

A Multidisciplinary Experience in the European Context

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1. Introduction

The design and implementation of a transverse activity is explained in this chapter. It has been developed and still is at the University of Cordoba (UCO) in Spain, undertaken in the degree of Technical Engineering in Computer Science in the branch of Management, taught at the High Polytechnic School. Three teachers are involved in such experience, very much in line with European Higher Education Area (EHEA), since self-learning, the use of new Technologies, a close relation with the labour market, interdisciplinary learning and the development of competences are especially focused in this activity.

Besides, as recommended and defined by some authors, a deep approach to learning is also carried out in this experience (versus a superficial approach). Through this, students perform an emotionally satisfactory and integrating learning which contributes to their personal growth.

2. The multidisciplinary experience

2.1 Context

Technical Engineering in Computer Science, Management branch is currently developed in three academic years.¹ As it is officially described, a Computer Management Engineering Technician is an applications analyst. The education curriculum for this degree is based upon the interrelation of many branches of the scientific field, such as Maths, Logic, Engineering, Linguistics, Physics, Electronics, Statistics, Economy, etc. Together with these disciplines, specific matters related to Computer Science and applications are also taught. Therefore, Computer Management Engineering Technicians develop their work by bearing always in mind the final user of computer equipments. Thus, a technician studies such needs, create and adapt software to them.

¹ <http://www.uco.es/organiza/centros/eps/en/index.php>

This experience is developed by three teachers who are responsible for seven different subjects during the three academic years. The amount of subjects involved can be found in Table 1.

PLAN OF STUDY	SUBJECTS	TYPE	ECTS CREDITS
First year	Business Economics	Core	5,5
Second year	Statistics	Core	10,0
Second year	English applied to Computer Science II	Core	4,0
Third year	English applied to Computer Science III	Elective	3,5
Third year	Data analysis	Elective	3,5
Third year	Business Management	Elective	5,5
Fourth year	Degree Final Project	Core	5,5

Table 1. Distribution of the subjects in the plan of study

The aim of this experience is mainly to provide students with a global and meaningful learning which integrates different disciplines within their plan of study. Two factors tremendously help in this experience. First, the fact that these subjects can very easily be interrelated, and second, the fact that these subjects are disseminated along the plan of study in a very convenient way for carrying out the activity. Students are more and more required by the European knowledge society to be enabled by Higher Education Area to have a critical and analytical capacity and a more practical education based on realistic and practical information.

In addition, the frame of this experience is theoretically tied with the aim of achieving the principal aspects characterising the deep approach to learning (Entwistle, 1988; Ramsden, 1992; Biggs, 1999). A list of the prevalent features which define a student undergoing a deep approach to learning is displayed (Hernandez & cols, 2001; Yan & Kember, 2004):

- Learning becomes an emotionally satisfactory act.
- A qualitative notion of learning is maintained so that students transform, modify their ways of regarding the world, become creators, foster their self-learning, promote their personal development.
- Motivation is founded upon students' interest in their matters, basically in understanding them as well as in being able that their learning bears a personal meaning.
- Performing a task is understood as a means for personal enrichment.
- Students become able to plan their work and carry it out. So they are enabled to long-term program as well as positively welcome suggestions about it.
- The strategies employed by students are based on their interest in their subjects, as they use it to maximise their understanding of them and to satisfy their curiosity.
- Different components of a given matter are related to each other and integrated as a whole.
- Inherent meaning of a matter is always inquired about.

- By examining logical arguments and relating evidences with conclusions students interact in a critical and active manner with a given matter.

Finally, through the tendencies marked by the EHEA (European Association for Quality Assurance in Higher Education, 2005) in the definitions of the new grade, master and doctorate titles have a strong emphasis on the acquisition of competences, understood as “knowledge in context”. In this sense, Higher Education has to foster a life project which includes professional development, and therefore, this experience must be understood as such.

2.2 Description of the Activity

The description of the experience is explained below on a yearly basis.

