more often, the new technologies are present in our lives. Internet came to revolutionize the concept of Computer Science. The Internet, in just few years, became one of the largest and most effective mediums of communication. Several persons risk saying that "Internet is the future". And to corroborate this, there are the changes between the old economy and the new one, the birth of new commerce activities (with the "e-commerce"), the new interpersonal relationships established through Internet (with the use of the e-mail and other interfaces), and the new teaching and learning methods [1].

A definition of e-learning is given on the eLearning Europa website, which gives the following definition: "e-learning means using new multimedia technologies and the Internet to improve the quality of learning by facilitating access to resources and services as well as remote exchanges and collaboration" [2].

Nowadays we live in a world of constant change, with access to a great volume of information and from where new technologies bloom. E-learning allows the delivery of knowledge in a more effective and rapid way, giving the students a chance to follow the evolution of technology.

2 INTERNET AND TEACHING

There are several projects that proposed the installation of Internet access in schools and libraries. In Canada, in 1996, an alliance between telecommunications companies announced a project to connect all schools of the country to the Internet. Microsoft and Oracle have given large donations to provide Internet connection to schools and libraries. Bill Gates (from Microsoft) announced the creation of the "Gates Library Foundation", which will spend several millions of dollars to equip schools and libraries of poor areas. Oracle announced a 100 million US dollars donation to the non profitable foundation "Oracle Promise", to allow the installation of a network computer in every school desk of North America. NetDay is another project with the goal of taking Internet to libraries and classrooms of the United States, in a total of 40 thousand classrooms.

The European Commission created Europe's NetDay to stimulate the pedagogic use of Internet at schools. NetDay is aimed for elementary and high school teachings, and also for technical education schools. European Schoolnet is another European project. It was created by ministries of Education representatives of the different European member states, with the goal of encouraging the development of multimedia resources in the teaching, namely of Internet.

In Portugal, the Nónio Program, launched in 1996, is the Portuguese representative of Schoolnet project. It was created by the Portuguese Ministry of Education, with the purpose of giving incentives for the training of teachers, for the creation of educational software and for the usage of communication networks, in order to achieve a better education in the Society of Information. The Portuguese Ministry of Science and Technology also launched a project, with the purpose of equipping all schools in Portugal with computers connected to the Internet [3]. Actions like all these are always welcome, although they should be complemented with training sessions, especially for the teachers.

Each time and more often, the leaders of our countries, and even the common citizens, have the notion of the importance of the new technologies in our lives. As proof of that is the decision 2318/2003/EC, from the European Parliament, which adopts a program from 2004 to 2006 for the effective integration of Information and Communication Technologies (ICT) in education and training systems in Europe, which presents directives to implement the European e-learning program [4]. The main goals of this program are the following:

- Promotion of digital literacy - This action will address the contribution of ICT in schools, particularly for those who, due to their geographical location, social situation or special needs, do not have easy access to those technologies. The objective is to identify good examples and build synergies between many national and European activities, which address these target groups.
- Implementation of European virtual campuses - The actions in this area will provide a better integration of the virtual concept, in order to achieve a higher education. The objective is to encourage the development of new organisational models (virtual campuses), to improve the European exchange and sharing schemes (virtual mobility), to build on existing European cooperation frameworks (Erasmus program, Bologna process) and to provide an "e-learning dimension" to their operational tools (European credit transfer system - ECTS, European Masters, quality assurance, mobility).
- Implementation of e-learning in European schools and promotion of teachers' training - This will allow support and further networking development in schools, in order to create the possibility for all European schools to build pedagogical partnerships with other schools, to promote innovative cooperation, to share educational approaches and to reinforce language learning and intercultural dialogue. Also, the actions in this area will permit the update of the professional skills for the teachers and trainers, in the pedagogical and collaborative use of ICT tools.
- Promotion of transversal actions – This action will promote e-learning in Europe, and to build new functionalities based on the monitoring of the e-Learning Action Plan. The objectives are the dissemination, promotion and transference of good and innovative practices and results from the projects. Another objective is the cooperation reinforcement between the various participants, through public or private partnerships.

The quality of the teaching projects depends from the factors associated with the performance of the agents of teaching/learning, and also depends of the implementation, accompaniment and control of these projects. It is expected that the teachers who have more involvement in these projects receive specific training, guided to the quality of the teaching and learning methods.

The Internet, for its amount and variety of information, can be an excellent assistant in education. It is already a mean of valid teaching, allowing the gain of several opportunities. It offers very significant benefits for everybody, students and teachers, which can fall back upon the sites of the Internet to solve the problems of geographical distance and lack of physical access. As an example, the references used in this paper, with a single exception, were all obtained from the Internet.

