

Influence of the implementation of the European Higher Education Area on Engineering and Architecture university teachers

Influencia de la implantación del Espacio Europeo de Educación Superior en el profesorado universitario de Ingeniería y Arquitectura



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ABSTRACT

- When Spain joined the European Higher Education Area (EHEA) it implied the reorganization of curricula and led to a new education model. Due to the controversies arising from this adaptation the objective of the study is to find out the satisfaction of teachers towards this process. Participants were made up of 1,842 Engineering and Architecture teachers from Spanish public universities. A survey was used which was formulated ad hoc and made up of questions about the level of satisfaction on different aspects of the EHEA. In total, 55% have found it easy to adapt to the EHEA. However, 46% thought that measures were not being implemented correctly and 48% doubted that the reform is positive for the university. The implementation limitations detected and the possible solutions can be used as a guide to establish effective education policies which can help to improve teaching and research quality.
- **Keywords:** Higher Education, satisfaction, teachers, Engineering and Architecture.

RESUMEN

La adhesión al Espacio Europeo de Educación Superior (EEES) implicó en España una reorganización de los planes de estudio y el impulso de un nuevo paradigma educativo. Esta adaptación genera grandes controversias, por ello, el objetivo del estudio fue conocer la satisfacción del profesorado hacia este proceso. Los participantes fueron 1.842 profesores de Ingeniería y Arquitectura de universidades públicas españolas. Se les aplicó una encuesta elaborada ad hoc formada por preguntas sobre el grado de satisfacción hacia diferentes aspectos del EEES. Al 55% le ha resultado fácil adaptarse al EEES. Sin embargo, el 46% piensa que la aplicación de las medidas no se está desarrollando de forma correcta. Asimismo, el 48% tiene dudas de que la reforma sea positiva para la universidad. Las limitaciones de la implantación detectadas y las posibles soluciones que se revelan sirven de guía para el establecimiento de políticas educativas eficaces que ayuden a mejorar la calidad de la docencia y la investigación.

Palabras clave: Educación Superior, satisfacción, profesorado, Ingeniería y Arquitectura.

1. INTRODUCTION

The European Higher Education Area (EHEA) was created so that member countries would contribute to a knowledge-based

economy and improve their competitiveness. Its implementation in Spain has led to a reorganization of university teaching and the creation of a new education model, in which the student takes on a more active role. Degrees will now have a duration of four years, during which students must pass 240 ECTS (European Credit Transfer System), except in special cases, such as Architecture. According to Royal Decree 1393/2007 [1], in studies training for professional activities, curricula should be adapted to European regulations and guarantee the necessary competences in order to exercise the profession (such competences are prescribed by law, what makes these degrees have a large part of their structure laid down by the guidelines of the competent Ministry). In 2015, the Council of Ministers (at the proposal of the Ministerio de Educación, Cultura y Deporte), approved the Royal Decree 43/2015 [2], according to which the duration of the degrees is established from the 180 credits ECTS (3 years) to 240 credits ECTS (4 years) or even more, depending on the recognition of their professional duties. In this regard, the Conference of Rectors of Spanish Universities (*Conferencia de Rectores de Universidades Españolas*, CRUE), approved an extension in order not to apply the plan for university flexibility until September 2017, which allows to offer three-year degrees instead of the current four-year ones [3].

Besides this, the European Research Area (ERA) has been created in order to promote R+D cooperation between member states to improve collaboration between researchers, academics, engineers and technicians [4]. De Filippo, García-Zorita, Lascurain-Sánchez, Marugán, and Sanz-Casado [5] detected an increase in research productivity and a tendency amongst Spanish universities to internalize research. In fact, according to Purnell and Quevedo-Blasco [6] the publication of articles by Spanish researchers in international journals has increased. Specifically, they strive to publish in journals with a high impact factor in order to have a professional career and academic recognition [7]. However, although there are parameters to measure research quality and classifiers of research articles [8], there is still no reliable automatic system that can guarantee it [9]. An example is the h-index, which according to Hirsch and Buela-Casal [10] complements other more subjective indicators. Because of this, the quality of doctoral training must be guaranteed, as well as the mobility of students and teachers, which has led to the publication of studies regarding these aspects [11, 12].

With the emergence of competence-based learning [13], students not only have to acquire knowledge but also skills, attitudes and values. Therefore, teaching innovation experiences have been

implemented which are directed, amongst others, towards Engineering and Architecture students, through which students take on the leading role in their own learning through fieldwork [14] or through Electronic Learning (e-learning), that is, distance learning using electronic means [15], Blended Learning (b-learning), a methodology that combines traditional classroom learning with distance learning using virtual communication methods [16] and Mobile Learning (m-learning), in which persons study a subject remotely using their mobile phone [17,18]. We must not forget that both knowledge and innovation have a marked relationship with Spanish university research [19].

