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Teaching Strategies to Apply in the Use of Technological Tools in Technical Education

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Abstract
The emergence of new technologies in education area is changing the way of organizing the educational processes. Teachers are not unrelated to these changes and must employ new strategies to adapt their teaching methods to the new circumstances. One of these adaptations is framed in the virtual learning, where the learning management systems have been revealed as a very effective means within the learning process. In this paper we try to provide teachers in engineering schools how to use in an appropriate way the different technological tools that are present in a virtual platform. Thus, in the experimental framework we show the results outcomes in the analysis of two data samples obtained before and after the implementation of the European Higher Education Area, that would be extrapolated for its innovative application to the learning techniques.

Keywords

Blended Learning, Learning Management System, Technological Tools, Innovation, Higher Education.

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1. Introduction

The incursion of Information Technology and Communication (ICT) in education is causing a change in the ways educational processes are conceived and organized. At the same time is leading to a questioning about the role of universities in our society.

For decades, there has been a speculation about the impact that the ICT revolution could have on education. This assumption has become in recent years, especially since the development of the Web, in a great movement that is transforming education in many parts of the world.

The education system cannot be left out of ICT. It is not possible to act without thinking about them, and how they should be used to enhance and facilitate both learning and the means of supporting the development of knowledge. The university should integrate, in the best of its ability, the tools that exist in society and that these are used to enhance the results in the acquisition of skills (Rodríguez and Ibarra 2011).

It shouldn´t be forgotten that students nowadays grow up surrounded by all kinds of technology, which are accessible from different areas such as homes, cafes or mobile devices, thus contributing to the understanding, managing and mastering of this new phenomenon. That is why if students benefit from these learning environments, enriched by the widespread use of ICT, it will be possible to transform the quality of education.

This incorporation of ICT in the classroom has led to all kinds of reactions, from people that defend it because they think it can be a very powerful tool for the teaching and the learning process, to those that say that its only purpose is to distract students in the teaching / learning development (Bakia et al. 2012).

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This new use of technology is no stranger to the teaching that is to be done in the degrees of the Technical Education branch. Like the rest of the degrees, Engineering must adapt to new teaching scenario that teachers and students demand which is more prevalent in the case of technical careers.

It should be kept in mind that the incorporation of ICT in the technical careers does not mean evading the notion of effort. New computer resources can contribute to the development of cognitive abilities of students, but never in the absence of personal effort. It has been observed that these technologies raise collaboration among students, help them focus on learning, improve their motivation and interest, favor their searching spirit, promote integration and stimulate the development of certain intellectual skill, which is highly valued in the Engineering career, such as reasoning, problem solving, creativity and learning to learn (Hill et al.2012).

The importance of the role of ICT in learning processes of Engineering is particularly significant because it forces teachers to reflect and to seek new ways of teaching and learning through the use of technological tools. One of the most active elements of these new trends are Virtual Learning Environments (EVA), which allow a rapidly expansion of virtual education, giving rise to a new and more flexible teaching, and that possess certain specific characteristics (Cabero 2006):

- Interaction: the student ceases to be a passive individual.
- Synchrony and asynchrony: it allows users to allocate their time according to their needs.
- Cooperation: as a cornerstone.

Therefore, the technical courses taught in universities face the challenge of training their teachers so that these can incorporate in their teaching strategies the new learning tools in new virtual learning environments.

From this communication we intend to provide the staff working in teaching technical subjects, analytical data on which are the tools most used by students in these virtual learning environments and that can benefit from them in order to design and define their own teaching strategies, taking into account the dependencies between technological tools and the use that students make of these ones for the acquisition of the subjects skills.

2. Technical Education and the Virtual Learning Environments

In order to meet the challenge of the *European Higher Education Area (EHEA)* to improve graduate employment, the importance that ICT plays in the teaching – learning processes implemented in universities is increasing, both in the educational aspects in face to face level, and as a way to support e-learning (Ministerio de Educación 2009). This importance includes innovative teaching plans related to the adaptation of the subjects and methodologies including the EHEA specific projects using ICT to support classroom teaching (Perez 2010).

