The impact of English-medium instruction on university student performance

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Abstract

During the last two decades universities around the world have increased the adoption of English-medium instruction (EMI) as a way to enhance internationalization and global competitiveness. EMI adoption presents a wide range of opportunities, but it also presents some challenges, being one of them the potential impact on students' academic performance. This paper analyzes the impact of EMI on the academic performance of the students in a Spanish university. The objective is to extend previous research, that shows contradictory conclusions. In the first part of the paper, using a multiple linear regression model to control key confounding factors, we have compared the performance of 229 EMI Vs 635 Non-EMI students, corresponding to cohorts 2013-14 to 2017-18, considering the average grade in the 10 subjects of the first course. In the second part, we focus on the 2017-18 cohort (49 EMI Vs 116 Non-EMI students), carrying out a longitudinal study of its behavior during two academic years in four different subjects. The results show that there are no statistically significant differences in academic performance between EMI and non-EMI students, i.e., language of instruction does not play a relevant role in academic performance.

Keywords.

Introduction

We are living in a global world; thus, internationalization becomes a key driver for the development of universities (MECD, 2016). A number of different universities worldwide have designed and implemented internationalization plans with the objectives of offering an international experience to different stakeholders, such as students, professors and staff, and, as Altbach & Knight (2007: 303) point out "internationalism will remain a central force in higher education, though its contours are unclear". There are different means to achieving these objectives, being one of them through mobility, i.e., by sending students or professors abroad or by hosting foreign students or professors at home (MECD, 2016; Yang, Volet, & Mansfield, 2017; Zhang, 2018). In this context, Internationalization at Home (IaH) strategies are also relevant (Nilsson, 2003), and a key part of them is the implementation of English as a Medium of Instruction (EMI).

EMI application is in clear expansion in many universities (Costa & Coleman, 2013; Hultgren, 2014; Broggini & Costa, 2017), and offers enhanced academic and professional opportunities to compete with international students due to several reasons. Firstly, it helps the students to be prepared to meet the requirements of the global academic and labor markets (Beelen, 2011; Kim & Shin, 2014). As Coleman (2006: 11) points out, "the world will become diglossic, with one language for local communication, culture and expression of identity, and another – English – for wider and more formal communication […]". Secondly, offering EMI in the university has the potential of developing students' sensitivity and capacity for appreciating cultural differences, as well as developing a sense of global citizenry. In fact, some authors consider that EMI in higher education (HE) not only could help to improve English language proficiency (Wu, 2006; Chang, 2010; Tatzl, 2011; Rose,

Curle, Aizawa & Thompson, 2019), but also to develop internationally minded students, professors and staff members. Finally, promoting the use of English in HE supports the initiatives to enhance international visibility for the institution (Dafouz, 2018) by attracting foreign talents and enhancing their connections within the international academic network. English is also the "the world language of academia" (Mauranen, Hynninen, & Ranta, 2010: 183), as it is commonly used in international conferences, journals and publications.

Despite the above-mentioned opportunities of the use of EMI in HE, there are some challenges that will be addressed in the next section. One of these challenges refer to the potential impact of using a foreign language as English in the academic performance of the students. The research question that governs this study refers to the analysis of the differences in academic performance of university students enrolled in the degree of Business Administration in a Spanish university, depending on the language of instruction. This article is structured as follows: after the introduction, a literature review section reviews the different challenges of EMI in HE, as well as the academic performance in EMI. Then, a methodology section presents the research methods used to conduct this study. Then, results are presented and discussed, as well as the research limitations; and finally, conclusions have been summarized.