Casquero, Portillo, Ovelar, Benito, and Romo [20] consider that teaching in virtual environments allows students to control their learning process. There are other studies regarding the use of the Information and Communication Technologies (ICTs) by teachers [21], the analysis of competences [22], learning methodologies [23, 24] and assessment techniques in which implementation costs for the teacher are analyzed [25].

In order to adapt degrees to the EHEA not only has the mobilization of university managers been necessary, but the process also implies the effort and motivation of teachers [26]. One of the problems of the process is that teachers have no reference of any previous model in order to develop their role in the EHEA context [27]. This has led to controversy, and therefore, the objective of the study is to find out the satisfaction of teachers with this process. Although there is already a study regarding the satisfaction of Engineering students [28] towards the EHEA, it is necessary to look at the teachers' point of view regarding the process in order to detect the strengths and weaknesses of degree adaptation in the Engineering and Architecture field.

2. MATERIALS AND METHOD

2.1. PARTICIPANTS

In this investigation participants were made up of 1,842 teachers from Spanish public universities teaching in the Engineering and Architecture field. In total, 74% were male and 26% female, 60% being official teachers, and the majority, university lecturers (39%). The average age of those surveyed was 45 ($SD = 9$), they had been teaching for an average of 17 years ($SD = 9$) and the majority had not carried out a research period (40%). The five universities with the highest participation of teachers were the *Universidad Politécnica de Cataluña* (14%), *Universidad Politécnica de Madrid* (11%), *Universidad de Sevilla* (5%), *Universidad de Castilla-La Mancha* (5%) and the *Universidad de Valladolid* (4%).

2.2. INSTRUMENTS

- *Survey Regarding the Satisfaction of University Teachers with EHEA Adaptation*, made up of 65 mixed questions (with Likert scale and multiple-choice questions and a final open-ended one) divided into seven sections and a final section for comments and/or suggestions. These sections contained questions regarding the personal and professional details of teachers, aspects related to the modifications introduced by the EHEA, tasks, training and teacher coordination, teaching methodology as well as center organization and resources. The Cronbach alpha coefficient was analyzed in order to measure the reliability of the survey and it was 0.8 (same or similar to the value obtained in other studies [29, 30]). All the questions of the questionnaire (except the final question for comments and suggestions) were mandatory response

and, therefore, all the items (from 1 to 64) had a response rate of 100%. The last open-ended question (n° 65) was answered by the 45.71% of the teachers.

- *Database to record the e-mail addresses of the teachers.*
- *IT program used to create and send the survey.* This is a computer tool that allows to create surveys in an electronic format, to be sent by email, and then to record the answers (anonymously) from the people who answer the survey (see further information about the application procedure in the section).

2.3. DESIGN AND PROCEDURE

It is a population-based, descriptive study using a cross-sectional survey with a probability sample. The sample was selected with a confidence level of 97 % and an estimation error of 3%. In order to measure the satisfaction of the Engineering and Architecture teachers with the implementation of the EHEA, a survey was formulated *ad hoc* (based on the literature/legislation analyzed) and evaluated using the judgment of experts, with experience in teaching and in the adaptation process of degrees to the EHEA (in order to verify the suitability of either the thematic blocks or the questions). After the evaluation and following the recommendations of the experts, some items of the questionnaire were reformulated, but the same number of questions from the initial version was maintained (because of their suitability). Once this was done, the questionnaire was applied to a sample of 15 teachers with the goal of verifying the drafting of the questions and possible difficulties to answer them. It was checked that everything was correct and that the application was working properly. Selected teachers were invited to participate in the survey using an IT program and they were able to reply individually and anonymously, as each person had their own personal code. The limitation found out is that some teachers did not want to respond to all the questions and therefore they left the questionnaire incomplete, so such records could not be taken into account for the research.

3. RESULTS

3.1. GENERAL AND INSTITUTIONAL ASPECTS

In general, the Engineering and Architecture teachers have found it easy to adapt to the EHEA (55%), but 23% found it difficult, because they were not prepared for the change. In total, 46% thought that the measures were not being implemented correctly and 44% considered that there is room for improvement. Likewise, 48% doubted that the reform is positive for Spanish universities, followed by those that did not believe that it will obtain good results (31%). Besides this, 44% would prefer to return to the old system compared to 40% who would not. Information regarding the effort made by Engineering and Architecture teachers in subject planning and the priority given to each of their functions (teaching, research and administration) can be seen in Table 1. It also shows the level of satisfaction towards degree structure, the credit and qualification system, the European Diploma Supplement, teaching accreditation as well as the level of improvement in the quality of Higher Education with the EHEA.