Many technical education teachers show great concern about how they can use virtual learning environments to their full potential, to properly manage their courses and reinforce student learning. This concern is heightened by the lack of new information about technology tools that VLE involves, especially in terms of tools oriented engineering (Roβling et al. 2008).

A VLE system acts as an intermediary between teachers and students, where teachers set the virtual learning environment loading course materials and allowing students to access at the same time. The benefits of using an VLE system consist mainly on allowing both students and teachers meet in virtual classes where the teacher can closely

observe the student's work and determine whether they are acquiring the necessary skills (Lei et al. 2013). They also incorporate pedagogical tools for group work, different types of interaction or even different devices to interact for instance tablets or mobile devices.

We must acknowledge that the learning methods in students of technical careers have different characteristics from other students. Among the most useful elements of learning in these cases are collaborative learning tools that enable simultaneous interaction of teacher and student to develop online experiments and see if the results are correct. For example, its use in matters of language programming has improved by 22% the performance of students (Cavus 2007).

But the use of ICT in the teaching-learning environment is valued in different aspects, noting that, along with varied potential benefits, we must also consider the possible problems with its risks and limitations. Thus, teachers have a wide source of educational resources, and more contact with the students to perform evaluation and control. However, they usually lack adequate knowledge about the use of available resources, and require a greater commitment to virtual tutorials, manage their emails or search information in Internet…

Meanwhile, students are aware of increased information available and they can encompass the pace of learning to their needs thus, boosting their motivation. They can even have at their disposal interactive tools through which they solve their own problems, collaborate and share information obtained to reach a joint solution. However, they need to know how to be selective with such an amount of information and do not become dependent of the ICT so as to generate isolation or furthermore, to cause collaborative work become a mere spectator when performing the work (Goncalves and Pedro 2012).

Given these facts, technical education teachers should be able to create a working environment in their courses perfectly suited to their preferences. For this purpose, they

can use the different tools that virtual learning environments offer them or they might as well develop new software applications that might be available from the platform, so that it represents a teaching-learning environment perfectly consistent.

3. Experimental Setting

The experimental framework faces two significant sample data used that allow to get to know the students usage patterns of the technological tools available in a virtual learning environment. To evaluate them, we´ll take into account a sample previous to the European Higher Education Area (EHEA) and other post-EHEA qualifications obtained from Computers and Education degrees taught at the Pontifical University of Salamanca, with a five-year period between both samples.

Thus, in September 2005 the Moodle implementation process began in the aforementioned degrees. From then, until now, have given more than 700 courses have been delivered and over 10,000 students have earned a degree following the learning system called "Blended Learning", which benefits from the following advantages (Salinas 2004):

- It develops an educational process that adapts to the student's learning pace, in the schedule and place they prefer.
- In the face to face sessions, the teacher and student spend time on the proper interpretation of the data as well as on its proper implementation.

Using a rigorous statistical and accepted model, on a representative sample, we have analyzed the use of technological tools offered by the Moodle platform in order to offer teachers appropriate strategies to create opportunities for effective interaction and achieve better results in the process of teaching and learning.

In the whole of the sample we have confronted data related to the academic years 2005/2006, before the implementation of the EHEA, and 2010/2011, after the implementation of the EHEA, and which correspond to all of the matters taught.

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It is noteworthy that in both courses it was necessary to make a great effort by teachers in order to use the platform, taking into account the fact that although they began to use it in 2005, later, in 2010 it was necessary to implement new educational reforms so as to achieve a greater monitoring and ongoing work by both, the student and by the teacher.

From the analysis of the subjects studied, it is possible to know the total number of accesses made during both academic years to each of the technological tools that coexists in the Moodle platform (Table 1):

Table 1. Number of Total Accesses by tools in each course.

