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Impact of the Economic Crisis and the Implementation of the EHEA on the Bachelor's Degree in Building in Spain*

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After five years since the introduction of the European Higher Education Area (EHEA) in Spain, it is time to examine its achievements. This study focuses on technical architectural studies and its transformation into a Bachelor's degree in Building. The analysis takes into account key issues such as the reduction in the number of new students due to the crisis in the Spanish construction sector that started in 2008. This paper presents a study of the impact of the Bologna Process on the abovementioned bachelor's degree programme from the point of view of the first-year subject of Descriptive Geometry. The methodology is based on time series analysis and correlation parameters of data collected between 2005 and 2014. The results, on one hand, show high correlations (0.94–0.98) between the decrease in the number of students enrolled and some construction sector economic variables, such as construction employment. However, according to surveys, the vocations are still the main reason of career choice. On the other hand, they also show that the four-month period division of the subject established in the new bachelor programme has improved students' academic performance. This is clearly shown in the range of students with marks over 7 out of 10. In conclusion, the Bologna Process has led to an improvement in the academic performance of first-year students and the development of highly motivated and engaged learners in the new Bachelor's degree in Building programme. In contrast, it is shown that the implementation of the EHEA will not reduce the number of years spent by students in their studies nor decrease the rate of students who drop out.

Keywords: construction sector; higher education; career choice; descriptive geometry; academic performance

1. Introduction

Since the introduction five years ago of the European Higher Education Area, hereinafter EHEA, in undergraduate studies at the School of Building in Madrid (Spain), it is now time to analyse the balance between the objectives proposed by the Bologna Process and the outcome of its implementation in Spain. The economic crisis, mainly in the construction sector, and the reduction of spending levels for education of families [1] have influenced the number of new students in the bachelor's degree in Building and it must be taken into account.

Although the number of university students has increased in Europe, the USA and Japan from 2003 (Fig. 1 top), the percentage of students enrolling in engineering, manufacturing and construction areas at universities is similar each year, except Japan with a negative trend (Fig. 1 bottom). This situation is too readily attributed to a general disaffection caused by the image that younger generations have of these studies: they are seen as being the most "difficult". This explanation is true but not sufficient. Over and above the similarities that can be seen between European countries, profound differences continue to exist, resulting in apparently similar effects but with very different causes. Not only do higher education structures taken as a whole remain very different despite the Bologna Process, but more fundamentally, the very meaning of the higher education system within each national society, its relationship with employment, and its position in individuals' personal career paths all vary [2].

The Bologna Process is the most important recent development in higher education policy at the European level. The obvious success of attempts to create an EHEA has increased interest on the other side of the Atlantic Ocean [3]. The convergence process to this new university model has brought a substantial change based on conceptual issues and resulting in a university model based on continuing education [4]. The main change has consisted in adapting all curricula to meet market demands according to the opinions of stakeholders, i.e. businesses, former students and government [5].

The main objective of this paper is to analyse the impact of this change in the curricula through a

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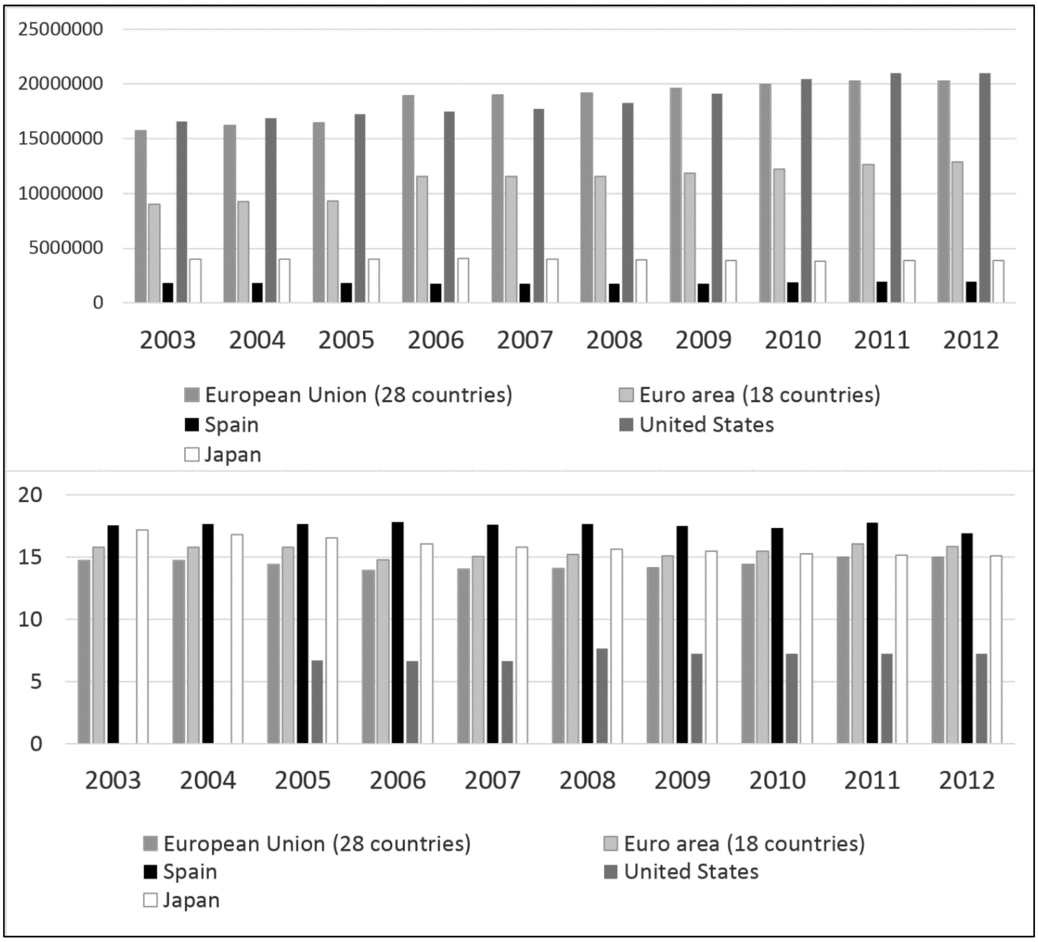