First year in the plan of study

During the first year students must enrol in *Business Economics*, subject where they must become familiar with the basic aspects which configure a given business reality. Students are provided with basic general concepts of business, paying special attention to the key variables influencing the normal progress of each of the departments belonging to such company. This subject covers a very wide and practical knowledge which is being more and more difficult to teach every year, due to a main reason: students show gaps in their previous knowledge as well as in learning techniques. Therefore, some methodological dynamics are developed together with the use of a software tool helping students to partially solve these problems. In this sense, such technological support has been possible thanks to the work of senior students. Specifically the preparation of their final projects have allowed the creation of a series of applets (see Fig. 1) which have been incorporated in a virtual platform supporting the work in the subject. It is important to highlight at this point that several statistical tools that students will have to use next year have been incorporated in some of the internal calculus provided to students in this software. Thus, this platform allows students with simulation practices related to each of the four main parts in which the subject is distributed (Fig. 1).

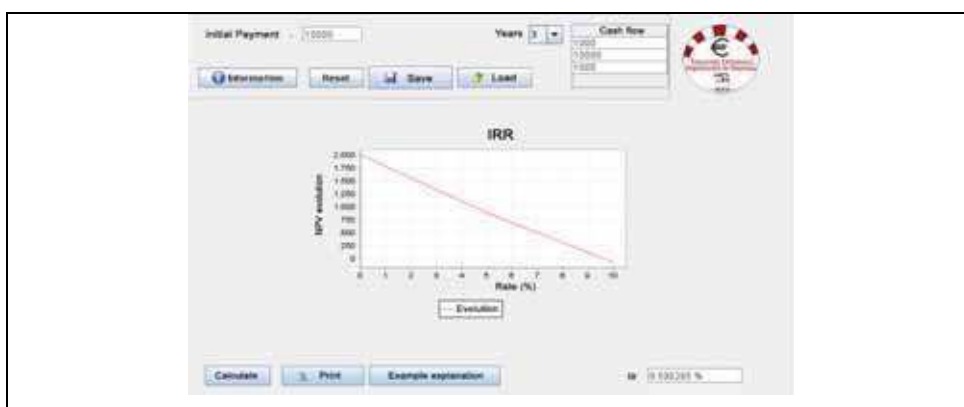


Fig. 1. Applet simulation

Once students have acquired the fundamentals of the subject, students are required to undertake a project about setting up a business where all the previously acquired concepts must be put into practice. Such project is accomplished in groups of up to five members. When this work is finished, all the information can be introduced in other softwares also being worked out by senior students' final projects (Fig. 2).

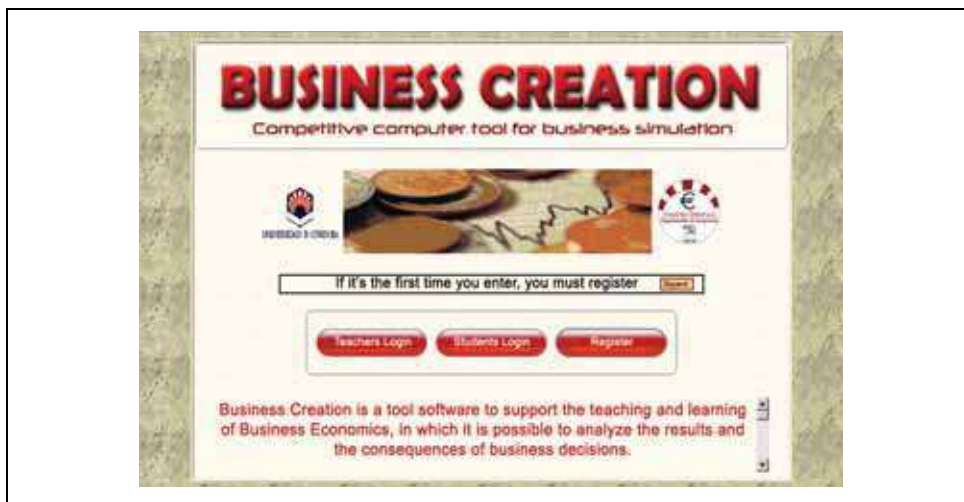


Fig. 2. Business creation software

This software works by allowing a constant competitive comparative score between the multiple results obtained by the different groups of students, similar to other software programs marketed through some consultants or specialized companies in simulation software.² As a final task, students have to write an abstract in English in which they briefly explain and assess their experience.

Second year in the plan of study

During the second year, students may enrol in the subjects *Statistics* and *English applied to Computer Science II*, although it is also possible that students do not accomplish first year and only choose some subjects from second year.