Literature Review

Challenges of EMI in HE

As a result of a study on HE in Europe in a Global Setting, the Ministers of Education of 47 countries signed in 2007 an agreement for the External Dimension of the Bologna Process, and a Mobility Strategy for Better Learning 2020. In addition, the Spanish government

published an internationalization strategy for the Spanish universities 2015-2020 whose main objective was "consolidating a strong and internationally attractive university system that promotes the mobility of entry and exit of the best students, professors, researchers and administration and service personnel" (MECD, 2016, p. 7). One key element was to increase the number of degrees offered in English, since one of the main weaknesses of the Spanish university system was precisely the "low rate of education taught in English and other foreign languages" (MECD, 2016, p. 20). However, according to the report available from CRUE in the 2016/17 academic year, public universities in Spain with on-site courses offered only 7.5% of their degrees in a bilingual modality, a percentage that rose to 17.8% in the case of private universities (CRUE, 2018, p. 115). In other words, HE in the Spanish university environment remains mostly monolingual, despite the above-mentioned advantages of EMI instruction. This has also been reported in other countries as China, where limited EMI courses or programs are offered, and asymmetrical number of international degree students (Zhang, 2018).

Nevertheless, it is important to highlight the fact that although the predominant view is that learning through a foreign language brings opportunities that will eventually payoff in a student's professional career, not everyone seems to share such a perspective, and as Hultgren, Jensen & Dimova (2015:2) point out "in some corners of Europe, it has been met with fierce resistance". In fact, the use of EMI in HE presents different challenges that have been extensively discussed within the academic world. For instance, Aslan (2018) debates from a sociopolitical perspective on EMI and globalization in the Turkish context. Other differences can be reported depending on the country, due to different national language policies, implementation strategies and teaching traditions, or because of different levels

of English proficiency among university students, lecturers and management in general (Costa & Coleman, 2013; Broggini & Costa, 2017; Pritasari et al., 2019). As Dafouz, Camacho-Millano & Urquia (2014: 225) point out, three major concerns arise: "teacher and student views of EMI instruction, student foreign language proficiency and student academic competence". We intend to focus our research in this third concern, as there is a lack of consensus in the related literature.

Some researchers view EMI as a requirement that complicates the learning process (Airey, 2004; AlBakri, 2017), and, as Macaro, Curle, Pun, An, & Dearden (2018: 36) point out, "key stakeholders have serious concerns regarding the introduction and implementation of EMI despite sometimes recognizing its inevitability". For instance, the students' limited language academic skills could be a barrier for an adequate implementation of EMI (Lee & Lee, 2018; Pritasari et al., 2019), provoking the frustration of lecturers involved in EMI university education (Hernandez-Nanclares & Jimenez-Munoz, 2015); thus, there could be a risk of producing a lack or reduction of course content comprehension (Chang, 2010; Byun, Chu, Kim, Park, Kim, & Jung, 2011; Tatzl, 2011). In fact, teacher and student attitudes have been broadly researched, and the findings can be grouped in three main areas, according to how positively they view their EMI experience. Some researchers, while recognizing the difficulties associated with EMI instruction, conclude that the advantages outweigh the inconveniences (Lasagabaster & Sierra, 2011; Costa & Coleman, 2013; Rowland & Murray, 2020). A second group has an ambiguous position, where is not clear whether positive issues overcome the negative ones (Kim, 2011; Jensen & Thøgersen, 2011; Jiang, Jun Zhang & May, 2016). Finally, a third group of papers reports mainly negative perceptions, and often point to the difficulties associated with learning

content in a different language other than L1 (Kim, Kweon & Kim, 2017; Belhiah,& Elhami, 2015).

The question is to what extent these perceptions on the part of students and teachers are really founded, that is, whether EMI instruction really has a negative impact on student performance, understanding this performance as being linked to the acquisition of specific knowledge about different subjects. In this regard, several investigations have concluded that there are no significant differences in the academic performance of students who follow EMI instruction (Dafouz, Camacho-Millano, & Urquía, 2014; Dafouz & Camacho-Millano, 2016), while others point out that, paradoxically, EMI students may perform better than their Non-EMI peers (Hernandez-Nanclares & Jimenez-Munoz, 2015; Del Campo, Cancer, Pascual-Ezama, & Urquía-Grande, 2015). However, as it will be discussed next, these papers present some limitations, reason why the objective of this investigation is to try to overcome them through a quasi-experiment in which all relevant confounding factors have been controlled.