Fig. 1. Annual Data 2003–2012: Top, university students in first cycle (bachelor) and first and second cycle (bachelor's + masters); Bottom, percentage of university students in engineering, manufacturing, and construction. Source: Eurostat.

comparative analysis from 2002–03 to 2013–14 academic courses. In doing so, the academic results of students enrolled in the subject of Descriptive Geometry of the first year of the Bachelor's degree in Building in the Polytechnic University of Madrid (UPM) have been analysed and compared. Previous studies have been carried out in other Spanish bachelor programmes (Pedagogy) [4]. In that study, the participants' experience of the EHEA is based on the analysis of academic qualifications and assessment of teaching. As a conclusion, these researchers have been found that there are no statistically significant differences between the scores of students from the traditional system and those obtained by participating in EHEA experiences. Student satisfaction is one of the result indicators established, based on student opinion, to measure the quality of the Spanish university system [6, 7]. In contrast, there is little documentation on studies of the influence of this new teaching model on the Spanish technical bachelor's degree. To date, this kind of degree has had a practical and participative teaching methodology, and therefore adoption of the Bologna Process should not be a big change. The study carried out by Castaño et al. [8] on the Bachelors of Technical Architect, Architect and Fine Arts brings out positive results on the methodology of the Bologna Process. All data in this last study are taken from satisfaction surveys of the academic year 2005/06, but the bibliography is almost nonexistent in terms of comparative performance in these technical bachelors. Engineers have always had to deal with technological change, but now there is a different change, a change of role. The job they do has broadened significantly in scope and engineering education must change in response [9].

In the first decade of the 21st century, up to 2008 to be precise, Spain was characterized by strong economic growth, accompanied by a significant increase in employment rates [10]. From that year on, the European economic recession abruptly ended growth and caused an impressive destruction of jobs in Spain. The economic outlook of the construction sector, the most affected by the economic crisis since 2008, has influenced high school students when choosing a bachelor's programme.

This fact has meant a decrease in the number of new student enrolment, which has led to unfilled spaces and consequently to lower pre-university cut-off marks. It is necessary to analyse whether there is a direct relationship between university entry marks and academic performance of these university students to evaluate the implementation of the Bologna Process. Thus, this study considers how the implementation of the Bologna Process has affected academic performance within a scenario of a decreasing number of new enrolling students by economic crisis.

1.1 The crisis in the construction sector and the choice of a university bachelor's programme

Construction output in the EU-28 peaked in February 2008, after which substantial falls in activity were recorded, reaching a low in February 2010, two years after the initial downturn. During the period 2007–13, construction output declined by more than one-fifth in half of the EU Member States, while there were only four Member States—Finland, Malta, Germany and Poland—where there was an increase in activity according to EUROSTAT data.

In Spain some other local problems arose such as the end of the so-called housing bubble, the banking crisis, and the increase in unemployment [10]. According Adiego and Ayala [11], one of the crucial factors for changes in the labour market has been the fall in the wage premium of graduated workers. The crisis has deeply affected the Spanish construction sector, especially its Gross Domestic Product (GDP) at market price, which has been reduced by almost half in the last six years (Fig 2a). Labour shedding has also been seriously affected in this sector. Regrettably, it has maintained its annual average in negative values far below the figures of all Spanish productive sectors (Fig. 2b).

