



Development of New Teaching Methodologies for the Degree in Building Engineering in Spanish Universities

Teresa Gallego, María J. Ruá, Lucía Reig, Patricia Huedo

Universitat Jaume I Castellón (Spain)

tgalleo@uji.es, rua@uji.es, reig@uji.es, huedo@uji.es

1. Introduction

The aim of the Bologna Process is to create a European Higher Education Area based on international cooperation and academic exchange that is attractive to both students and university staff alike. It was implemented in Spanish universities during the academic year 2008-2009, involving many changes regarding teaching methodologies due to the fact that the learning process is now focused on the students [1], while the old system was based more on lectures. Hence, from now on, student-centred learning, in which an autonomous learning process will take place, must be promoted [2]. Therefore, new methodologies must be developed in order to guide students throughout the learning process [1], and they should be based on competences, active methodologies, and continuous assessment. First of all, it is necessary to clarify the difference between learning activities and methodologies [3]. In Tables 1 and 2, both terms are described for the particular case of the Bachelor's Degree in Building Engineering (DBE), as offered by Universitat Jaume I (UJI) in Castellón (Spain) [4].

ACTIVITY	DESCRIPTION
Theoretical classes	Teacher lectures with theoretical contents in which the student could participate or not. This involves techniques such as lectures, debates, discussions, etc.
Practical classes	Classes in which to apply the theoretical contents acquired in the theory classes. They could consist in problem-solving, laboratory, experiments, simulations, use of ICT, etc.
Seminars	This activity is oriented to point out contents that have already been assimilated. Different techniques can be used for this, including workshops, expert lectures, etc.
Supervision	This could be performed for one or for a group of students. It is oriented toward guiding the autonomous work. It could apply different techniques, such as project-based learning, research-group supervision, etc.
Evaluation	This embraces all those activities designed to evaluate the student, such as written exams, oral presentations, reports, etc.
Autonomous work	Students must prepare seminars, reports, presentations, research work, etc. either individually or in groups; this work must then be handed in to the teacher for evaluation.
Exam preparation	This includes all the activities to be carried out in order to prepare the examinations, such as autonomous study, complementary reading, acquiring practice in problem-solving, etc.

Table 1. Teaching activities implemented in the DBE at Universitat Jaume I

METHODOLOGY	DESCRIPTION
Lectures (L)	Method where the contents of the subject are presented by the teacher.
Problem-Solving (PS)	Method: Situations where the student must develop and interpret appropriate solutions by applying routines, formulas, or procedures to transform the initially proposed information.
Problem-Based Learning (PBL1)	Teaching-learning method, based on a given problem, used to develop competences which have been defined previously.
Case Studies (CS)	Intensive and comprehensive analyses of a fact or problem, in order to know, interpret, solve, generate hypotheses, compare data, think, acquire knowledge and, sometimes, look for alternative solutions.
Project-Based Learning (PBL2)	Teaching-learning method, based on a given project, used to develop competences which have been defined previously.
Cooperative Learning (CL)	Interactive approach to organizing work in which students are responsible for their own learning and share responsibility with peers for developing a strategy to achieve group goals and incentives.
Virtual Platform Learning (VL)	Teaching-learning situation where a computer is used as a system of communication between teacher-student in order to carry out the training activities integrated into the curriculum.

Table 2. Teaching methodologies implemented in the DBE at Universitat Jaume I

In Spain the DBE is taught at many universities (32 altogether). Although these studies have been recognized as official degrees by the Spanish Ministry of Education, it is difficult to know the real extent to which the new teaching methodologies have been implemented. The aim of this paper is to analyse the teaching methodologies used in Spanish universities and to define their implementation in compliance with the needs of the Bologna



Process. The paper is structured as follows: firstly, the stages followed to develop the study are described. Secondly, the results obtained in each stage are shown. Finally, the main conclusions from the analysis are discussed and some further conclusions based on the observed deficiencies are inferred.

2. Methodological Approach

In order to carry out the present study, the following stages were developed:

1. Identification of the Spanish universities where the DBE is offered.
2. Analysis of the study programs so as to be able to identify differences between the teaching methodologies used in classroom hours and in autonomous learning hours, as well as identifying which teaching methodologies have been implemented.
3. In-depth analysis, in order to obtain further information about the teaching methodologies. Due to the fact that there are more than 40 subjects per university, and every single subject has to be checked, five representative universities were selected.

3. Results and Discussion

The results of the stages carried out and explained in the previous section have been summarized in the figures and tables and shown in the present section. It has to be said that some of the information is not complete because the Bologna Process is still being implemented in the universities. In addition, the terminology used to define the teaching methodologies is based on that currently used at UJI. This implies that there is an interpretation by the authors, based on the information available for the universities that were analysed. Nevertheless, it can be interpreted as a first approach that can help to shed some light on the current situation.