Number of Accesses Course 2005/2006	Technological Tools	Number of Accesses Course 2010/2011
8	**Workshop**	0
4.705	**Wiki**	450
67.067	**User**	65.794
10.674	**Upload**	7.753
5	**Survey**	7
371.402	**Resource**	333.234
40.158	**Quiz**	84.161
4.596	**Lesson**	5
1.273	**Label**	1.317
7.177	**Journal**	2
31.033	**Glossary**	11.576
378.881	**Forum**	466.340
561.905	**Course**	478.616
283	**Choice**	28.220
693	**Chat**	460
20	**Calendar**	18
141.463	**Assignment**	114.785
1.621.343	**TOTAL**	**1.592.738**

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If outlined accesses are added, we observe that the number of these ones to the Moodle platform tools analyzed in the two academic years is very similar, showing an insignificant difference of 1.8% for the previous year to the EHES.

A basic analysis of the data presented, first conclusions can be obtained as follows:

- Initially it should be noted that the *Course* and tools *User* tools cannot be considered as such, since they only indicate the number of subjects that are accessed and the number of users accessing the materials of which they are enrolled.
- The most important tools in the number of accesses are the tools Forum, Resource and Assignment, noting an increased use of the Resource and Assignment tools in the academic year 2005/2006 more than in the academic year 2010/2011, with a decline of 23.2% and 11.4% respectively. In contrast, the Forum tool with 466,340 accesses has been used more often in the academic year 2010/2011 than in 2005/2006, with an increase of 23.1%.
- It is worth noting the drop the Journal, Lesson, Wiki, Glossary Upload tools in the academic year 2010/2011 compared to 2005/2006. This decrease is very significant in the Journal Lesson tools with a decrease of 99.9% and the Wiki tool that has been decreased 90.4%. Equally notable is the decline of the Glossary tool, which has fallen by 62.7%, and less remarkable, the Upload tool experiencing the least decline of 27.4%.
- By contrast, Label, Choice, and Quiz tools are those that have undergone a rise in the number of accesses in the academic year 2010/2011 compared to 2005/2006. While *Labe*l has been the tool that has less increase, 3.4%, it stands out the increase in the Quiz tool, which has increased by 109.5%, and *Choice* tool with an exponential increase that has gone from rarely being used to be used frequently during the year 2010/2011.

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- The other technological tools that the platform offer (Calendar, Chat, Survey and Workshop) barely changed in both academic years, so they are not subjected to any consideration.

While these initial findings provide a comparison on the evolution of the use of technological tools, it is more interesting to focus on a more rigorous analysis sample for the academic year after EHEA, seeking to obtain meaningful conclusions that can be applied today to the subjects taught in grades of Technical Education.

To perform this analysis, and given the availability of a wide range of technological tools in the platform, it is necessary to classify/organize the tools into four groups which we´ll denominate: *Storage, Collaboration, Communication and Evaluation*. This classification is made taking into account the use that is made of the tools, and following the directions on the same Moodle platform. The tools that comprise each group are detailed in Table 2.

Table 2. Classification of Tools by Groups of Tools.

	Classification Groups of Tools
Storage	Label, Resource, Upload
Collaboration	Forum, Glossary, Wiki, Workshop
Communication	Calendar, Chat, Journal
Evaluation	Assignment, Choice, Lesson, Quiz, Survey

Once this classification of tool groups has been done, a cluster analysis by groups of tools has been made in order to know the average number of accesses to the different group done by each student. The average number of each student´s accesses by group of tools is reflected in Figure 1.