The decrease of employment in the Spanish construction sector GDP is also associated with lower housing construction in Spain. In fact, building permits have been reduced from 187,147 in 2007 to only 28,956 in 2012, which is a reduction of almost 85%. The community of Madrid had a very similar scenario evolving from 634,098 residential building licences in 2007 to 57,543 in 2012. Those values represent a reduction of 91%, representing 6% higher than the Spanish overall value according to the Spanish Statistical Office.

This is the real approach that high school students and their families have when it comes to choosing a university bachelor's programme. Access to information, resources and opportunities about engineering are critical to students' decisions to enter undergraduate studies in the field [12]. Employment prospects in a given sector or another are a determining factor in their choice. According to the surveys conducted in a study by Salas [13], the main reason given for taking university studies lies in the fact that as graduates they hope to get more employment opportunities. On the other hand, the reduction in the purchasing power of Spanish families has affected their children's higher education investment, though to a lesser extent than expected due to reductions in some other family costs [1]. This could justify the fact that the number of university students in Spain has not decreased in recent years. In fact, according to the Spanish Statistical Office there has been an increase in nearly 170,000 university students in the period between 2008 and 2011, following the European trend as well as in the USA and Japan (see Fig. 1 top). The latter would also indicate that in regard to new bachelor's degrees we must add a significant increase in enrolment of the traditional bachelor's degree. Fig. 1 bottom shows a steady trend at around 17.7% in the percentage of university students in the field of engineering, manufacturing, and construction is similar to European and USA

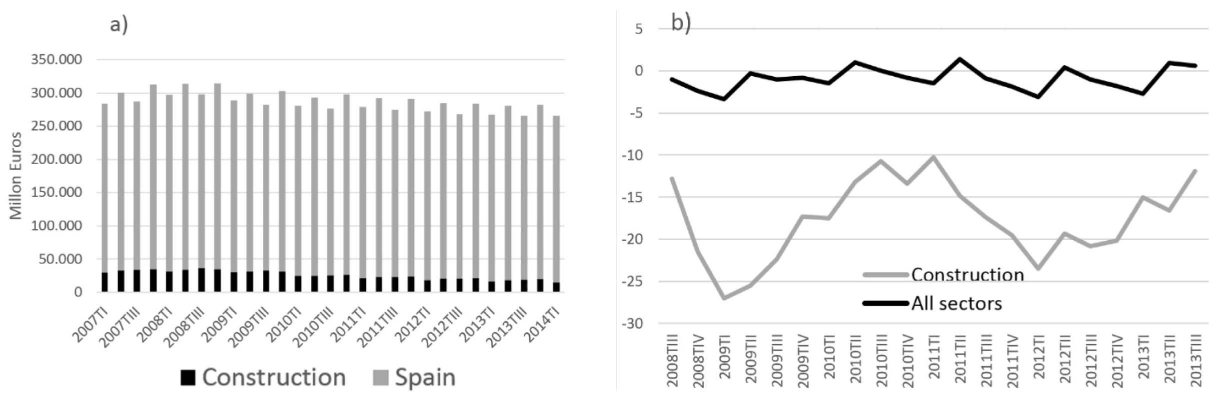

Fig. 2. (a) Quarterly Gross Domestic Product at market prices in Spain and in the Spanish construction sector; (b) Annual change (quarterly raw data) of employment in "construction industry" and in "all sectors" during 2008–2013 in Spain. Source: Spanish Statistical Office.

values. If we take for granted studies that confirm a decline in the number of construction students because of the crisis, and in knowing that the total count has remained unchanged, then we must infer that the rest of the bachelor programmes in this field have absorbed this decrease of students.

Finally, it should be mentioned a notable increase in first-cycle students (bachelor) with an increase in the number of low-income families according to the Spanish Statistical Office. In fact, there is a significant relationship between family income and type of studies in which low incomes are more associated with short-cycle studies [14].

1.2 The EHEA and academic performance in the technical bachelor's degree

As previously mentioned, the start of the global economic crisis coincided with the implementation of EHEA for the 2008–09 and 2009–10 academic courses. The EHEA has meant to European universities a big change in terms of education structures and organization. For this purpose, the Spanish university system has assumed the need for deep reform based on three cycles: bachelor, master, and doctorate [15].

Teaching practice has undergone changes related to planning, teaching and evaluation. Likewise, teachers have been required to make a readjustment of their practices, knowledge, and beliefs to comply with those new learning environments [16].

The EHEA places the student at the centre of the teaching-learning process. This change of educational paradigm represents a methodological change that enhances the active role, initiative, and critical thinking of students. There is thus a need for counting on the point of view of the student as an actor involved in higher education [17].