3 UNIVERSITY OF MINHO AND THE E-LEARNING

University of Minho is committed to explore new pedagogical technologies, namely the e-learning, applying it to the teaching and learning activities. To implement e-learning, it was adopted a platform (learning management system) called EASY [5]. This platform has been developed by a common effort of Santa Catarina Federal University (from Brazil) and University of Minho.

Another initiative of University of Minho is "The Virtual Campus" [6]. It is an integrated initiative, which involves services, contents, applications and network communications (inside and outside of the university campuses) for students and teachers of University of Minho, which intends to motivate and promote the production, access and sharing of knowledge. Its objectives are fomenting the creation of online university services, and the production and sharing of academic contents. The Virtual Campus project also focuses on teaching the different subjects of all degrees, including Master's courses, with the aid of e-learning. In a first phase, the Virtual Campus Project started up in a pilot phase within the degrees in Civil Engineering, Computer Science and Administration, Engineering and Industrial Administration, and Applied Biology Engineering. It is desirable that this kind of experiences happens in a significant number of additional degrees, in several different scientific-pedagogic areas. In relation to the implementation of "Virtual Laboratories", this project is guided to the economy of resources, to the introduction of new teaching and learning methodologies, and to the development of contents.

It is important to refer that the exceptional aspects of the experiences of new teaching and learning methodologies require the direction and supervision of the University of Minho Council of Courses, Scientific Council of the Schools and Academic Council, in order to validate the educational projects from the scientific-pedagogic point of view.

4 TEACHING AND LEARNING WITH INTERNET SUPORT – CASE EXAMPLE

The subject of Power Electronics Complements (PEC), in the Degree of Industrial Electronics and Computer Engineering at University of Minho, is taught in the first semester of the last year of the course. It aims to complement previous subjects of the course (like Electrical Power Systems, Electrical Machines and Power Electronics) and also to prepare the students for the new technologies in Electrical Engineering, in various areas like, Power Quality, Active Power Filters, Renewable Energy, Fuel Cells, Superconductors, etc. By accessing the PEC website, in the domain of the Department of Industrial Electronics, of the University of Minho, the students

can access or download information, such as: PEC's program, bibliography, evaluation method, study material, presentations used in the classes, warnings to the PEC students, etc.

During the last school year it was introduced an innovative work in PEC's program: an individual work, different for each student, covering topics, regarding to Electrical Engineering. This work was not obligatory. From a total of 70 PEC registered students, 53 decided to do the work. Each one of these 53 students chose his work from a given list with 55 different topics (students could also suggest works, what happened in a single case). Each student had to prepare a 6 pages written report in IEEE Transactions paper format, and a *PowerPoint* presentation (it was not imposed a number of slides for the presentation). Besides, all information used to prepare the work should be stored in a CD.

Although students could use any source of information to prepare their works, they were encouraged to use Internet as a privileged source. However, prior to the execution of the works, students were informed that not all information can be considered trustful in Internet. Examples of misleading information in Internet were pointed out, and ways of avoiding them, by comparing different sites, and by identifying the most reliable sites, were explained. Information about the use of 'Internet Search Engines' was also given to the students.

All the 53 papers and presentations developed by the students were kept available to them through the PEC's website, by the use of a given password. Besides preparing their own works, the students had the task of reading the other students papers and presentations, in order to evaluate their peers' works.

This work was proposed with the intention of achieving several objectives, which are described bellow:

- To make students acquire new knowledge, by preparing their individual works.
- To make students obtain new knowledge, by reading their peers' works.
- To help students develop their ability in searching for information, mainly in Internet.
- To stimulate students to develop skilfulness in writing a report in a standard 2 column format (IEEE Transactions paper format).
- To motivate students to develop proficiency in preparing a PowerPoint presentation. It was advised to students that a presentation should be light and interesting, with some captivating points, in order to maintain the audience awake.
- To face students with the assignment of evaluating other works. It is a task that is hardly developed by students at Universities, but it assumes a very important role when they work as Engineers, since they have to evaluate the quality of information of works performed by others. For the execution of this task, some evaluation criteria were discussed in class, but it was told to students that they were free to choose their own evaluation parameters. However, it was pointed out that an evaluator must always be fair in their judgment, and that they should evaluate the quality of the works forgetting personal relations with their colleagues. Besides, the quality of the evaluations was one of the parameters to the attribution of the grade obtained with the proposed work, as explained next in this paper.