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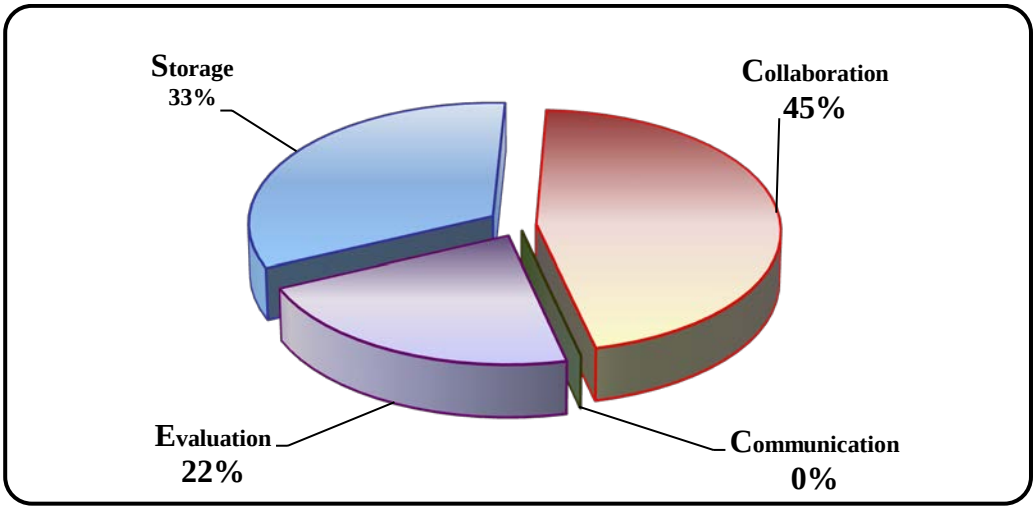

Figure 1. Average access per student and per subject type 2010/2011

As can be seen in Figure 1, the highest average accesses per pupil corresponds to Collaboration tools, with 45%, followed by Storage tools, with 33%, and Evaluation tools, with 22 %, being practically insignificant the access to Communication tools.

These data show that the group of tools most used is that of Collaboration, Storage and Evaluation which correspond respectively to the Forum, Resource and Assignment tools which are the most used as can be seen in Table 1. Conversely, Communication tools, rarely used, so further analysis is discarded with respect to variation and depending on the groups of tools.

In order to detect possible variations among groups of tools the sample is therefore analyzed using a statistical analysis Chi-square, where it is confirmed that all tools have variation groups. The group of tools that experiences a higher variation in the average number of accesses per student per tool group is the group Collaboration tools (Chi-squared value 199.131), followed by Storage tool group (Chi-value 23,143 square), being the Evaluation tool group the one which presents the least of variation (Chi-squared value 9,611), providing evidence of the predominance of accesses to Collaboration and Storage tools.

Finally, the experimental framework also performs a statistical analysis of the dependence or independence existing between the different pairs of tool groups during the period 2010/2011, concluding that all pairs of group's tools show dependence with each other.

The highest dependence exists between the two set of tools Storage and Assessment (Chi-squared value 148.01), followed by the dependence of the group tool of Storage with Collaboration (Chi-squared value 82, 96). In contrast, the least dependence exists between the Collaboration tools group and the Evaluation tools group (Chi-square 35.08 value).

This dependency analysis reveals that those who access the Collaboration tools also access the Storage and Evaluation tools and that only two thirds of those who access Storage tools access the Evaluation tools.

4. Extrapolation to Technical Education

From the data provided by the experimental framework it is possible to establish an extrapolation to technical education studies. Prior to establishing or planning virtual teaching it is highlighted as a crucial step the need for students to be knowledgeable of the tools and its use provided by the virtual learning environment (Georgouli et al. 2008). From these data, technical education teachers can design new learning Blended learning activities to reinforce and enhance learning based on empirical data.

So, initially, we can conclude that the most commonly used technological tools present in an VLE are Forum, Resource and Assignment, both before and after the implementation of the EHEA, which makes us infer the comfort of students in their use, regardless the type of subject. Therefore, if the use of these tools in the virtual teaching technical education is increased it is likely that motivation will also be promoted thus, obtaining better academic results.

Likewise, it is also possible to see the decline of certain tools with the new implementation of the Degree studies. Tools like Journal, Lesson, Wiki, Glossary or Upload present such a decline in its use that it leads us to discard them when designing a virtual subject, seeking to strengthen the new tools that have shown a clear increase such as Choice, Quiz and Label, in order to approach the technological tools that are being mostly used by students in the current educational field.