The implementation of the EHEA to the Spanish university system proposes procedural improvements aimed at higher academic performance and graduation in the expected period. This last aspect has become one of the greatest obstacles in the Spanish technical bachelor's degree. According to a report from the University Coordination Council, before the introduction of the Bologna Process the average completion rate for Technical Architecture studies was 6.4 years. It should be noted that this was a short-cycle bachelor programme (3 years). The abovementioned figures are the result of the average of 16 out of the 27 centres where the Bachelors of Technical Architecture was offered in Spain (Table 1).

To do this, on the one hand subjects have been designed considering predefined learning objectives [18]. On the other hand, results of students' final evaluations rely not only on exams, but also on the work done by students throughout the academic year. This student-oriented university and its learning has facilitated new forms of study [19].

1.3 The EHEA bachelor in technical architect at Bologna

The current Bachelor's degree in Building has inherited a long tradition of different professionals in the area of construction. From the old "Master Builder" through various formal qualifications, such as Quantity Surveyor, Technical Architect in Execution of Building Works, and Technical Architect, the profession has always had in Spain a wide and recognized acceptance by both other construction professionals and the rest of society. That acceptance at a national level has not always been recognized in the international fora, making the work of our professionals abroad very complicated. In most cases and depending on the requirements of every country, this fact has forced them to take conversion courses to win recognition of their titles.

The European convergence process has become a great opportunity to achieve this recognition of diplomas and, in turn, is helping to renew some

Table 1. Average completion rate for the Bachelors of Technical Architecture in 16 Spanish universities*

University	**Average (years)**	**University**	**Average (years)**
La Coruña	7.0	Granada	6.8
Alcalá	4.1	La Laguna	7.7
Alfonso X el Sabio	4.4	Navarra	4.3
Alicante	6.0	Politécnica de Cataluña	6.1
Burgos	7.3	Politécnica de Madrid	6.5
Castilla la Mancha	5.2	Politécnica de Valencia	6.4
Extremadura	5.5	Salamanca	4.6
Gerona	6.3	Sevilla	6.8
TOTAL AVERAGE FOR TECHNICAL ARCHITECT (in years)			**6.4**

* NOTE. No data from the following universities: Camilo José Cela, Catholic San Antonio, European Miguel de Cervantes, Illes Balears, Basque Country, Cartagena Polytechnic, Pompeu Fabra, Ramon Llull, SEK, San Pablo CEU, and Zaragoza. Source: University Coordination Council.

outdated educational systems far from the real needs of the professional environment. New bachelor's degrees have proved adequate to European requirements without forgetting the traditional skills of the Spanish Technical Architect. In addition, academic training aspects have been enriched by new construction sector sensitivities such as those related to environmental issues and energy saving.

Both the former bachelor's degree and the new one remain as a four-year bachelor. The difference between them is the number of hours needed to complete them. The former Bachelor's in Technical Architect was obtained once completed and passed the 270 old credits[1] established in the curriculum. However, the new bachelor's degree entitles students to practise the profession of Technical Architect once they have passed 240 ECTS.[2]

1.4 Teaching plan of the descriptive geometry subject at the Polytechnic University of Madrid (UPM) during the period 2002–14

The subject of Descriptive Geometry is shown in this research as a clear example in the restructuring process following the establishment of the EHEA. In the case of the Polytechnic University of Madrid (UPM), the early annual subject Descriptive Geometry with 12 credits has been replaced by two quarterly subjects: Descriptive Geometry I and Descriptive Geometry II, with 6 and 3 ECTS respectively. In the new subjects, attempts have been made to keep the training objectives, such as general and specific skills. For this, the programme content has been split depending on the requirements of the new subjects, but unlike other European countries in which the only activity of the teaching-learning process lies still in the classroom, more importance to students' effort, both personal and in-group tasks, has been given [20].

Traditional working methods have been strengthened with a gradual implementation of information and communication technologies focused on learning and assessment activities. The latter has also been supported by web applications of the virtual education sector. Similarly, old practice manuals have been reviewed, transforming them into publications adapted to the new reality of the subject and thus adapted to be taught within the Bologna Process.

[1] One credit = 10 teaching hours. RD. 1497/1987 of 27 November Art. 2.7. Whereas established general guidelines of common curricula of official degrees are valid throughout the national territory (Updated by Royal Decree 1267/1994, 2347/1996, 614/1997 and 779/1998).

[2] The new ECTS system is regulated by Royal Decree 1125/2003 (BOE of 18/09/2003), establishing the European credit system and the grading system is set to the degrees of official and valid throughout the country. Under this system, the minimum number of hours per credit is 25, and the maximum number is 30.

2. Data and methodology

Since the initial implementation of the EHEA, many models have studied the relationship between different variables to explain students' academic performance [21–23]. After a thorough analysis of the situation, two groups of variables have been identified in the present study: "Crisis" and "Studies". Both variables have become the basis for the development of this research. The variables called "Crisis" have been selected within the indicators for the construction sector. The so-called "Studies" variables are directly related to the Bachelor's degree in Building. The time series from 2005 to 2013 have been obtained from both variables, although in some cases not all values were available and those available had a different frequency. In these latter cases, quarterly data have been transformed into annual (Table 2).

