

Blended Learning in a Postgraduate ICT course

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Abstract: University subjects tend to be very theoretical, while enterprise generally demands graduate students with high practical skills. The major concern in remote teaching and online learning is the high trend to create a theoretical course. This is usually solved adding remote practices and hands on practices in a real laboratory. In this paper, we present a blended learning training plan carried out during three years with graduate students. First, we will present the course content and the pursued objectives. Then, we will show the learning methods performed to achieve our goals. This paper also analyses the profile of the students included in this course and reviews, in terms of age and gender, how they impact to the class results. The most part of course is conducted through an online learning platform where all students are supervised through tutorials. During the attendance days, students perform collaborative practices with real devices. Finally, we will analyze the student's opinions and their qualifications during the three years. As results show, the level of acceptance of this kind of teaching innovations depends on the age of the participants and their previous knowledge of these new technologies.

Keywords: Cisco Networking Academy, practical skills, online platform, postgraduate courses, new methodologies.

Introduction

In the last years, the way of teaching in university classes are changing from traditional methods, based on magisterial classes, to a new way of teaching based on new technologies (Lloret, 2009). This change is possible thanks to the integration of new technologies in universities and daily routine of professors and students. The use of Information and Communication Technologies (ICT) in the classrooms and outside the classrooms allows students preparing their lessons more easily than using classical methods. The knowledge acquisition is also benefited by the introduction of new didactic methodologies. The ICTs can be a good way to motivate the students and offer them a desirable autonomy for their future working life. Finally, the ICTs can bring to the students the opportunity of performing more complex practices in real environments that are difficult to recreate in master class lessons.

Postgraduate students, who decide performing masters and postgraduate courses, want to acquire those practical skills and specific knowledge not obtained during the university courses. Students should be able to work individually but also as a part of a team work. The practices that students can develop in the classroom with the limited time cannot be enough in some cases. For engineering students, the capacity of solving real problems is required in their immediate future, but those real problems are quite difficult and complex to recreate in classroom. So the possibility of performing these practices, under a remote supervision or specific software at home can be a good option to solve it (Garcia, 2008), (Coll, 2008) (Lloret, 2008).

In this paper, we show our experience teaching a course for postgraduate students. It is a blended learning course, which uses online learning platforms (Bri, 2009). We will present the content, tools used and the evaluation method. Finally, the students' ratings and their overall opinions are analyzed. The results are very satisfactory because they are improving over the years. Most part of the course is practical, which allows the students to acquire many hands-on skills to solve real problems, more autonomy to work individually and good capacity to work in teams or collaborative

groups. All of these facts offer to graduate students the possibility of obtaining better jobs. This course includes a certification given by Cisco Networking Academy. In our previous works (Lloret, 2013a), we observed along the years that the fact of including industry certifications in the university curricula (especially in the university experts and masters) generate bigger confidence to the students with their professional skills, while they are able to acquire more practical knowledge on real cases.

The rest of the paper is structured as follows. Section 2 shows some proposals of learning innovation applied to different fields. Section 3 explains the content of our course and the students' profile. Section 4 shows the tools and techniques used to form our postgraduate students. The students' results and their opinions about the course are explained in Section 5. Finally, conclusion and future work are presented in Section 6.

Related Work

In last 10 years, our society has suffered significant changes. The way we relate, communicate, work, buy, and even how we learn, are changing. These changes are generated by the improvements and appearance of new technologies, new systems and smart systems such as telephones and tablets (Marcelo, 2013) (Lloret, 2013b). Currently, we are using these technologies to improve our daily routines. Considering these aspects, we need to change how to transmit the knowledge to our students making use of these new resources. In this section, we will show some previous works where authors use ICT tools in higher education for different purposes.

C. C. Chen et al. presented in (Chen, 2007) a comparison of their experience teaching a blended learning course vs. teaching a traditional class in higher education with the same evaluation process. The students were divided into two groups, i.e., 38 students followed the course using the traditional class and 58 students followed the course with blended learning methodology. In the traditional classroom the professor teaches 75 minutes lessons twice a week. In blended lessons, the professor meets the students using two hours online meetings every week and one face to face meeting at the beginning of the course. A questionnaire passed at the end of courses showed that students in traditional classroom were happier with the clarity of instruction. On the other side, the students of blended learning indicated that their analytical skills were increased with the course and they were interested on realizing more courses with that methodology. Results suggested that both methodologies offer the same final results and indicated the possibility of improving them through the combination of both.

M. Paechter et al. in (Paechter, 2010) showed which aspects were more important in e-learning according to the students' opinion. To have enough information, the authors sent questionnaires to 2196 students from 29 different universities of Austria. 1361 of them were females (62%) and 928 were males (37.4%) and only, the 7.88% were 31 year old or older. 12% of students were attending to pure e-learning courses, while the rest were attending to blended learning course. According to results, there are two main aspects that contribute to course satisfaction and learning achievements. On the one hand, students consider especially important the learning of competences and skills, which made them to experience higher satisfaction. On the other hand, the instructors with highest experience had students with highest satisfaction. An important revelation was that in blended learning the role of the teacher does not become less important.

F. Alonso et al. (Alonso, 2011) analyzed the impact of using blended learning by the academic achievement and the dropout rate. They compared the results of computer science subject between the years 2006 to 2008 with face-to-face classroom and the results of the course in 2009 when distance learning and blended learning were offered. The total number of students surveyed was 693 where, the 107 of them received the course during the last year (55 students chose blended learning while 52 followed the distance learning). The teachers of the subjects were the same in all cases. Results showed that students that followed the e-learning course reached higher scores, due to the flexibility of the course. There were more students passing the course in 2009 than in the previous years and students obtained higher marks in 2009.

A. Lopez (López-Martínez, 2014) studies the incorporation of ICT tools in formative activities in classrooms. The author shows different tools that have been proposed in different teaching innovation projects for the elaboration of teaching material. The material was by tested 508 students distributed on the first course of pedagogy and third course of teaching in primary and infant education. Students had to learn how to manage the learning platforms and they participated in the creation of learning networks. The results show that students who have used these tools have notably improved their theoretical and practical knowledge.

S. Sendra *et al.* (Sendra, 2014) proposed a blended training plan based on the use of two online learning platforms. In this case, the course was given to employees of a national enterprise. Authors presented the content of the course and the online learning platforms used during the course. The experience was performed during 3 years and the results of polls allowed extracting several conclusions. The most important issue was the satisfaction of the students, which was much related to their ages. Nonetheless, all of them obtained very good marks.

D. Healy et al. (Healy, 2005) presented the experience of using a virtual platform for the students with the aim of complement their experience during the practices. The virtual platform was used with 148 medical undergraduate students at the University College Dublin. The students had 42 weeks of practices in the surgical area of hospitals. During 14 weeks, students used the platform to complement their real experience with different study cases. The results show that students who used the platform on weekdays and in day-time hours were positively associated with improvement in class rank. While the usage of virtual platform in weekends and out of day-time hours do not have this positive relation. Authors conclude that the use of e-learning and ICT offers the possibility to the students to keep learning outside of classroom and this learning is reflected in their academic marks.

As we have seen, the use of ICT technologies in different areas such as social, engineering (Medrano, 2012) or medical (Healy, 2005), among others, is becoming a widespread practice because of their several benefits. Most of these works were focused on undergraduate students in higher education. For this reason, in this paper, we have focused our efforts on postgraduate courses in order to improve the students' acquirement of knowledge and their hands on skills in order to form better professionals.

Content and Course Goals

The course "Computers, network operating systems and computer security" (its original name in Spanish is "Ordenadores, sistemas operativos de red y seguridad

informática”) is aimed at training professionals to repair and maintain computers and on the design, installation and maintenance of computer networks. This course allows students to detect and correct typical failures in computers. Students also acquire the necessary knowledge for the configuration of local computer networks, in terms of hardware and operating systems. Finally, students acquire advanced skills on security in operating systems. This course is included in the University Expert called "University Expert on networks and computer communications" (its original name in Spanish is “Especialista universitario en redes y comunicaciones de ordenadores”). The content of this course is shown in Table 1.

Table 1. Course content divided by chapters

Chapter and Title	Description
Chapter 1. Introduction to the Personal Computer	Describe a personal computer system
Chapter 2. Lab Procedures and Tool Use	Describe the safe lab procedures and proper tool use
Chapter 3. Computer Assembly	Describe the procedure to assemble a computer from compatible components and update a computer system.
Chapter 4. Overview of Preventive Maintenance and Troubleshooting	Explain the purpose of and basic rules of preventive maintenance and the troubleshooting process
Chapter 5. Operating Systems	Install, upgrade, navigate and troubleshoot various operating systems
Chapter 6. Networks	Describe, create and maintain a network
Chapter 7. Laptops	Describe how laptops are constructed, their basic configuration, maintenance, and troubleshooting
Chapter 8. Mobile Devices	Describe operating systems, basic configuration, maintenance, security and repair for mobile devices
Chapter 9. Printers	Demonstrate all procedures required for printers
Chapter 10. Security	Explain importance of security, describe procedures, and perform security measures
Chapter 11. The IT Professional	Describe the communication and related skills needed by an IT professional
Chapter 12. Advanced Troubleshooting	Advanced troubleshooting procedures on computers, operating systems, laptops, printers and network security

Course Goals

The specific objectives pursued in this course are:

- Provide to the student the adequate technical training on professionals for computers repair and the maintenance of computers networks installations, enabling them to detect and correct typical failures in computers, at hardware and operating system levels.
- Discuss computer security topics in operating systems.
- Design, install, configure and manage computer networks for small and medium enterprises.
- Know the Ethernet technologies in order to find failures in computer networks.

Students Profile

Students attending this course are graduate students in engineering related to telecommunications. There are some other students from companies who work in the ICT sector. We usually have both men and women in the courses, but the number of

women is quite small. We also observed large differences in the ages of the students. In fact, groups are quite distinct. On the one hand, we receive young people with extensive knowledge of new technologies and computer skills. The second group is formed by people over 50 years old who did not have great fluidity handling computers. These differences do not happen in other similar courses taught in the first degree (Jimenez, 2014). Figure 1 shows a summary of the student profiles who have attended our course in the last three years. We can see that most of people are men older than 40, but there was no women older than 40.

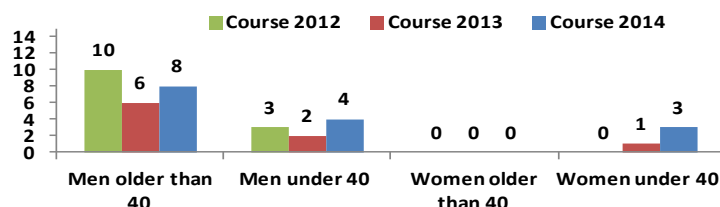


Figure 1. Students profile in the last three years

Development of innovation

In this section, we present the methodology carried out within this course and the learning platforms used to provide the students the course content and the online tutorials.

The course duration is five weeks, in which students must study and prepare the issues addressed in the curricula. Each topic has associated several practices that should be regularly delivered, according to pre-established dates. Finally, the content is evaluated by remotely controlled exams. This methodology includes personalized monitoring through online tutorials.

Course Activities

The course "Computers, network operating systems and computer security" follows a blended learning scheme which was initiated in 2012. The online platform makes possible the improvement of the dynamics of the course and its progress but also requires the development of specific training materials specially designed for this new learning environment. The use of Internet and computer networks allowed us to develop a more flexible teaching model where the activity, students participation and acquisition of knowledge prevails to the evaluation itself and its numerical assessment of the acquired knowledge.

However, due to the characteristics and profile of our students, we can find the disadvantage of having to encourage the habit of continuous study and increase the students' effort. Therefore, this course requires that professors make an almost personalized supervision through online tutorials and email. The methodology of this course is mainly focused on the students' participation in their own learning process, so that students are not only recipients of knowledge. This course aims to give and show the students the necessary tools, so they can build their expertise in cooperation with the professor and the rest of their classmates. This strategy is known as Model of Educational Reconstruction (MER) (Duit, 2012) and it is intended to generate strategic learners.

To this end, it is important to specify a set of specific tasks and objectives to promote the cognitive strategies of exploration and discovery. With this, we help students to learn to plan their activities. Organizing and preparing the course information contribute to a better understanding of the contents. With this goal, we proposed a set of activities that involve a continuous effort of the students. It allowed the professors to know the students' progresses. The educational activities are structured on both autonomous and collaborative work of the students.

Non-Classroom activities: Autonomous Work of the Students

The self-study is a methodological strategy based on self-education and the ability of students to learn at their own initiative and motivation. Students perform some individual activities. Additionally, we include a set of 5 or 6 practices per module that students should perform to be sent to the tutors. There is another remote practice where students should perform several activities on a remote server. These practices are oriented to install and configure different operating systems which can be installed on virtual machines or natively. Finally, outside the Non-Classroom activities, partial exams are included. They should be done through the Cisco learning platform.

Classroom activities: Collaborative work of the Students

In order to promote the collaborative work, we use a forum, where students and professors can share comments and questions, which can be answered by any member of the forum. In addition, there are 3 face sessions where students perform several practical activities on real equipment and the final exams. These practices are totally collaborative. In fact, if the team is not able to work together, the implementation of these practices can be very long. With these, it is encouraged the participation of all members. We can also demonstrate the leadership skills of some members.

Online learning platform: NetSpace Cisco Networking Academy.

The process of this course is done with the help of an online learning platform. This platform is used by students and tutors to exchange all kinds of information, doubts and questions, tutorials, teaching material, software for making practices, etc. As important and distinct parts, this platform includes (See Figure 2):

- Course content allows students to access to the course content. They can also see a calendar with the most important dates.
- Qualifications section where students can see their ratings.
- Course forum where students and professors can send message to all group members. The forum is used to raise widespread doubts that will be answered by the tutors. Students often make contributions on the issues raised.
- Tasks section, where students can find the exams and other activities created by the professors.

The theoretical course content is provided through the online learning platform NetSpace by Cisco Networking Academy. At the beginning of the course, each student is registered as a member of the local academy which manages the course. Each student has a username and password to access to the course content as well as other resources offered by Cisco. Figure 2 shows the main window of Cisco NetSpace platform. This web page contains direct links to the different course modules as well as the qualifying examinations of the chapter and the questionnaire prepared for each chapter. By clicking the "Start Course", we access to the content window (see Figure

3). In this window, students can read and study the chapters' contents. In addition, all text is accompanied by illustrations and demonstrative videos that help the understanding of theoretical content. At the end of each chapter, students have available non-evaluable questionnaires that help them to check their knowledge of this chapter and deepen in those aspects they have failed. In addition, we have developed an online platform through which students can download the practice statement and answer sheets. The tutorials are also used for the delivery of practices.

Evaluation of activities

Within the classroom activities, the final evaluation of the course is included. On the one hand, individual exams evaluate the theoretical and practical knowledge acquired during the course. Practical skills exam is performed in groups following a similar methodology to the face sessions. The rating of the practical exam consists of two parts, i.e., the tasks performed individually by each student and the group mark where it is evaluated whether they have met the overall objectives of the exam. These objectives are related to the correct interconnection of all devices, their settings and clients' authentication over a server. The theoretical exams are conducted through Cisco NetSpace platform that specifies that the minimum grade to pass their exams is 70% (equivalent to 6 out of 10). This rule is set by Cisco in order to ensure that all students meet the requirements and objectives of the course, before receiving their certification. The evaluation of this course takes into account all tasks performed by students, both online part and final exams following the next distribution:

- Review Skills Exam (10%): Individual exam performer at the beginning of course through the NetSpace platform.
- Practice skills tests (20%): Performed in groups in the laboratory and encompasses all the acquired knowledge during the delivered practices and the practices in classroom sessions.
- 12 partial exams and Checkpoint Exam (40%): Partial exams conducted over the course. The checkpoint exam covers theoretical contents of chapters 1 to 6. All of them are individually performed through the NetSpace platform.
- Final theoretical exam (30%): This exam includes the theoretical contents of all chapters and it is individually performed through the NetSpace platform.

Students Results and Course Statistics

At the end of the course, students perform a poll where they can express their opinions on different aspects such as the content of the course, resources, teaching methods, professors, methodology and organization of the course, among others. In this section, we present the results of the courses carried out in 2012, 2013 and 2014.

Students results

This section shows the results of our students during the years where this methodology has been applied. Figure 4 shows the students results for 2012. During that year, we had 13 students but two of them left the course (red circle). The rest of the students had qualifications above 8 out of 10. Figure 5 shows the students results for 2013. During that year, we had 9 students and only one of them left the course (red circle). Most of the remaining students had final qualifications above 9 out of 10.

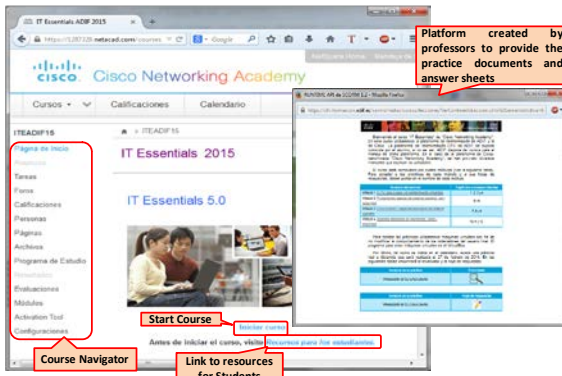


Figure 2. Main window of NetSpace platform and platform created by professors

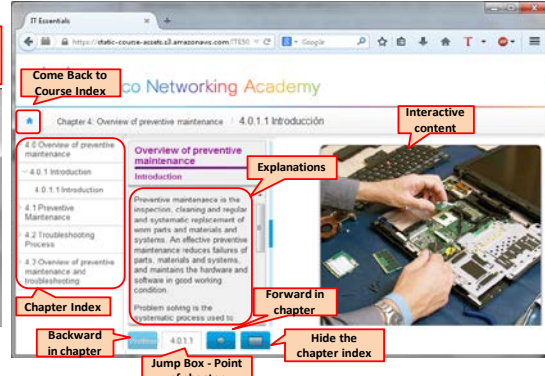


Figure 3. Course curricula with the contents of each chapter

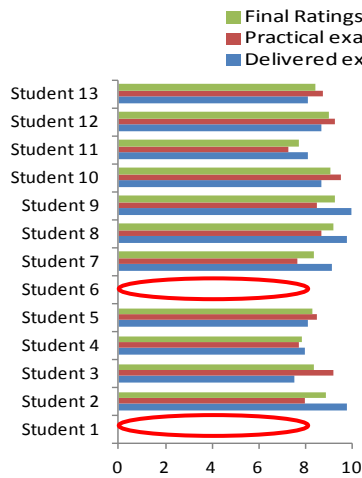


Figure 4. Students marks for 2012.

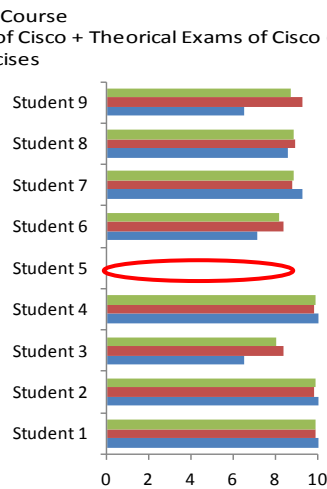


Figure 5. Students marks for 2013.

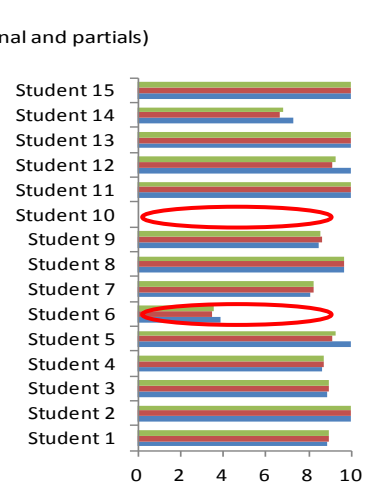


Figure 6. Students marks for 2014.

Finally, Figure 6 shows the students results for 2014. In that year, we had 15 students and two of them left the course (red circle). Most of the remaining students had final qualifications above 9 out of 10, and 4 of them achieve the maximum ratings.

From these results, we can deduce several conclusions. The number of students older than 40 years was higher in the first year. In most cases, this implies that students need more efforts to become familiar with the learning tools. These persons generally attend the course to learn some concepts and the skills they need for their works.

Students opinion and course statistics

The poll results are pretty good and there was a positive evolution over the years. Figure 7 shows the results of the surveys for three courses. As we can observe, the results were quite satisfactory. During the 2012 course, the results are placed above 5 (being 5 the mark that lets the students pass the exam). We highlight the aspects related to the contents, methodology and distance learning resources. All of them have a rate of 7 out of 10. In 2013, the results are better than the results obtained in the previous year, as they have increased the ratings in all aspects. Comparing both results, we highlight that the rating for the professors and technical media has increased. Finally, we can see that the opinion of the students for 2014 has also been improved in comparison to previous courses. Most cases present a qualification above 7 out of 10. Figure 8 shows a summary of the students' opinion in regard to the overall opinion about the course, general satisfaction and the overall opinion of course

assessments for 2012, 2013 and 2014. As we can see, over the years, the general opinion has been improved. In 2012, the course was valued with 6 out of 10, in 2013 the valuation was 6 out of 10 and finally, in 2014, students evaluated the course with a rate higher than 7 out of 10.

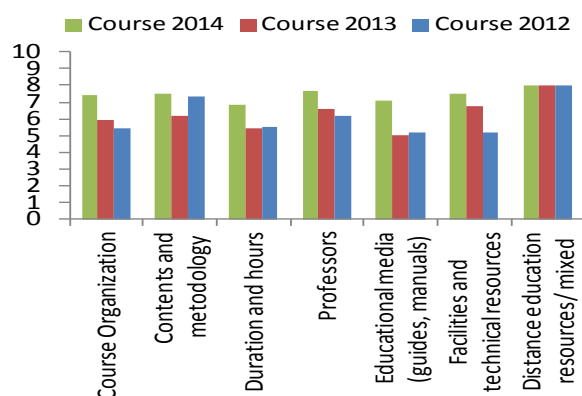


Figure 7. Results of the surveys for course of the 2012 year.

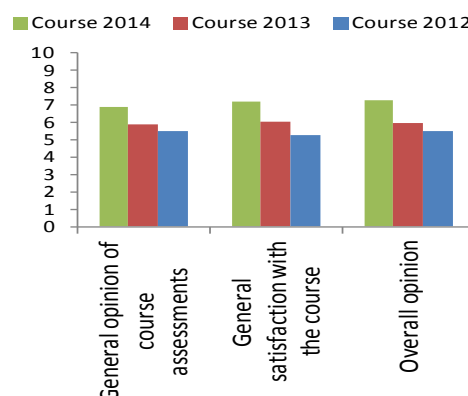


Figure 8. Summary of global opinion for 2012, 2013 and 2014.

Conclusion

In this paper, we have presented a training plan of a blended learning course for graduate students that were taught at the Universitat Politècnica de Valencia during the years 2012, 2013 and 2014. From the analyzed results, and taking into account the profile of students we had, we draw several conclusions. The first is that taking into account the average marks obtained by the students, this methodology is very effective, as it makes students learn the skills defined by the course. Students also meet the requirements demanded by Cisco Systems Inc. for their courses. Moreover, the results of the surveys and students' ratings have been improved year by year, which indicates that the teaching methodologies based on ICT are well accepted by the students. As future work, we would like to extend this methodology to some subjects of university degrees where students are younger and therefore their knowledge about new technologies is higher. We are confident that this training plan will give good results, both in terms of grades and student's satisfaction.

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