Regarding Degree length, 39% of teachers opted for four years, followed by five (29%) and three years (28%). The length they considered ideal for an official research Master is two years (52%). With regard to the information received on an institutional level in order to help adapt the subjects taught to the EHEA, 41% of teachers maintained that they had received enough, compared

	Not at all	Little	Moderately	Quite	Very
Planning	2.1	6.7	23.7	43.8	23.4
Teaching	1	.9	6.2	25.3	66.4
Research	1.7	4.6	16.1	31.2	46.2
Administration	19.8	29.4	36.5	10.2	3.8
Structure	21.8	27.2	28.5	19.4	2.8
ECTS	12.4	20.5	32.1	28	6.7
Qualifications	13.5	21.8	32	27.6	4.8
EDS	11.2	13.8	32.4	28.8	13.6
Accreditation	17.2	21.4	33.1	22.3	5.8
Quality	26.7	32.3	26.3	13.1	1.3

Note. ECTS= European Credit Transfer System; EDS= European Diploma Supplement

Table 1: Percentage of Engineering and Architecture teachers according to their level of satisfaction towards aspects related to the EHEA

to 31% that had received little. Likewise, 57% stated that collaboration plans for EHEA adaptation had been implemented. The limitations noted by teachers can be seen in Appendix 1 (See supplementary material at the end of the paper).

3.2. TEACHING, RESEARCH AND ADMINISTRATION

In total, 50% of the group analyzed said that their lesson planning was quite well adjusted to the EHEA, followed by those who stated that it was moderately adjusted (22%) and very well adjusted (21%). Currently, teachers need more time to prepare classes (52%) than they did before the EHEA and 32% declared that they take more or less the same time. The level of effort needed to carry out teaching related tasks can be seen in Table 2.

In total, 58% of the teachers had a positive attitude towards the ERA, compared to 32% who had a negative vision. Besides, 46% would prefer to be able to dedicate more time to research, in accordance with the criteria set out by the Spanish National Agency for Quality Assessment and Accreditation (Agencia Nacional de Evaluación de la Calidad y Acreditación, ANECA) to evalu-

ate scientific production, while 26% stated that they dedicate the same time to this task now as before the implementation of the EHEA. Regarding doctoral studies, 32% of teachers affirmed that they prefer the new structure (divided into a training period through a research Master and another period to carry out the doctoral thesis), compared to 27% who opted for the traditional Doctorate Programs, which had a teaching period and another one for research, being necessary a Research Competence diploma or an Advanced Studies Diploma (Diploma de Estudios Avanzados, DEA) in order to carry out the thesis. However, 19% said they did not have enough information in order to comment on the structure they consider appropriate.

With regard to the thesis format that they feel is more appropriate, 56% preferred the traditional format, while 31% preferred the collection of published scientific articles. In total, 49% of teachers thought that it is viable to carry out the thesis in three years depending on the field and 25 % believed that it is possible in all fields. However, 67% stated that there would not be an improvement in quality with the new doctoral studies (comprised of

	Not at all	Little	Moderately	Quite	Very
Acting as mediator	5.2	15.9	34.3	32.3	12.1
Theory classes	4.6	17.2	36.9	28.2	12.9
Practical classes	3.1	10.4	28.3	34.7	23.2
Seminars	8.7	15.5	34.9	28.7	11.8
Student supervision	4.8	14.3	28.2	31.9	20.5
Tutorials	6.3	20.2	35	24.7	13.7
Student assessment	3	8.1	23.6	31.9	33.2
Teaching coordination	3.9	10.6	30.7	31.6	23

Table 2: Percentage of Engineering and Architecture teachers according to the level of effort required for teaching functions

	Not at all	Little	Moderately	Quite	Very
Skills	1.7	7.9	28.1	44.6	17.4
Motivation	21.2	41.8	29.9	6.4	.4
Tutorials	7.7	60.2	22.1	8.2	1.6

Table 3: Percentage of Engineering and Architecture teachers according to the level of skill development, motivation and use of tutorials by students

a Master and the Doctoral Thesis). Likewise, 33% were indifferent to the creation of Doctoral Schools. Moreover, 57% would like to be able to dedicate more time to administration. The limitations noted by teachers in this section (regarding teaching and research) can be seen in Appendix 2 (See supplementary material at the end of the paper).