Academic performance in EMI

Academic performance is a difficult concept to define, since it can be done according to a number of different approaches. We will focus only on the immediate performance, where performance metrics will be based on some averaging measure of the students obtained grades. These metrics can be accepted as a first approximation although they are not perfect (Di Gresia, Porto, & Ripani, 2002), and this approach is adopted by the majority of the authors who analyze academic performance in terms of the language of instruction.

In a recent paper Lin & He (2018) tested the relationship between the achieved academic performance and the language chosen as a medium of instruction (Chinese versus

English), analyzing a sample of 498 Chinese students enrolled in a first-year course during the 2015 academic year. After discounting the obvious cultural and academic differences, the authors argued that the association between academic scores and bilingualism turns out to be a statistically insignificant phenomenon. We believe that the limitations in Lin and He's paper can be found in the fact that the students taking part in their experiment did not actually experience EMI education but bilingual instruction. The difference, as the authors themselves point out, is that "bilingual sessions use English version material" but "in a bilingual class, the instructor mainly uses L1 (Chinese) in lectures and interactions" (p. 6). In addition, authors focus on a specific subject, Fundamental Accounting, and therefore, their work is not able to detect whether a student's performance may or may not improve over time as English proficiency naturally progresses through the degree.

Hernandez-Nanclares & Jimenez-Munoz (2015), consider instead the data produced by a sample of students enrolled in a Spanish University where English is the medium of L2 instruction. The EMI data is contrasted with a control group of Spanish-taught students who were exposed to identical methodologies and took the same final exam in two different first-year subjects, World Economic History and World Economy. Their results show similar grades in both groups, but these researchers hinted that "those students taught through a foreign language generally learn and perform better" (pp. 11). Similarly, Dafouz, Camacho-Millano, & Urquía (2014) assess the statistic difference between the performance of a group of EMI and non-EMI students enrolled in a Business Administration degree at a large public Spanish university, whose scores in three different first-year subjects, Accounting, Finance and History, were recorded. Again, EMI and non-EMI groups obtained similar results in the three subjects. This work presents an important differential element with

respect to other similar research, which is the control of the quasi-experiment for the university access grade. However, these authors omit other relevant confounding factors, which will be analyzed later. The research of Dafouz & Camacho-Millano (2016), on the subject of Financial Accounting I, also showed no statistical differences across EMI and non-EMI students. Finally, Del Campo, Cancer, Pascual-Ezama, & Urquía-Grande (2015), carried out an exercise in a Bachelor Degree in Business Administration, trying to isolate the effects of all the possible confounding factors, although with a very different methodological approach than the one in the present paper. Contrary to previous works, their results show significant differences between the final grades of the two students groups. However, this research presents the important limitation of working exclusively with 30 students, 15 EMI and 15 Non-EMI.

In this research we try to overcome what, from our point of view, are the main limitations in previous research: we have used a large sample, we have analyzed more than one subject, and, which is certainly the key element of this paper, we have controlled the quasi-experiment for all relevant confounding factors. Additionally, in the second part of the paper, we considered the performance of a constant sample of students analyzed in different subjects taught in different years. Our aim was to capture the possible variations in learning strategies and performance as students progress through their studies (Urquía-Grande, Camacho-Miñano, & Dafouz, 2018), as well as the possible differences existing between subjects. Table 1 shows a comparison of this paper with previous research already mentioned.