The subject *Statistics* is divided into three main parts: linear programming, descriptive statistics (taught during the first semester) and statistical inference (taught during the second semester). Among other tasks, in each of these parts, students must undertake teamwork where they use the acquired knowledge by applying them to real situations. This work must be handed in by following format guidelines, including an abstract in English. This work must also be presented in class.

In this way, students of *Statistics* are asked to carry out several projects. They necessarily need to use their theoretical knowledge previously acquired in *Business Economics* in the

² www.arkhe.com; www.bsg-online.com; www.cesim.com.

previous year. Therefore, during the first semester students have to continue improving some aspects related to the business they created last academic year, mainly focused in predicting sales, transport costs optimization, marketing costs optimization, management, product choice or data gathering and market samples.

Statistics is focused on the development, analysis and interpretation of surveys during the second semester. For this end, students are asked to create a survey first and to analyse their results secondly about the competition affecting their merging businesses. For such end, students have to create a questionnaire, select a significant sample, analyse the obtained results and, lastly, extract and learn to properly interpret the data so as to be able to conclude the study using the tools available for this.

The subject entitled *English applied to Computer Science II*, constituting the second part of *English applied to Computer Science I* taught in first year, also develops a series of activities related to the aforementioned subjects. Students enrolled in *English applied to Computer Science II* are already intensely familiarised with reading technical, scientific and academic texts belonging to their field of study. However, it is during second year when students are systematically instructed in writing this type of documents. In order to establish a meaningful relation between the previously coursed matters, students are shown the abstracts they prepared for the subject *Business Economics*. Before abstracts are taken to the class, the English teacher provides them with other real published articles taken from prestigious publications of the field as a way to offer models to imitate in the future. Once they are prepared to assess their own abstracts' linguistic structure and content, they are asked to analyse the way of improving them as a previous exercise before creating new versions of their abstracts. Apart from this activity, students are also linguistically trained in preparing a correct survey in English, as they need to create them for the subject *Statistics* also taught during the first semester.

Third year in the plan of study

During third year, *English applied to Computer Science III*, *Data Analysis* and *Business Management* are the three subjects involved in the experience.

English applied to Computer Science III is taught during the first semester. As this is an optional subject, not many students enrol and the activities undertaken in the subject are more related to their immediate future as active members of the labour force. Therefore, preparing their *curriculum vitae* (CVs) is one of the core activities. Another activity that they have to do is to prepare a job interview in English. In this sense, instructions and the right tools are provided to them so that they not only properly adequate to the situation but also become able to participate in the allotment of workers according to their more developed competences. It is interesting that all these activities are usually framed within a list of businesses they created in first year provided by the teacher of *Business Economics*. It is unavoidable to find students who coursed that subject a long time ago and that did not have to do this activity. In these cases a list of businesses is available to all so that they only have to choose the ones they like most and pretend that this is their own creation.

Also coursed during the first semester is the subject *Data Analysis*. The aim of it is the use of computer tools so as to practice more efficiently the contents acquired in the subject *Statistics*. One of the activities proposed during the first part of the semester is the elaboration of a detailed final report which summarises the results provided by the statistic software, by way of a first research work dealing with the results and conclusions obtained the previous year. Such report must be written both in Spanish and in English.

During the second semester, many of the concepts developed in *English* are taken up again in *Business Management*. This subject is mainly focused on the importance of managerial decisions as guaranteeing the success of a given business. For this subject, students have to analyse the sector to which the businesses they created belong from the perspective of their specialty, i.e. Computer Science for Management. The aim of the activity is that students can finally provide a solution to any aspect where they have detected a weakness and a possible improvement. As an option to this project, students can undertake another activity consisting in properly managing workers' competences in their business.

Fourth year in the plan of study

It is essential at this point to mention the cooperation and help obtained from students who decide to develop the computer tools used in this experience. These students have normally coursed these subjects and been in this experience themselves, which provides them with a general perspective of the needs.

Therefore, such students have developed some of the aforementioned computer tools as their degree final project (Fig. 3).