3.3. METHODOLOGY AND THE TEACHING AND LEARNING PROCESS

In total, 56% of teachers were in agreement with acting as a guide/mediator with their students, compared to 25% that were not. In fact, 55% of teachers stated that they were in favor of encouraging the active role of students. During classes 37% of Engineering and Architecture teachers declared that they would continue to offer master sessions. According to 50% of the teachers this methodology will not necessarily lead to an increase in teaching quality, although 36% thought that it will improve. In Table 3, it can be observed that approximately 45% of teachers stated that they develop their student's skills quite well, although student motivation to adopt an active role in class is low (42%) and besides, they do not go to tutorials very frequently (60%). With regard to doctoral training, 53% of teachers doubted that the current doctoral system guarantees the acquisition of skills by doctoral students, compared to 20% that believed that it does. Furthermore, 80% declared that they use ICTs (Information and Communication Technologies) on a regular basis in their classes. The requirements detected by teachers regarding methodology and the teaching and learning process can be observed in Appendix 3 (See supplementary material at the end of the paper).

3.4. EVALUATION

In total, 52% of Engineering and Architecture teachers found it easy to evaluate students' skills and 44% found it difficult. Furthermore, 63% declared that they carry out a continuous assessment in theory work and 85% in practical work, the rest of the teachers do it after finishing the subject. Besides, 36% showed a moderate satisfaction towards students' academic results, followed by 32% that felt quite satisfied and finally 20% indicated that they are not very satisfied with these results. If the results are compared with those from the previous system (three years to obtain a Diploma and five years to obtain a Degree [Licenciatura]), 36% of the teachers considered that they are practically the same, although 34% thought that grades were better before.

3.5. TRAINING

Of all the Engineering and Architecture teachers, 54% had adequate training in order to give classes in the EHEA context, although 39% acknowledged that it could be improved. Furthermore, 70% maintained that their university provides them with the necessary means to improve their training. Besides this, 95% defended lifelong learning and 45% of the teachers wanted to make use of the benefits of mobility by carrying out a stay abroad, compared to 35% that did not want to. The problems

found in teacher and student training can be seen in Appendix 4 (See supplementary material at the end of the paper).

3.6. COORDINATION, STUDENT ORGANIZATION AND RESOURCES

The coordination results are very balanced: 50% of the teachers stated that they maintain a high level of coordination with the rest of their department, while 46% said that they maintain little. In total, 65% declared that the ratio of students in the classroom has not been reduced in their center while 28% reported that it is being applied. With regard to the human resources observed by teachers in their center, 28% affirmed that there are enough, followed by those that thought there are some or little (26%). Regarding economic resources, the majority of teachers received very little (approximately 44%). Concerning materials and infrastructure, approximately 30% declared that there are some or little (see Table 4). The limitations observed by teachers concerning these aspects can also be seen in Appendix 5 (See supplementary material at the end of the paper).

4. DISCUSSION

In general, it has been easy for Engineering and Architecture teachers to adapt to the change, and although they expressed the difficulty they had faced in adapting their particular subject, half of the sample teachers stated that their teaching was quite well adjusted to the EHEA. Regarding satisfaction with degree structure (see e.g., [31]), there are very little differences between those that were moderately satisfied, and those that were moderately dissatisfied. Almost 40% opted for a four year degree length, although around 30% preferred a length of three or five years. In research Masters they chose a duration of two academic years. This duration fits within the stipulated for Master studies in the EHEA, as in Europe Master studies of less than 90 ECTS are not recognized and it is recommended that they are 120 [32].

With regard to doctoral training, the majority of Engineering and Architecture teachers considered that the new Postgraduate is more appropriate, but they are indifferent towards Doctoral Schools, probably due to a lack of awareness of their functions. Like the teachers from the study of Quevedo-Blasco and Buela-Casal [33] and the Science and Social/Legal teachers [29, 30], in the Engineering and Architecture field the doctoral thesis in its classic format is preferred. In fact, the majority did not consider it ideal for doctoral students to have publications before they defend their thesis (see [34]). Besides this, the Engineering and Architecture teachers thought it was viable to carry out the thesis in a period of three years depending on the area researched, despite the fact that, in the case of the Engineering thesis, the average duration is 5.5 years [35]. However, the Engineering and Architecture teachers did not believe that the new organization would necessarily imply an improvement in thesis quality and they doubted that the acquisition of skills by doctoral students is guaranteed.