3.1 Spanish Universities where the DBE is offered and analyses of curricula

Figure 1 shows the universities where the DBE is offered. In all cases, the courses have been approved by the Spanish Ministry of Education. Although the study programs of all the universities have been analysed, only general information regarding teaching methodologies could be found. Despite the fact that teaching methodologies are not specified in the study plans as a whole, they are individually defined for each subject.

It can be said that implementation of the Bologna Process is still under way, and this means that in many cases there is not as much information available as one would desire. For this reason, besides UJI, four other universities presenting quite complete information regarding teaching methodologies were selected for in-depth analyses. They are shown in bold in Figure 1.



Location	University
1	Universidade da Coruña
2	Escola Politècnica Superior d'Alacant
3	Escuela Universitaria Politécnica de Cuenca
4	Escola Politècnica Superior de Girona
5	Escuela Universitaria de Arquitectura Técnica de Alcalá
6	IE School of Architecture – IE University
7	Universidad de la Laguna
8	Universidad Camilo José Cela
9	Escuela Universitaria de Arquitectura Técnica de Sevilla
10	Universidad Católica San Antonio de Murcia
11	Escuela Universitaria Politécnica de San Sebastián
12	Escuela Universitaria Politécnica La Almunia de Doña Godina - Zaragoza
13	Universidad Politécnica de Madrid
14	Escola Politècnica Superior d'Edificació de Barcelona
15	Universidad de Navarra
16	Escuela Politécnica Superior de Burgos
17	Universidad de Salamanca
18	Universitat Jaume I
19	Escuela Politécnica de Cáceres
20	Universitat Ramon Llull
21	Universitat Pompeu Fabra
22	Escola Politècnica Superior de la Universitat de Lleida
23	Escuela Universitaria de Arquitectura Técnica de Granada
24	Universidad Alfonso X El Sabio
25	Universidad Politécnica de Cartagena
26	Universidad CEU San Pablo
27	Universitat Politècnica de València
28	Universidad Antonio de Nebrija de Madrid
29	Universitat de les Illes Balears
30	EPS Valladolid, Universidad Europea Miguel de Cervantes
31	Universidad Europea de Madrid
32	Universidad Pontificia de Salamanca – Campus de Madrid

Figure 1. Map showing the location of Spanish universities where the DBE is offered

3.2 Teaching methodologies implemented

From the individual analyses of the subjects, it has been inferred that there are many uncertainties when comparing the methodologies implemented in subjects both at UJI and at the rest of the universities. There is no consensus about the terminology employed to describe the teaching methodologies. In many cases, what is defined as an “activity” at UJI (Table 1) is called a “methodology” at other universities (Table 1). However, in order to facilitate the comparison, an effort has been made to translate the other universities’ methodologies into those employed at UJI. Results of this comparison are summarized in Figures 2, 3 and 4.

Figure 2 represents the percentages of classroom hours (C) and autonomous learning hours (A) for each of the universities analysed. As can be inferred from Figure 2, classroom hours represent between 37% and 43% of the hours devoted to the learning process, whereas autonomous learning accounts for between 57% and 63%. Therefore, all universities are in a similar range of values.

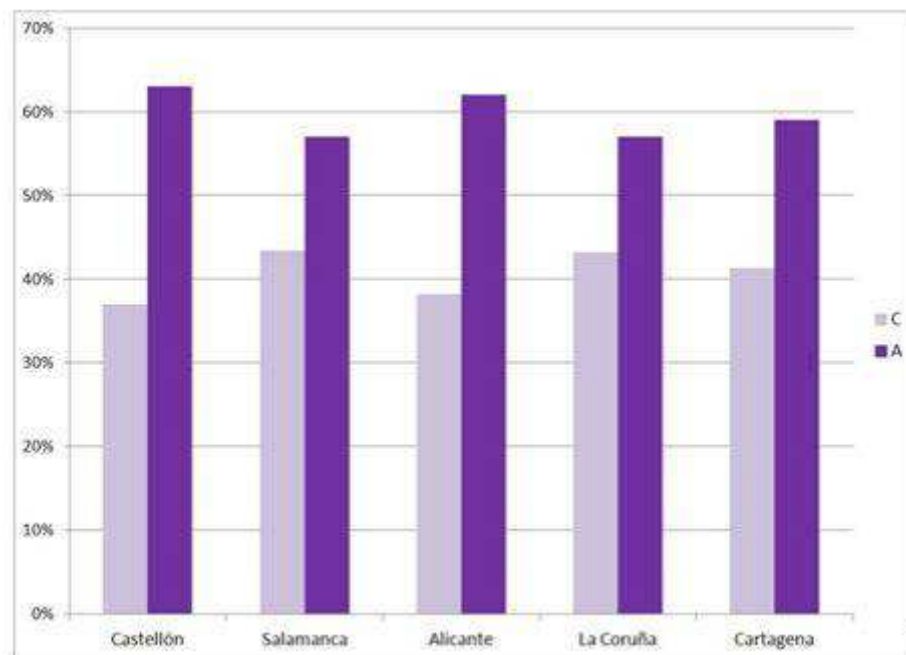


Figure 2. Mean percentage of classroom (C) and autonomous (A) learning hours per university

Figure 3 represents the percentages of the different methodologies. They have been taken from the information provided at each university about each subject and translated according to UJI terminology (Table 2). There is an extra initial (O) which refers to "other teaching methodologies employed", such as visits to building sites and companies, portfolios, conferences, research tasks, and so forth. As shown, L, PS and PBL1 are the most common methodologies, representing more than 50% in all universities but UJI. On the contrary PBL2 and CL are more prominent in UJI than in the rest, due to their implementation in 1st, 2nd and 3rd academic year.