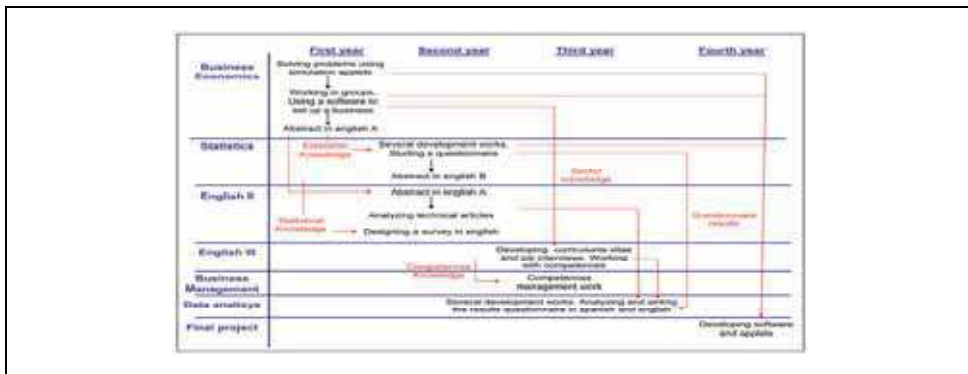


Fig. 3. Relations between subjects

The aim of this kind of activities is that students work and acquire many of the generic competences: teamwork, problem solving, organization and planning capacities, communication abilities both in their mother tongue as well as a foreign language.

3. Materials used in the experience

In order to carry out this experience, several materials have been necessary. First of all, the intense cooperation of the three teachers who participate in these subjects; second, several computer tools have also been of great help. Specifically, a server and some computers having access to Internet are necessary for the implementation of the experience.

4. Evaluation process

Evaluation is going to be considered here in two different senses:

- On the one hand, evaluation understood as the way of assessing if a student properly acquired the contents of a given subject. In this context, this type of activities allows teachers to do a continuous evaluation, as it is also proposed from the European Higher Education Space philosophy.
- On the other hand, the evaluation of students' opinion about this experience, but also about the performance of their own classmates.

In order to obtain information from the previous issues, students were asked their views about the following items concerning other students' essays:

- Originality of the problem/case proposed.
- Difficulty of the problem/case proposed.
- Clarity in the oral presentation.
- Ability in the oral presentation.
- Clarity of the resources used (.ppt files presentations mainly).
- Technicality used.
- Specific real problem/case.
- Clear definition of objectives.
- Results shown.
- Conclusions drawn.

The assessment of the different activities carried out in the subjects belonging to the experience have necessarily to be independently marked by each teacher, since assessment is always done about what students have acquired in each subject. Besides, it would be extremely difficult and inappropriate to ask another teacher to assess a project carried out in a subject completely alien to their own field. In spite of this fact, a joint assessment was done in the past with negative results since it proved unadvisable from the point of view of the students' learning.

Evaluation percentages are always provided to students so that they know well in advance how their work will be continuously assessed and how their final marks are obtained. These are described below.

Business Economics:

Final examination (include contents from theoretical and practical sessions): 70%.

Activities autonomously developed: 20%.
Attendance and participation: 10%.

Business Management:

Final examination: 80%.
Activities autonomously developed: 20%.

Statistics:

Final examination: 40%.
Teamwork: 35%.
Attendance and participation: 10%.
Activities proposed in class: 15%.

Data analysis:

Teamwork: 60%.
Attendance and participation: 20%.
Activities proposed in class: 20%.

English applied to Computer Science II:

Final examination (include contents from theoretical and practical sessions): 70 %.
Activities: 30 %.

English applied to Computer Science II:

- Without exam, just essays and other activities (100%):
- Oral presentation (one or two students) and summary: 30 %.
 - Reports handed in once a month: 20%.
 - Reading form (one book minimum): 20%.
 - CV and cover letter: 10%.
 - Attendance: 10%.
 - Activities proposed through moodle: 10%.

In the subject *English applied to Computer Science II*, the activity related to the writing of an abstract is only one of the many text types that students have to learn to properly write. Therefore, it has a direct influence of their final marks for the subject but it is just one of the many written exercises they have to do for the subject.

In relation to *English applied to Computer Science III* students are also asked to carry out a series of speaking, listening and writing activities among which are the ones related to this experience. Thus, there actually is an influence in their final marks but it is very imprecise to establish a percentage.

Students were asked if they considered the experience interesting, according to the following specific questions:

- The method used is in accordance with the ECTS philosophy.
- Students conceive as a good way to learn the fact that they should write essays and expose them afterwards.

- Students would like to modify this working system in order to return to traditional system.
- They believe that through these activities they understand better the subjects in a real context.
- They think the results obtained by the rest of the working groups were interesting.
- They would like to change this system for the next period.