Like the science teachers, the majority of Engineering and Architecture teachers would return to the traditional system [29].

	None	Little	Some	Quite a lot	A lot
Human	8	26	26	28	11.9
Economic	22.1	44.3	24.1	7.8	1.6
Materials/Infrastructure	10.3	30.1	30.2	24.5	4.7

Table 4: Percentage of Engineering and Architecture university teachers according to the human, economic and material/infrastructure resources received in their centre

Besides, they considered that it would have little effect on the quality of Higher Education, although the results are very even between those that thought it would not improve and those that believed that it would do so moderately. Teaching is the task with most priority for these teachers, more so than research and administration. However, the majority needs more time to prepare classes since the introduction of the EHEA and would like to be able to dedicate more time to research and less to administration.

Most of the group were in favor of the teaching and learning methodology in which the teacher acts as a guide/mediator and the student takes on a more active role, although to a lesser extent than the Social/Legal and Health and teachers [30, 36]. Nevertheless, there are teachers stated that master sessions would predominate in their classrooms. Likewise, 50% considered that this methodology would not improve learning quality, just like the Science teachers [29]

It is positive that almost all teachers defended lifelong learning, as they should serve as a role model for students and provide learning experiences that encourage students to continue learning throughout their lives [37]. However, 35% declared that they would not carry out a stay abroad, despite the fact that it is a quality indicator in the evaluation of university teachers. This could be due to reasons of compatibility with their work (as demonstrated in the open question), or a lack of financing. Although there was a gradual increase in the mobility of Spanish Teaching and Research Staff in the decade 1999-2009 [38], there are mobility differences between the EHEA countries, being a lot higher in Northern and Central European countries than the Mediterranean ones [12].

Concerning coordination, at least, the teachers maintained that there is a high level with the other members of their department, just like the Science teachers [29], although there is a large non-coordinated proportion. The teachers observed very few economic resources, and on the other hand, the majority perceived quite a lot of human resources, although with little differences between those that informed that there were few. Nor did the teachers think that there are enough material resources, an aspect that they emphasized in the open question. According to the latest data of the 2015 report "La Universidad Española en cifras-2013-14" of the Conference of Rectors of Spanish Universities-CRUE [39], the state spending on University has dropped back to figures of 2006 (representing a decrease of 11,8%). In this report, it is literally stated that "In Spain, the spending on I + D had dropped back in 2013 below the level corresponding to 2007" [39] p. 86). Besides, in recent years the number of students enrolled in this field has declined significantly [40].

Finally, some of the recommendations proposed by the Engineering and Architecture teachers in order to improve the development of the EHEA are: a) Carry out collaboration agreements with companies so that students can appreciate if degree contents adapt to work demands; b) Introduce an access exam for each specific degree so that the students that pass it are those with a high enough level to carry out their studies in the scheduled time; c) Before creating the degree offer it is necessary to discover the possible job prospects for graduates and the demand believed necessary on a national and international level; d) Control the work done by university teachers (absenteeism, little or no research, etc.), e) Improve teaching method training for university teachers and teacher training programs regarding EHEA matters should be compulsory, even for senior university teaching staff; f) Demand that universities present strategic teaching plans and promote their specialization in order to better use human and material resources; and g) In doctoral studies research transfer should

be valued more, and not only JCR publications, so that doctoral students have more opportunities to join companies, given that universities cannot currently accept them.

5. CONCLUSIONS

In this study the satisfaction of Engineering and Architecture teachers from Spanish public universities towards the EHEA has been evaluated. In all of these fields there is very little difference between those that thought the process could be improved and those that did not think the process is being developed correctly. The majority of Engineering and Architecture teachers believed that EHEA adaptation could be improved and that the changes would not be positive for the university.

Teachers stated that they are not qualified to teach in the EHEA and that they would need to receive further training. Accordingly, they have received quite a lot of institutional information regarding the process, there are collaboration plans with teaching staff and they are receiving the necessary means to improve. However, as detected in the open question, maybe the courses offered are not very useful and on occasion assistance is difficult, so it may call into question the quality of the training offered to university teachers.

In conclusion, it can be established that the Engineering and Architecture teachers are not completely satisfied with the way in which the EHEA adaptation has been carried out, although the limitations and possible solutions revealed could be used as a guide when establishing effective education policies to help in improving teaching and research quality, as well as enabling EHEA and ERA consolidation.

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SUPPLEMENTARY MATERIAL

http://www.revistadyna.com/documentos/pdfs/_adic/8045-1.pdf