The "Crisis" variables consist of values that have been found to reflect the crisis in the construction sector. Some other parameters have also been studied in order to compare those variables to overall performance, i.e. Spanish GDP. In those cases where the variable has a national or a regional expression, the two of them have been taken in order to check the influence of spatial proximity based on the territory of Madrid. The total number of analysed variables was 18. 4 out of the total 18 are directly related to employment in construction (both in Madrid and Spain). 6 out of the 18 are related to building and construction visas and permits and five related to the building business. Finally, 2 out of 18 are related to the GDP.

On the other hand, the "Studies" variables consist of values related to academic and registration data such as: new registered students, students enrolled in Descriptive Geometry, academic performance, admission marks and finally, the outcome of a survey conducted in the academic year 2013–14 on the reasons for enrolment in the Bachelor's degree in Building.

The analysis has been divided into two main parts: the influence of the crisis and the implementation of the new curriculum in academic performance. In the first part, the study of the influence of the construction crisis has been made according to the Pearson product-moment correlation coefficient (Equation 1) between both variables "Crisis" and "Studies":

$$r = \frac{S_{xy}}{S_x S_y} = \frac{\sum_{i=1}^{n}(x_i - \bar{x}) \cdot (y_i - \bar{y})}{\sqrt{\sum_{i=1}^{n}(x_i - \bar{x})^2}\sqrt{\sum_{i=1}^{n}(y_i - \bar{y})^2} \quad (1)$$

In the second part, the study on academic performance has been supported by the analysis of data

Table 2. Description of variables "Crisis" and "Studies"

Category	Units	Period	Description and Source
		Crisis Variables	
Madrid Construction Employment	Thousands	2005–2013	Employment in thousands in Madrid in the construction sector. Quarterly data. Source: INE.
Spain Construction Employment	Thousands	2005–2013	Employment in thousands in Spain in the construction sector. Quarterly data. Source: INE.
Madrid Employment	Thousands	2008–2013	Employment in thousands in Madrid. Quarterly data. Source: INE.
Spain Employment	Thousands	2005–2013	Employment in thousands in Spain. Quarterly data. Source: INE.
Spain Building permits	Unity	2008–2013	Total number of building permits in Spain. Annual data. Source: INE.
Madrid Local Licensing Buildings	Unity	2005–2012	Local building licences for buildings in Madrid. Annual data. Source: Ministerio de Fomento.
Madrid Local Licensing New Buildings	Unity	2005–2012	Local building licences for new buildings in Madrid. Annual data. Source: Ministry of Development.
Madrid New Approved Work	Unity	2005–2012	Number of work construction permits in Madrid. Annual data. Source: Ministry of Development.
Madrid Total Number of New Visas	Unity	2007–2012	Total number of new visas in Madrid. Annual data. Source: Ministry of Development.
Spain Total Number of New Visas	Unity	2007–2012	Total number of new visas in Spain. Annual data. Source: Ministry of Development.
Madrid Turnover	Thousands	2005–2011	Turnover in the construction industry in Madrid counted as thousands of Euros. Annual data. Source: Ministry of Development.
Spain Turnover	Thousands	2005–2011	Turnover in the construction industry in Spain counted as thousands of Euros. Annual data. Source: Ministry of Development.
Madrid Salaries Construction	Thousands	2005–2011	Salaries in the construction industry in thousands of Euros in the community of Madrid. Annual data. Source Ministry of Development
Spain Salaries Construction	Thousands	2005–2011	Salaries in the construction industry in thousands of Euros in the community of Spain. Annual data. Source: Ministry of Development.
Spain Number of Construction Companies	Thousands	2005–2011	Number of companies in the construction industry in Spain. Annual data. Source: Ministry of Development.
Spain GDP	Millions	2005–2013	Spain Gross Domestic Product at market prices. Offer. Annual data. Source: Datosmacro.com.
Madrid GDP	Millions	2005–2013	Madrid Gross Domestic Product at market prices. Offer. Annual data. Source: Datosmacro.com.
Spain Infrastructure Budget	Millions	2005–2013	Spanish general state budget dedicated to infrastructure. Annual data. Source: El Mundo Digital.
		Studies Variables	
Number of DG Students	Unity	2005–2013	Number of students enrolled in the subject Descriptive Geometry 2005–2013 the old Plan. Annual data. Source UPM.
Number of Incoming Students	Unity	2005–2013	Number of new students in studies of Technical Architecture and Building 2005–2013. Annual data. Source: UPM
Cut-off Mark for Entrance Exams	Unity	2005–2013	Minimum mark enrolment 2005–2013. Annual data. Source: UPM.
Performance DG	%	2005–2013	Academic performance obtained as the percentage of number of above 7-point mark regarding the number of students enrolled in Descriptive Geometry (DG).

collected on grades in the 2005 to 2013 period in addition to the analysis of survey data already mentioned.