Figure 3. Percentages of teaching methodologies at each university

Figure 4 represents the percentages of the teaching methodologies considered for each university. As shown in the figure, L is implemented in almost 100% of the cases. Moreover, it is interesting to remark that this methodology is clearly included in classroom hours. PS and PBL1 also account for a high percentage – around 90%, although it is logical to expect these two methodologies to be highly implemented, since the DBE is a technical degree. On the other hand, CS presents a wide range of percentages of implementation, ranging from 8 to 50%, with a lower presence in more basic subjects (math, physics, etc.), as it seems logical to assume. Finally, for the rest of the methodologies considered, there is a large difference between UJI and the rest of the universities. This is due to the fact that UJI methodologies are based mainly on PBL2, in the first, second and third academic years [4]. As a consequence, cooperative learning is promoted because it is directly related to the PBL2 methodology. Note the fact that VL seems to be applied in a higher percentage at UJI than at the rest. This does not seem to be very realistic, because in fact today all universities have a high level of implementation of VL. The reason could be that it is not reflected in the study programs as VL as such.

4. Conclusions

The Bologna Process has just been adopted in Spanish universities. In many cases the DBE is still being implemented, so to some extent it could be said that many things have to be improved in the next few years and we firmly believe that this is the time to start.

From this analysis the following conclusions can be extracted:



1. There are 32 universities where DBE is offered in Spain. From the information available about their curricula, it can be said that there are big differences among them. Some of them present complete data while others present hardly any information. These differences should be reduced in the short term.
2. The study programs do not contain enough information regarding the teaching methodologies implemented at each university. Every subject has to be checked individually to get further information. Of the universities analysed, only UJI specifies that PBL2 is implemented in each academic year, while also ensuring the coordination of the different subjects taught in the same year [4]. This results in a higher implementation of teaching methodologies such as PBL2 or CL.
3. There is some confusion about what is meant by teaching activities and teaching methodologies, when comparing universities. There is also some confusion about the terminology used to describe the teaching methodologies and this makes it difficult to compare universities.
4. Autonomous work represents a higher percentage of hours than classroom hours, with about 60% and 40% respectively. However, although classroom hours are usually clearly defined as regards their teaching methodologies, there is a lack of information about autonomous learning hours. This is something to bear in mind because autonomous work has become a very relevant part of knowledge acquisition. In consequence, a greater effort must be made to define the teaching methodologies to be used.
5. All the study programs must be accredited again in 3 years' time by the Spanish Ministry of Education. One of the aspects that will be evaluated has to do with the definition of the teaching methodologies, especially those related to autonomous learning, which constitutes another reason to improve this part of universities' curricula.

To sum up it could be said that study programs in DBE in Spain still need to be improved. Information from the different curricula should be more uniform and teaching methodologies should be better defined. In this context, comprehensive information is desired so that students are able to choose the program that best suits them. Especially important is the way in which autonomous learning is managed, because it has become a relevant part of the learning process. New technologies are a very interesting means of helping to implement methodologies when the self-learning process is concerned [5], and they should also be defined in the universities' curricula. This student-centred learning will allow them to become more independent and lifelong learners [6], which will result in better professionals who are well-prepared to cope with the many changes that Society faces nowadays.

References

- [1] Trends V: Universities shaping the European Higher Education Area. D. Crosier, L. Puser and H. Smidt. 2007. European University Association
- [2] Effective teaching methods, Borich Gary D. 2009
- [3] Modalidades de enseñanza centradas en el desarrollo de competencias. Orientaciones para promover el cambio metodológico en el Espacio Europeo de Educación Superior. M. de Miguel Díaz. 2005. Universidad de Oviedo.
- [4] Implementation of new teaching methodologies. The case of Building Engineering at Jaume I University in Castellón, Spain. T.C. Gallego, M.J. Ruá, L. Reig, J.A. García-Esparza, A.M. Pitarch, P.M. Huedo. ICERI 2011
- [5] What technologies will shape the future of higher education. C. Osborne. 2012
- [6] Assessing autonomous learning in research methods courses: Implementing the student-driven research project. Vandiver D.M., Walsh J.A. 2010. Active Learning in Higher Education 11(1) 31–42.