5. Problems Detected and Solutions

In each stage of the experience different problems emerge. In first year, students frequently lack the necessary knowledge to understand and pass many of their subjects. This may be due to the qualitative change between Secondary education and Higher Education. Moreover, students do not present homogeneity in their education, since Secondary Educative system allows them to have chosen subjects related to Humanities or other areas not appropriate for this degree. Thus, this means that students enrolled in first year subjects frequently show very high variability in their individual choices and education, which makes teaching very difficult.

Another problem found in the implementation of this experience lies in the fact that the subjects involved in it are taught during very different time spans. Thus, these subjects are distributed along the whole plan of study and can either be taught during the first or the second semester. Apart from this, in the case that subjects are not core, students can freely choose to enrol in them, which makes extremely difficult to control if the same students have already taken part in the project. The fact that these subjects are scattered in semesters can actually make students lose a global perspective in the connection between them.

Finally, it is particularly difficult to assess students simultaneously in all the subjects or in a given set of subjects. As a consequence, a joint evaluation has been discarded. A similar experience was unsuccessfully carried out in a more modest scope between the subjects *English applied to Computer Science III* and *Business Administration* due mainly to the evaluation system. It proved to be really difficult to make evaluation for each subject depend on each other as first, each teacher has his/her own personal criteria; second, different contents are evaluated in each subject and making marks depend on other subjects can become counterproductive for students' personal abilities and competences. Thus, teachers have independently established the percentage of each activity for their own subjects but a common concept is always actively remembered to students in class: the fact that this is part of a broader experience in which they are taking part and which will allow them to be able to improve a project from very different perspectives and fields.

Several other problems are explained specific to each to each subject involved in the experience. In relation to *Business Economics*, it is very difficult to delimit the variables that students have to handle in their projects about setting up a business. This problem has been solved by the software previously referred to (see Fig. 2). *Business Management* has also faced a problem regarding students' choices, that is to say, when students do not wish to continue their project in the same market sector either because they have lost interest in it or because they feel it as worn-out. In these cases, the teacher provides them with projects carried out

by other students in previous years so that they can choose among a wide variety. A similar procedure is followed for the subjects *Statistics*, *Data Analysis* and *English applied to Computer Science II* and *III* as they share the same kind of problem: as students do not normally pass their subjects yearly it is probable to find that groups are completely broken when they reach last years and therefore it is not possible for most of them to continue the work they started in the first years. In these cases, teachers usually allot previous works to their newly created groups with students who are following the plan of study with difficulties.

6. Conclusion

This experience is adapted to the philosophy of the new European Higher Education Area as it requires a very high dose of transverse work between subjects, which provides students with an overview of their studies from a more immediate, lively and practical perspective. This is possible through the close cooperation of teachers in charge of a group of subjects in this degree. Moreover, it contributes to the acquisition of some basic competences that are very important to student's future successful immersion in the labour market.

Besides, students are asked to evaluate the activities put in practice. There has been so far a very positive answer. Our results suggest that students think that they learn more easily and that the knowledge they acquire is more practical. On the other hand, it allows to link different subjects, providing them with a wider perspective of their degree.

Teachers believe that the experience is interesting since it allows them to implement creativity as well as a deeper knowledge of the contents taught.

More specifically, the figures that the student survey provides are the following (they evaluated the questions in a scale ranging from 1 to 5):

- 100% think that the method used is agreed to ECTS philosophy. The punctuation is 4.11.
- 92.7% of students conceive as a good way to learn the preparation of some written works firstly and its public explanation afterwards. The punctuation is 4.01.
- 97% of students would not like to change this system of work to return to the traditional system.
- 97.6% think that through these activities they understand better the subjects in a real context.
- For the 98% of the students the results obtained by the rest of the working groups were interesting.
- 92.7% do not want to change this system for the next period.

A more than interesting data appears when students are asked evaluate their classmates: more often than not they mark each other with lower punctuation than teachers do. Specifically, 20.4% of students marked fellows with lower grades than teachers. One example of it is an average score of 6.8 from students and 8.6 from teachers.

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From 3rd to 5th March 2008 the International Association of Technology, Education and Development organised its International Technology, Education and Development Conference in Valencia, Spain. Over a hundred papers were presented by participants from a great variety of countries. Summarising, this book provides a kaleidoscopic view of work that is done, all over the world in (higher) education, characterised by the key words 'Education' and 'Development'. I wish the reader an enlightening experience.

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