3. Influence of economic crisis in the bachelor's degree in building

A fall in the number of new students should be the main indicator of how the economic crisis has affected the construction sector. However, as noted earlier, the number of university students has grown during the crisis and also remained stable, at least in the field of engineering, industry, and construction (Fig. 1 bottom). This fact indicates that there has been a balance between the decrease in the number of students in some bachelor's degree programmes and an increase in others of the same branch of activity.

The correlation between the variables "Crisis" and "Studies" offers us the extent to which this relationship is dependent. In addition, it was considered useful in order to look more closely into the reasons for that drop to run a survey to ask the students why they chose the bachelor's degree in Building.

3.1 Correlation between the crisis of the construction sector and the number of enrolments

Enrolment in the former Bachelor of Technical Architecture and the new bachelor's degree in Building have decreased from 603 to 357 students over the 2005–06 to 2012–13 academic years. That makes a dramatic 41% drop (Table 3). Likewise, enrolment in Descriptive Geometry, a first-year course subject, has also been even more affected; over 54% drop in the same period. This is due to the high number of repeaters coming from the old bachelor's degree, amounting to up to 40% of the enrolment value (1007 students enrolled with only 603 new students). This is considered a starting value and therefore higher than the number of new registered students.

Crosses with the "Crisis" variables leave very high correlation values between the "Number of Incoming Students" and job-related variables. Especially high are those related to "Madrid Construction Employment", with values of 0.97 or "Spain Construction Employment", with values of 0.95 (Table 4). Similar values are obtained for the variable "Number of DG Students", with values of 0.97 and 0.94. The correlation value decreases to 0.72 if "Spain employment" is taken into account because the decrease of all-sector employment has not been as drastic as in the construction sector. The parameters related to local licensing, work and visas also provide high values near to 0.9 for "Number of Incoming Students" and up to 0.96 for enrolment in the subject ("Number of DG Students"). This only indicates that the fall of licences and visas is more pronounced than employment and therefore it has a higher correlation with enrolment in the subject which has also had had a very pronounced decrease. Sector salaries ("Madrid Salaries Construction" and "Spain Salaries Construction") show significant values above 0.9 too with "Number of Incoming Students" and therefore a high correlation between series. On the contrary, correlations with GDP provide negative values because their numbers have been growing from 2008. Infrastructure investments ("Spain Infrastructure Budget "), turnover ("Madrid Turnover" and "Spain Turnover") or the number of companies in the construction sector ("Spain Number of Construction Companies") despite offering values between 0.48–0.75 do not provide a clear relationship.

Regarding the variable "Cut-off Mark for Entrance Exams", there is not a value below 5 thus making the series stagnate at a minimum (see 2010–11 and 2012–13 in Table 3). In addition, the top mark changed in the year of entry of the new pre-university exam in 2011, where the maximum score rose to 14 points, and this 5-point rise mildly but falls back to this minimum the following year. It could be said that considering this modification of the pre-university maximum mark exam that the mark has been in continuous decline. The study of their relationship along with the crisis is largely reflected in variables of employment, with the max-

Table 3. Annual time series values of the "Studies" variables

Academic Year	DG	DGI	DGII	Number of DG Students	Number of Incoming Students	Pre-University Cut-off Marks
2005–2006	1007			1007	603	6.10
2006–2007	997			997	568	6.06
2007–2008	933			933	556	6.01
2008–2009	802			802	519	5.78
2009–2010	248	450	410	698	455	5.84
2010–2011	64	634	460	698	412	5.00
2011–2012	28	658	447	686	319	5.63
2012–2013	6	554	377	560	357	5.00

Table 4. Correlation coefficients between annual time series variables "Crisis" and "Studies"

	Number of DG Students	Number of Incoming Students	Cut-off Mark for Entrance Exams
Madrid Construction Employment	**0.97****	**0.97****	0.89**
Spain Construction Employment	**0.94****	**0.95****	0.87**
Madrid Employment	**0.94****	**0.91****	0.73**
Spain Employment	0.72*	0.77**	0.79**
Spain Building Permits	0.92**	0.89**	0.72*
Madrid Local Licensing of Buildings	**0.97****	**0.90****	0.78**
Madrid Local Licensing of New Buildings	**0.96****	**0.89****	0.78**
Madrid New Approved Work	**0.96****	0.88**	0.76**
Madrid Total Number of New Visas	**0.98****	0.87**	0.69*
Spain Total Number of New Visas	**0.98****	0.88**	0.69**
Madrid Turnover	0.52	0.75*	0.70*
Spain Turnover	0.48	0.75*	0.56
Madrid Salaries Construction	0.82**	**0.92****	0.79**
Spain Salaries Construction	0.80**	**0.91****	0.67*
Spain Number of Construction Companies	0.76**	0.84**	0.58*
Madrid GDP	**–0.66**	**–0.57**	**–0.37**
Spain GDP	**–0.56**	**–0.47**	**–0.31**
Spain Infrastructure Budget	0.49	0.60	0.55
Number of DG Students	1.00		
Number of Incoming Students	**0.91****	1.00	
Cut-off Mark for Entrance Exams	0.83**	0.76**	1.00

* $p< 0.05$, ** $p< 0.01$ (1-tailed).

imum value of 0.89 for "Madrid Construction Employment" or with "Local Licensing of Buildings".

3.2 Identification of students' motivations for the choice of university studies

After confirming the high correlation of some of the "Crisis-Studies" variables, it has become necessary to conduct a survey on the reasons which had led students to enrol in the bachelor's degree in Building (Table 5). The sample consisted of 111 first-year students of academic year 2013/14. It is an adequate sample with a 99% confidence level and 10% error from the total population of 357 students. The main objective was simply to check if their motivations to choose the Bachelor's degree in Building were influenced by the crisis in the construction sector.

Almost 50% (54) chose to enrol in the bachelor's degree in Building for vocation. However, the second option chosen was that it was not their first career choice (21) because, according to the data collected, many of them are students who failed to enrol in Architecture. Next there are those who believe that the sector's outlook will improve at the end of the level (12) and finally, those who believe there is work in the sector abroad (7). Excluding the reasons unrelated to the sector ("Other"), it can be said that 85% decide to be trained within the construction field, despite the current crisis. Almost 20% of the students surveyed indicate that they are aware of the state of the sector, but they have expressed confidence in the near future or they will look for alternatives abroad.

Table 5. Reasons declared by students for enrolment in the bachelor's degree in building

Reason	Number of Replies	%
Vocation	54	49%
It was not his/her first choice	21	19%
Others	17	15%
Future improvement of the sector	12	11%
Working abroad	7	6%

Source: Survey conducted on February 21 and March 7, 2014 among students in the first-year course of the bachelor's degree in Building. Prepared by the authors.

4. Analysis of the impact of the Bologna Process in the performance of the subject "Descriptive Geometry"

After we analysed the influence of the crisis on new students, the second part of this study focused on performance after the implementation of the Bologna Process. To that end, a first-year subject existing in both plans called Descriptive Geometry has been chosen to make a comparative study and to get reliable and tangible numbers to help us conclude whether adoption of the Bologna Process has improved the results obtained by students or not.

Grades obtained by the students in the subject Descriptive Geometry, according to their distribution (Table 6), from 2005–06 to 2013–14 were used as input data. Fig. 3a and Fig. 3b represent respectively, the percentage distribution of grades between the old and the new Plan.

Table 6. 2005–2013 annual time series of scores for the subject Descriptive Geometry (DG)

		2005–2006	**2006–2007**	**2007–2008**	**2008–2009**	**2009–2010**	**2010–2011**	**2011–2012**	**2012–2013**
DG	Number of enrolled	1007	997	933	802	248	64	28	6
	Non-attending	350	287	256	186	40	26	15	3
	Merit	7	20	6	6	2	0	0	0
	Good	92	147	113	72	45	3	1	0
	Pass	353	351	404	383	114	22	7	2
	Fail	201	182	149	150	42	11	5	1
EHEA DG I	Number of enrolled					450	634	658	554
	Non-attending					77	116	149	112
	Merit					5	7	15	5
	Good					41	80	130	69
	Pass					141	225	211	187
	Credit recognition					4	4	3	0
	Fail					179	159	129	177
EHEA DG II	Number of enrolled					410	460	447	377
Non-attending					36	48	70	56	
Merit					6	6	16	3	
Good					99	99	146	86	
Pass					226	26	160	179	
Credit	recognition					4	2	4	0
Fail					35	43	45	50	
DG	**PERFORMANCE**	9.8	16.8	12.8	**9.7**	**19.0**	4.7	3.6	0.0
					DG I	10.2	13.7	**22.0**	13.4
					DG II	**25.6**	**22.8**	**36.2**	**23.6**
					DG I + DG II	**17.6**	**17.6**	**27.8**	**17.5**

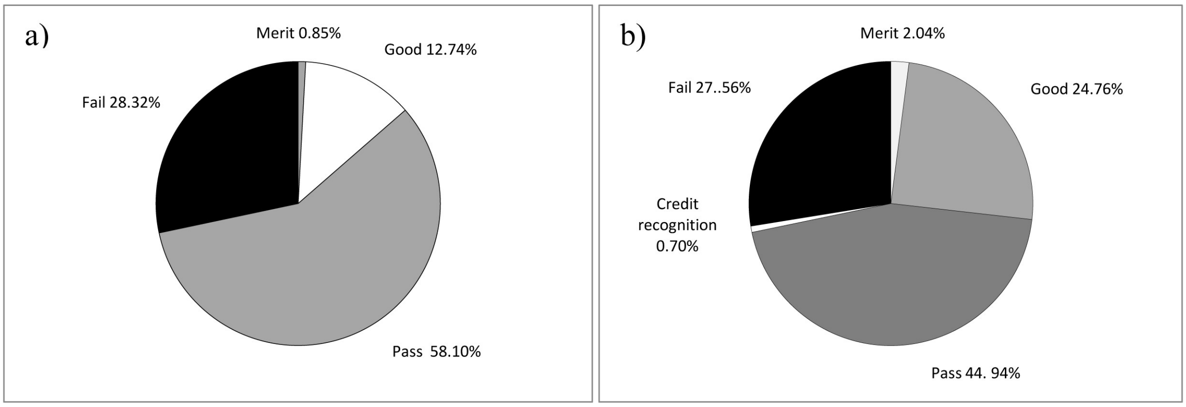

Fig. 3. Distribution of marks: (a) old Plan (b) Bologna Process.

According to the figures on performance values in Table 6 it can be said that performance in Descriptive Geometry I and II of the Bologna Process is greater, with percentages above 17%. It improves in nearly double the figures of the old Plan in Geometry Descriptive II. Data increased to 36.2% of total enrolment in Good and Merit for the academic year 2011/12. In accordance to this behaviour and despite the drop in the pre-university cut-off exam, it can be concluded that the quarterly division seems to have benefited the students, especially in Descriptive Geometry II. This trend was reinforced by the aptitude of most students in the choice of their career, as a motivated learner implies more attention and interest.

According to Fig. 3, higher qualifications such as Good and Merits are doubled as a result of the implantation of the Bologna Process. However, it can be seen that the Fail rate remains between 27% and 29%. Despite data related to the Bologna Process are presently only available for four years, the trend is towards maintaining these figures.

In view of the data in Table 6 other pertinent comments can be made. The number of non-attending students in the old Plan have grown in proportion to the enrolled students in Descriptive

Geometry once the Bologna Process was implemented. That is students who did not pass the subject the first year it was not offered (performance values of 19% and a lower proportion of non-attending students) prefer to give up and transfer to the new Plan instead of trying to pass over the years. The percentage of students taking that subject reaches a peak in 2009–10, the same year of the implementation of the Bologna Process. However, in the following courses, where the old Plan practically disappears, the values remain similar to the old Plan. According to this statement, it can be inferred that the new Plan does not reduce the rate of non-attending students.

5. Conclusions

The decline in enrolment in the Bachelor's degree in Building at the UPM in Spain has a high correlation with construction employment both nationally and locally (community of Madrid). At a local level, figures even exceed the national average with values of 0.97 for a 9-year annual time series. The variables more relevant to students such as employment and salaries have a greater effect on the view of the construction sector than others such as visas, building licences or business volume. These variables are probably more relevant to students because of they are featured in the media or by word of mouth. The data obtained in the community of Madrid reflect a higher ratio than in the rest of Spain, as was expected since most of the students are from this community or nearby.

Despite the decrease in enrolment and in the access cut-off mark, a survey shows that most students, nearly 85%, want to work in this sector as their first choice. Among this group, they choose the bachelor's degree in Building by vocation. Along with the modernization of the education system, this is one of the reasons why the marks in the Bologna Process are higher than those of previous plans. Students are fully motivated and identify with their studies. This fact has been clearly demonstrated since the implementation of the EHEA in the bachelor's degree in Building. Better academic performance of students has been achieved and the percentage of students with good and merit marks has doubled. The quarterly division of the subject has clearly helped students pass the course with very good grades. In addition and contrary to what was expected, this decrease in the number of students has made students more motivated.

The effort made by both last-year students of the old Plan and first-year students of the new Plan to pass the subject Descriptive Geometry is remarkable. This effort is clearly shown in the large number of students enrolled those two years and in the improvement in their performance up to 19% during the 2009–10 course. The new Plan, however, did not drastically reduce the rate of non-attending students. Figures are not clear and it cannot be inferred if the rates are similar to those recorded before its implementation or could possibly be a gradual improvement.

Finally, one of the main objectives of the EHEA was the completion of university studies at the expected time (not in much higher terms as typical in the old plans). If we rely on the maintenance of the failure rate, this goal is not going to be accomplished. However, the proposed intention to achieve higher performances in subjects is clearly achieved, but considering lower enrolment due to the crisis in the construction sector.

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