These early extrapolations are a guide for teachers when planning innovative strategies for the teaching of their subjects, since they allow them to know the tools best perceived by the students. However, the major contributions are provided by the analytical study of data after the implementation of the EHEA which outlines a number of unfamiliar rules that technical education teachers can implement perfectly well.

It should be noted in the first place that the low use made of the Communication tools against other groups of tools, leads to a scarce use of these tools.

With respect to the other tool groups, they show an average of accesses less spread out, where accesses to group Collaboration tools account for 45%, being 12% higher than the average of accesses to the Storage group and doubling the accesses of the group Evaluation tools. These ratios show the need to spend more time working with Collaborative tools, as these are the most accessed, compared to Storage or Evaluation tools, allowing to extrapolate the technical education teachers the need to design more collaborative activities that promote group work by students, compared to the high number of found in the Evaluation activities.

In addition, the experimental framework shows a total dependence of the Collaboration tools group with the group of Storage and Evaluation tools, it is advisable to design new teaching strategies that address this dependence and that can also provide more feedback on the interaction of students with teachers in technical education studies.

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5. References

Bakia, M., Shear, L., Toyama, Y. and Lasseter, A. (2012). Understanding the Implications of Online Learning for Educational Productivity. Washington: Office of Educational Technology, U.S. Department of Education.

Cabero, J. (2006). Bases Pedagógicas del eLearning. Revista de Universidad y Sociedad del Conocimiento (RUSC), 3(1), 54-63.

Cavus, N. (2007). Assessing the Success Rate of Students using a Learning Management System together with a Collaborative Tool in Web-based Teaching of Programming Languages, Journal Educational Computing Research, 36(3), 301-321. DOI:10.2190/T728-G676-4N18-6871.

Georgouli, K., Skalkidis, I. and Guerreiro, P. (2008). A Framework for Adopting LMS to Introduce e-Learning in a Traditional Course, Educational Technology & Society, 11(2), 227-240.

Goncalves, A. and Pedro, N. (2012). Innovation, e-Learning and Higher Education: An Example of a University's LMS Adoption Process, World Academy of Science, Engineering and Technology, 66(1), 258-265.

Hill, A., Lynch, A. and Dalley-Trim, L. (2012). Positive Educational Responses to Indigenous Student Mobility, International Journal of Educational Research, 54(1), 50-59. DOI:10.1016/j.ijer.2011.12.012.

Lei, C., Wan, K. and Man, K. (2013). Proceedings of the International MultiConference of Engineers and Computer Scientists 2013 (IMECS 2013), Facilitating Teaching CPS and Technology-based Content with Learning Management Systems, Vol. II, March 13-15, Hong Kong.

Ministerio de Educación (2009). Estrategia Universidad 2015. Resumen Ejecutivo.

Perez, F. (2010). Libro Blanco de las Tecnologías de la Información y la Comunicación en el Sistema Universitario Andaluz. Sevilla: Junta de Andalucía, Consejería de Economía, Innovación y Ciencia.

Roβling, G., Malmi, L., Clancy, M., Joy, M., Kerren, A., Korhonen, A., Moreno, A., Naps, T., Oechsle, R., Radenski, A., Ross, R. and Velázquez, J. (2008). Enhancing Learning Management Systems to Better Support Computer Science Education, ACM SIGCSE Bulletin, 40(4), 142-166. DOI: 10.1145/1473195.1473239.

Rodríguez, G. and Ibarra, M. (2011). E-Evaluación orientada al e-Aprendizaje Estratégico en la Educación Superior, Madrid: Narcea Ediciones.

Salinas, J. (2004). Innovación Docente y Uso de las TIC en la Enseñanza Universitaria, Revista de Universidad y Sociedad del Conocimiento (RUSC), 1(1), 1-16.