By accessing a dedicated web site, the students of PEC could, through an interactive way, evaluate the works made by their colleagues, according to the following rules established in a program developed in PHP language:

- the students could not evaluate their own work;
- the evaluation was made by placements: each sudent ranked 52 works from the best to the worst, according to his/her opinion;
- each ranking position could be assigned to just one work in each individual evaluation;
- for each student evaluation the best work received 52 points and the worst got 1 point;
- after the students evaluations were completed, the works were overall ranked, summing the total of points that each work received;
- the work with more summed points was considered the best overall evaluated work, and received a grade of 3.5 values; the work with the least number of summed points received only 2.0 values; to the other works were attributed values between 2.0 and 3.5, according to their obtained summed points.

The PHP program also ranked the students as evaluators, using the following criterion:

- for each student evaluation ranked list, it calculated the difference between every work ranking position and the position of the same work in the overall ranking, and then, the program summed all the differences obtained for each of the evaluated works.
- the student with the smallest summed differences was assigned as the best evaluator, and received a grade of 2.5 values; the student with the largest summed differences (considered the worst evaluator) got 1.5 values; and the other evaluator students received values between 1.5 and 2.5, according to their evaluations summed differences;
- to those students that made the proposed work, but did not evaluate their colleagues' works, was assigned 0 (zero) to the evaluation grade.

The PEC approval criterion was based only in a written exam, both for those students who decided to do the proposed work and for the ones who did not. This exam was graded from 0 to 20 values, and students had to obtain at least 50% of the exam to pass. For the students who chose not to do the work the value obtained in the written exam was the final

grade. For the students who did the proposed work the PEC final grade was assigned in a scale between 0 and 20, taking into consideration the grades obtained with the written exam (70% weight) and with the work (30% weight), according to:

Final Grade = (14/20) x Grade of the Written Exam +
(Grade for doing the proposed Work) +
(Grade for the Evaluation of the Works)

Tables 1 and 2, and figures 1 and 2, present a comparative study made by evaluating the evolution of the students' performance in PEC, covering the school years from 2003 to 2005. Only in the year of 2005 was introduced the work described as 'case example' in this paper. It can be seen (Table 1 and Figure 1) that the percentage of approved students and the average grade increased in the year of 2005, in a significant way in relation to 2004, and slightly regarding to 2003. It also can be observed (Table 2 and Figure 2) that in 2005, thanks to the introduced work, the number of students with low final grades (with grades 10 and 11) deceased considerably (from values of respectively 45.2% and 52.9% for years 2003 and 2004 to a value of 6.4% in 2005).

In the year of 2005, when the proposed work was introduced, there were 70 registered students in PEC subject. 53 students accepted to do the proposed work, and from them 45 were approved, what corresponds to a success percentage of 85%. It is important to say that 4 students who did the work, did not evaluate their colleagues, which indicates that they did not study the other works. From the 17 students who decided not to do the work, only 2 of them were approved, which represents a success rate of only 12%.

It is interesting to note that, although the proposed work was not a PEC approval criterion, which was based only in the written exam, there was a huge difference between the performance of the students who did the work and the others. It proves that the commitment of the students with the proposed work helped them to learn more, and motivated them to the topics taught in PEC. Therefore, based on these results it can be concluded that, with the assistance of e-learning techniques the students can be stimulated to acquire knowledge in more effective way, rather than using only the methods of traditional teaching.

After the publication of the final grades, the students who did the proposed work were asked to filling in a small questionnaire, which was elaborated in order to have feedback from the students' satisfaction regarding the innovative and experimental practices of e-learning in the current teaching of PEC. With these data, and with the help of the students, it is intended to improve the most pertinent aspects and review the weak points, in order to improve these kinds of initiatives. From the statistical data retrieved by the questionnaire it could be concluded that the students enjoyed this initiative, as 100% of them answered that similar enterprises should be applied also to other subjects of the course.

5 CONCLUSION

Internet is a powerful tool and an excellent alternative to complement or even substitute the traditional teaching and learning methods. However, there is the need to know how to prepare the students to develop the necessary techniques to take advantage of all the resources offered by Internet.

There is no doubt that there is a lot of knowledge and information in the Internet, but a good planning and structuring, is mandatory to make the Internet a privileged channel of communication and teaching.

The results of the case example presented and analysed in this paper show that, the traditional teaching allied to the new teaching techniques of e-learning with Internet support, can motivate students to work more and captivate them to participate more in the classes, since they become more interested in the taught themes. The final results can be seen as an improvement in the students learning, which is reflected in an increase of their approval rates and final grades.