Table 1. Comparison of this paper with previous research

Controlled by

	EMI	Sample	More than 1 subject	More than 1 cohort	University access grade	Other confounding factors
Lin & He (2018)	No	498	No	No (2015)	No	Yes
Hernandez-Nanclares & Jimenez-Munoz (2015)	Yes	654	Yes (2 subjects)	Yes, 2 cohorts (2012–2014)	No	No
Dafouz, Camacho-Millano, & Urquía (2014)	Yes	316	Yes (3 subjects)	No (2010-2011)	Yes	No
Dafouz & Camacho-Millano (2016)	Yes	383	No	Yes, 4 cohorts (2010–2014)	No	No
Del Campo, Cancer, Pascual-Ezama, & Urquía-Grande (2015)	Yes	30	Yes (all the compulsory courses)	No (2009-2010)	Yes	Yes
Current research						
Part 1	*Yes*	*864*	*Yes (10 subjects)*	*Yes, 5 cohorts (2013-2018)*	*Yes*	*Yes*
Part2	*Yes*	*165*	*Yes (4 subjects)*		*Yes*	*Yes*

As Makel & Plucker (2014) point out, there is a shortage of replication in the Education Sciences, and this work aims precisely to fill this gap, extending the work of Dafouz, Camacho-Millano, & Urquía (2014), and Dafouz & Camacho-Millano (2016). Our research paper aims to deepen the above discussion about content learning for EMI in HE for non-English native speaking students. The main contribution of this paper is the design of the quasi-experiment (see Table 1), which mitigates the main confounding factors. So, our research question is formulated as follows: does the language of instruction have an impact on students' academic performance?

Methods

Data and confounding factors

The study was carried out at the Universidad Pontificia Comillas, a private Spanish university. The university, founded in 1890, is composed of seven different schools, with over 13,000 students and around 1,700 lecturers, and offers 43 different undergraduate

degrees and 21 official master's and doctoral programs. Both lecturers and students are largely of Spanish nationality, and the teaching activity is developed mainly in a monolingual context. Nevertheless, the first EMI program in Business Administration was launched in 2013.

In this sense, the students admitted to the EMI group must demonstrate an equivalent to a C1 level in English speaking and comprehension, according to the Common European Framework of Reference for Languages (CEFR), evaluated at an entry test provided by the Comillas University.

The analysis developed in this paper is divided in two different parts. The first one in based on data from 2013, when the bilingual business degree was launched, to 2017. So, considering a sample of 864 students enrolled in the Business Administration degree, the academic performance of EMI and Non-EMI groups at the end of the first course have been compared, considering the 10 subjects that constitute the mentioned course. In the second part, we have carried out a longitudinal study on two groups of students who were analyzed during two academic years in four different subjects, all belonging to the area of Quantitative Methods: Mathematics I, Mathematics II, Financial Mathematics, and Statistics. All students whose first language is other than Spanish and those repeating the academic year were removed from the data set[1].

In both cases it is key to identify the confounding factors. As previously mentioned, the main contribution of this paper is to carry out a comparison by carefully controlling them. The first of these factors is the student's gender, since some papers have reported a superior performance by female students in Business Administration related subjects when

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[1] It should be noted that the four subjects of the EMI group considered in this paper were taught entirely in English, without codeswitching at any time, while this practice is not permitted by university regulations.

compared to their male counterparts (Martínez de Ibarreta, Rua-Vieites, Redondo-Palomo, Fabra-Florit, Nuñez-Partido, & Martín-Rodrigo, 2010; Durán-Santomil, Maside-Sanfiz, Rodeiro-Pazos, & Cantorna-Agra, 2016), although the current empirical evidence is not conclusive. The second confounding factor is the specialty studied in high school. In the Spanish university system, high school students can choose different branches of specialization. The science major is for students who wish to pursue a STEM-style degree, while the social sciences and humanities major is recommended for those who will choose a degree in those fields, which includes business administration degree. Although the research on this issue remains scarce, some studies underline that in Business Administration-related degrees, paradoxically students who chose a science specialization tend to have a better academic performance than those who have opted for other specialties. Arroyo-Barrigüete, Tirado, