A practical experience towards the new European Higher Education Space

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Abstract: - The necessity of adaptation to European Higher Education Space [1][2] is already a fact. There are voices that emphasize the difficulties that we are going to meet so that a real change in the teaching-learning process in the university environment will take place. We expect that it isn't only a vain effort that will only persevere at conferences and talks. For this purpose, it is absolutely necessary to form the lecturers in active methodologies and assessment processes; it will be fundamental that universities value the investigation as well as the use of good teaching practices. In this paper we present the results of the process of adaptation of a first course of Technical Engineering of Telecommunications, Area of Electronic System which has been developed and implemented during the courses 2005/06 and 2006/07, showing both the problems found during the process and how we have solved them.

Key-Words: European Higher Education Space, teaching adaptation model, competences.

1 Introduction

The general directives to the adaptation to the EEES are related to the competitiveness of the *European* Higher Education Space, to students and lecturers' mobility as well as to the incorporation of the students in the working environment. Everything will cause deep changes. We believe that the main change will be in the teaching methodology, until now what the students acquired in a few years was supposed to be enough for the rest of their professional lives . The vertiginous technological advance of our society entails continuous learning and this is generating the necessity of using educational models that allow the students to "learn to learn". From the student's point of view these educational models are more active.

Teruel Polytechnic University School (EUPT) has been developing actions of innovation and educational improvement for several years. This process has already been described in detail in a previous work [3]. Actions carried out by the different management boards and by teaching committees of our university have tried to involve both lectures and students. These actions have achieved an improvement of the students' academic performance.

The following step in this process is the adaptation to the EEES, we think that this change will be easier because our university already has a culture of teaching innovation and improvement due to all previous steps taken.

Zaragoza University presented a project to the ECI/924/2005 announcement in March 2005, this announcement was published by the Teaching and Science Spanish Ministry and it establishes the bases and grants to develop projects to EEES adaptation. Fourteen centres of the Zaragoza University took part in this project. Due to both the imminent transformation of current degrees to the new grades and due to the existing interest, the EUPT participated in this initiative with the project "Adaptation of the first course of Telecommunications Technical Engineer degree, Area of Electronic Systems. The main sections of this study were:

- Degree analysis: professional profile and general and specific competences.
- Elaboration of the teaching guides.
- Initial assessment: developed strategies and possibilities of generalization and implementation of the study carried out.
- Description of teaching methodologies.

The project began in the course 2005/06 with the study of the adaptation of the first course, and it has continued along the course 2006/07, During the current course two further actions have been taken: the implementation of the first course and the study of the adaptation of the second course.

2 Course 2005/06: study of first course adaptation of Telecommunication Technical Engineering to the European Higher Education Space.

2.1 Introduction

Along the course 2005/06, lecturers in charge of the subjects of the first course of Telecommunication Technical Engineering formed a workgroup for the development of a study about the adaptation of the first course.

On the one hand this group carried out several group meetings, and on the other hand each lecturer realized individual work. The work group had the support of the Zaragoza University's Sciences Education Institute that facilitated the training on curricular design under the perspective of the ECTS (European Credits Transfer System). Therefore, the objective of the project was the design of a new educational guide educational in accord with the EEES; to prepare the guide the workgroup developed the next tasks:

Task 1: Description and contextualization
Task 2: Analysis of competences
Task 3: Definition of the objectives of each subject
Task 4: Selection and organization of the contents for each subject
Task 5: Teaching methodology and work plan
Task 6: Assessment

2.1 Teaching guide

2.1.1 Description and context

The Plan of the degree under consideration, that is, Telecommunication Technical Engineering, area of electronic systems, consists of 225 LRU (11/1983 organic Law of University Reform of August 25th) credits: 109,5 of main credits , 69 of obligatory ones, 18 of optional ones and 22,5 of free election. A detailed description of this plan can be consulted in [4]. Each LRU credit only measures the hours spent by the teacher giving lectures to the students; thus, one LRU credit is equivalent to ten hours of classes with the teacher. The subjects of first course can be seen on table 1.

The credit meaning [5], as we have already commented, changes with EEES; where credits measure all the academic work carried out by one student to reach the objectives. Therefore, these credits include activities such as class attendance, both theoretical and practical, classes preparation, individual study, tests and exams, guided projects, seminars and tutorials

One ECTS credit should be between 25 and 30 hours of student's work [6]; moreover, the value of a credit in engineering degrees usually is closer to the second value. In Spain, Telecommunication Engineering White Book [7] determines the contents and the distribution of ECTS credits for the elaboration of the syllabus of this degree. However, our aim with this project is to adapt the current degree, it is not to implement a new grade, since this hasn't been approved yet. To establish the number of ECTS credits for each subject of our current degree we have used the next formula:

ECTS=LRU credits x 60 x n / T

This formula has been established by Zaragoza University. LRU credits are the credits belonning to the subject, "n" is the number of the courses (in our case n=3) and "T" is the total number of credits of the degree (in our case T=225).

Next, we can see the subjects of the degree and the final ECTS credits:

- Analysis of circuits and lineal systems: 8,8
- Physical fundamentals of Engineering II: 4,8
- Calculus: 4,8
- Telecommunication Mathematics: 7,2
- Linear algebra: 4,8
- Graphical expression: 4,8
- Physical fundamentals of Engineering I: 3,6
- Electric and Magnetic Materials: 6
- Statistical Methods engineering: 4,8
- Programming: 7,2

That made a total of 56,8 credits ECTS for the first course of the degree under consideration.

2.1.2 Competences

The Spanish Universities Organic Law (2001) in its first article establishes "The creation, development transmission and criticism of Science, Technology and Culture" as University first function. Consequently, students must develop intellectual, technical, artistic, social and personal abilities. These abilities or competences will encourage creativity, problem solving and autonomous learning through all their life.

The Tunning project [8] proposes a total of 30 competences classified in three groups: instrumental, interpersonal and systemic. For the carrying out of the present teaching guide we considered the generic competences that were specified in the Computer Engineering White Book [10], where the importance of each of them is valued starting from the results analysis of surveys carried out to company communities, qualified people and lecturers.

For the selection of the specific competences and due to the current uncertainty we opted to use the Telecommunication Engineering white book. We selected from it the main competences that our students must develop and we used them as the starting point to design our subjects.

Moreover, we decided to assign a weight to each of these competences, therefore, each lecturer assigned a value to each competence depending on the importance they thought the competence had on their subject.

The most valued competences, that is, those ones the lecturers thought were the most important to develop in the students, were: the analysis and synthesis ability, organization and planning ability, resolution of problems, ability of working in teams and critical reasoning.

We must think that the competences selected will be developed in the first course of the degree, the rest of the competences dealt with in the White Book will be developed in higher courses when students are better trained.

Once the generic competences were defined, we studied the specific competences. The selection of these competences was carried out starting from the Telecommunication Engineering White Book.

Some of the selected specific competences were: digital design, systems design and architecture, applications design concepts, hardware knowledge and up to seventy-three more specific competences.

2.1.3 Objectives, contents, methodology and assessment

Once the competences were outlined, each lecturer determined the subject objectives and related them to both generic and specific competences. Afterwards, they detailed contents and teaching activities. The activities outlined were selected from [9] where they were classified into big group work, seminars, practical classes, ECTS tutorials, autonomous work in group and individual autonomous work. We expected that the educational model wouldn't be centred exclusively on lectures but rather it would promote different types of work such as group work, individual study and tutorials.

As a result of the activities designed lecturers estimated the number of hours that one student would have to work to pass each subject. Through this study the number of hours for each ECTS credit was estimated. A total of 1637,5 hours of student's dedication was calculated, that is, a student has to work an average of 28,83 hours for each credit. The total number of hours will be therefore slightly above 1600 hours; nevertheless we can see that it is within the range considered for an ECTS credit, which is between 25 and 30 hours.

Finally, once the planning and the sequencing of the activities have been carried out, lecturers established the subjects assessment criteria.

All the obtained data were collected and a new first course telecommunication technical engineering guide was generated.

3 Practical experience. Course 2006/07

3.1 Introduction

During the present course 2006/07 we have started the implementation of the project developed in the course 2005/06. Along this course we have analysed the adaptation period and the load of work to which the student is exposed in the different subjects, the initial planning has been modified according to the results obtained. The students who followed a continuous assessment were supposed to work during 40 weeks divided into two four-month period, just as the system ECTS establishes, including exams and holiday periods.

In the following sections some of the data obtained after the first four-month period is presented. It has been carefully analysed and compared with the planning. The values assigned go from 1 to 10.

3.2 Activities

The main activities developed have been fundamentally those presented in the study: theoretical lessons, problem solving and group work lessons, practical laboratory work, individual tutorials, ECTS tutorials, student's presentations and exams.

The first idea of giving more autonomy to students from the very beginning to make them improve the acquisition of generic competences was discarded. Because we realized that first course students accepted guided work better than autonomous work. Therefore, lecturers decided to use

more guided activities at the beginning and to introduce autonomous work little by little.

3.3 Class Attendance.

A clear difference exists among the students that follow the continuous assessment and those that don't do it; in general, the first ones are conscious of the necessity of following the subjects on a daily basis, while the second ones prefer to put greater effort only in the weeks previous to the exam. If we analysed the average of both we can see that a 52,66% of enrolled students usually attend classes.

3.4 Student's participation and motivation

Depending on the subjects, lecturers value the student's participation assigning values between 3 and 9 points; with an average of 6,33. In general, students follow lessons well, however they sometimes find it difficult to participate in some activities; some of them aren't very motivated for the continuous work, they don't usually study every day and therefore they find it difficulty to reason and work out problems because they lack important concepts that should already have been assimilated.

Some of the reasons that cause a low participation of the students are: lack of knowledge of intellectual work techniques, low previous knowledge, weak motivation, low self-esteem and not very clear objectives.

Something similar happens to motivation. It varies depending on the subjects, it is valued by lecturers with figures between 4 and 8; the final average is 6,5. Also, those students that attend lessons but don't follow the continuous assessment are less motivated and they participate less in the proposed activities.

3.5 Student's work dedication.

An academic term consists of 20 weeks distributed in 15 teaching weeks, 3 exams weeks (18^{th} 19^{th} and 20^{th}) and 2 holiday ones (weeks 14^{th} and 15^{th} on the first term and 9^{th} and 10^{th} on the second term). A course is divided into two terms. Next we will analyse the distribution of the student's work along the first term.

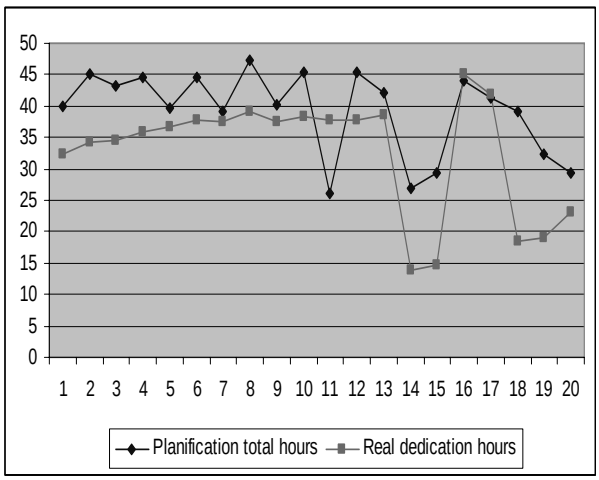


Table 1. Student's workload (hours) per week (Planned vs. real)

We can observe that in general, students have worked below planned almost every week, devoting a greater effort than planned the previous weeks, just before examinations.

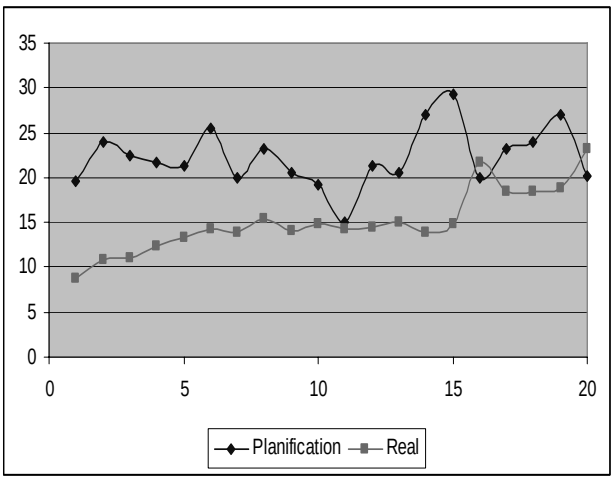


Table 2. Private student's workload (hours) per week (Planned vs. real)

Table 2 shows that student's personal work is less than the one they should do. Work is only superior in some previous weeks before exams and in the exam period. An average student doesn't work in a uniform way along the term; he devotes 2,09 hours on average to individual work for each subject. However, the working hours change depending on the weeks. We have observed that some students work on some subjects 0 hours some weeks and 7,5 hours some other weeks. Nevertheless, although we can affirm that in general students have improved their habits of continuous work, they still should improve their capacity to distribute the effort in a more uniform way throughout the course and not to centralize it at final weeks of the terms.

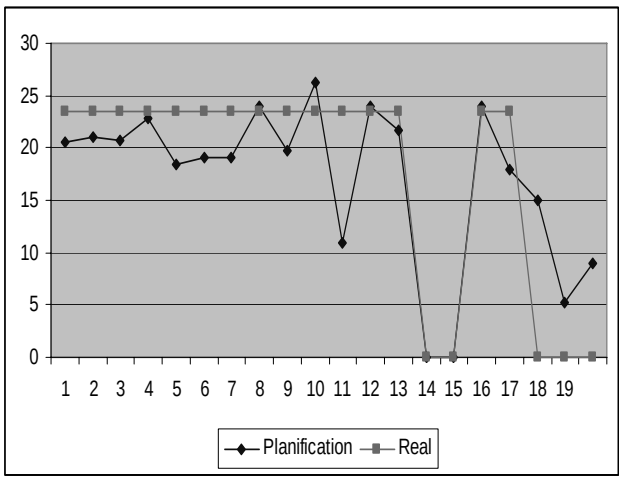
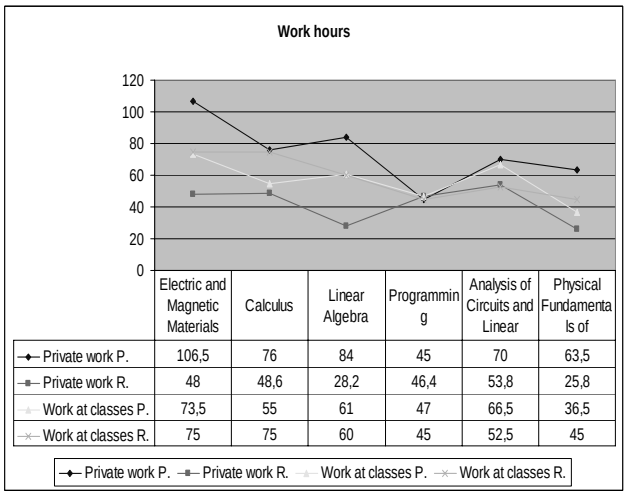


Table 3. Student's workload (hours) in the classroom per week (Planned vs. real)

Class attendance has been superior to the one planned, it has been largely due to two factors: Firstly, the students don't understand the necessity of working at home and secondly they have a lack of continuous work habit.



	Electric and Magnetic Materials	Calculus	Linear Algebra	Programming	Analysis of Circuits and Linear	Physical Fundamentals of
Private work P.	106,5	76	84	45	70	63,5
Private work R.	48	48,6	28,2	46,4	53,8	25,8
Work at classes P.	73,5	55	61	47	66,5	36,5
Work at classes R.	75	75	60	45	52,5	45

Table 4. Hours of student's private work and hours of student's work at classrooms (P-planned, R-real).

Table 4 shows the same conclusions as the previous tables. On the one hand, student's private work is below the planned work in almost all subjects. On the other hand, the work at classroom is higher than the planned one. Percentages are exchanged when we compare the established ones in the planning and the real ones:

- Planning: 57,96% of student's personal work, 42,04% of work in the classroom.
- Real: 43% of student's personal work, 58% of work in the classroom.

Furthermore, the dedication ratio changes. If we estimated 28,85 hours for ECTS credit in the planning, it becomes 22,18 hours for credit ECTS in practice, being this last value below the 25-30 working hours estimated for one credit ECTS.

Students dedicate a total of 31,3 weekly hours on average to the study and preparation of all subjects (including personal work and work in the classroom). This value is lower than the planned one; the suitable number should be approximately 40 hours. Therefore, we can conclude that students should make a greater effort.

3.6 Assessment

Lecturers carry out a continuous assessment in all the subjects. The weight they give to it varies from 15% to 100% (depending on the subject), having an average weight of 43,34%. A final exam is also done in all subjects, with a weight, in this case which varies from 15% to 80%, with an average of 38%.

Students value positively the use of continuous assessment; they state that this way of assessment helps them to study on a regular basis. Moreover, it improves the follow-up of the subjects, facilitating the learning process and improving both the student's interest in lessons and their performance. Those students that don't follow the continuous assessment can do end-of-term exams; in this case this exam will be the main assessment criteria.

Some of the reasons for which students give up continuous assessment are the overlapping of the different courses timetables, the necessity of a greater effort and continuous work and lack of aptitudes for planning and organization.

Each student is enrolled in an average of 5,6 subjects, of which a 50,67% are first course subjects, a 28% are second course ones and a 17,33% are third course ones.

The number of subjects which were passed first time was 2,23 subjects (on average); that makes a percentage over enrolled subjects of 38,67%. This percentage is slightly higher than previous years; most of the students that follow the system of continuous assessments were successful.

3.5 Student's valuation of used methodologies.

Students value the methodologies used by lecturers in a positive way, the assigned marks oscillate between 5 and 9, averaged 6,5.

On the one hand, the best assessed aspects by students have been: very good communication to one

another in group activities, positive experience of this type of activities and a better learning regarding other methodologies.

The most developed aspects according to the students have been the work in groups, effective communication with the other students and autonomous learning.

On the other hand, students consider that they have worked harder than with traditional methods, the course has been quite difficult and the subjects had too many contents. Nevertheless, all of them recommend these teaching methodologies.

3.6 Lecturer's work

Lecturers' dedication has been higher than other previous courses, it has been mainly due to the increase of work to prepare new materials, new activities, correct more exams and more exercises and others. According to lecturers assessment, the increase of work regarding previous years has been about a 46% on average. Furthermore, coordination tasks have generated a 7% of additional work.

4 Conclusions

In this work, we have dealt with the adaptation of a complete course of Telecommunication Engineering according to the new requirements of the European Higher Education Space. The gradual adaptation of the subjects will allow lecturers to act carefully and thoughtfully when facing the necessary adaptation to the new educational framework; results obtained will let us correct the tested methodological strategies and work on their improvement.

It is not expected that the first steps suppose a traumatic change in the exercise of the educational practice. Due to the forthcoming implementation of the new educational model, we think that it is a good moment to unify all reflections that have been done to carry out a unified deep and serious reflection on the situation. The implementation of the study has been carried out throughout the academic year 2006/07, Both students and lecturers have made a positive assessment of the obtained results. Although they are promising, a lot of work will have to be done to achieve the complete process of adaptation.

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