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ADDRESS OF AUTHOR

João Luiz Afonso - E-mail: jla@dei.uminho.pt
Dept. of Industrial Electronics - University of Minho
Campus of Azurém, 4800-058 Guimarães, Portugal

Phone: +351 253 510190, Fax: +351 253 510189.

Table 1 - Comparative data of the students' general performance and evolution of the average grade from 2003 to 2005.

Year	Average Grade	Registered Students	Flunked Students	Approved Students
2003	12.7	65 (100%)	23 (35%)	42 (65%)
2004	11.9	84 (100%)	33 (39%)	51 (61%)
2005	13.5	70 (100%)	23 (33%)	47 (67%)

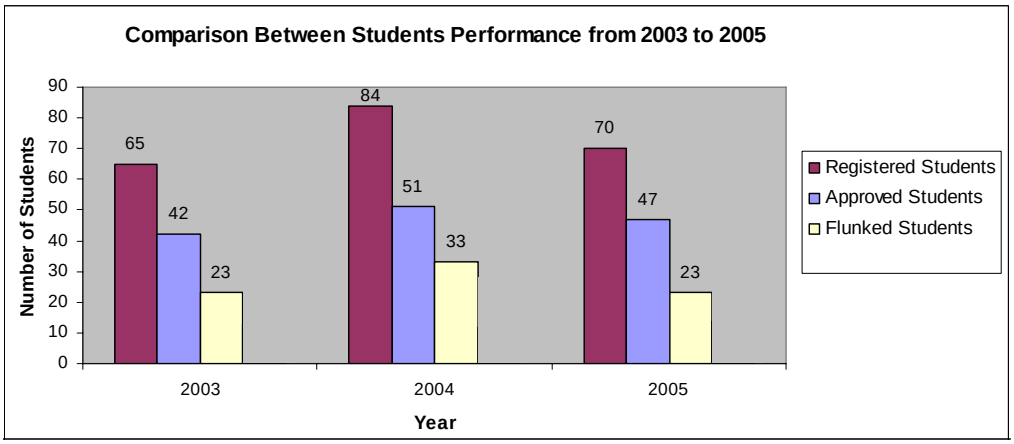

Fig. 1 - Graph that corresponds to the comparison of the students' performance, in the years from 2003 to 2005, relative to the evolution of the number of registrations, approvals and failures.

Table 2 - Comparative data of the students' performance, according with the intervals of grades, and evolution of the average grade from 2003 to 2005.

	Number of Students With Grades Between:				
Year	10-11	12-13	14-15	16-17	18
2003	19 (45.2%)	8 (19.0%)	5 (11.9%)	9 (21.4%)	1 (2.4%)
2004	27 (52.9%)	11 (21.6%)	5 (9.8 %)	7 (13.7%)	1 (2.0%)
2005	3 (6.4%)	17 (36.2%)	17 (36.2%)	10 (21.3%)	0 (0%)

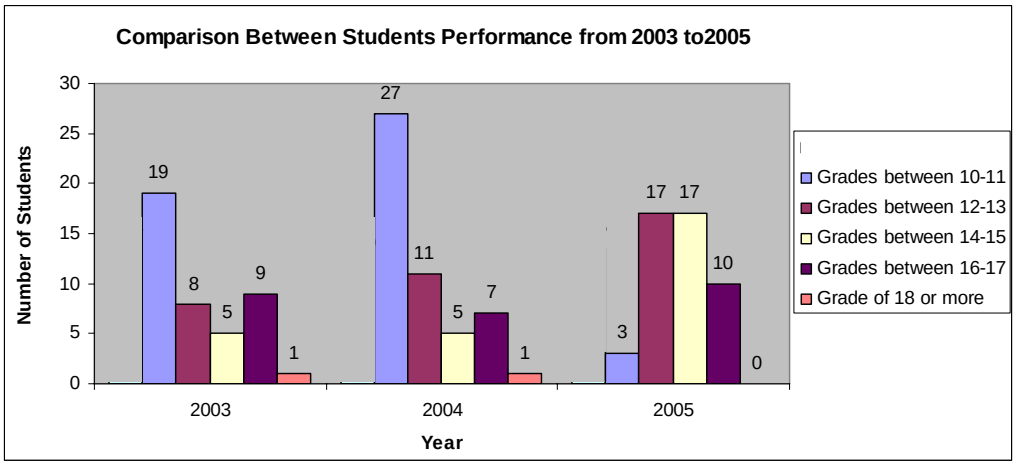

Fig. 2 – Graph that corresponds to the comparison of the students' performance, in the years from 2003 to 2005, relative to the interval of the grades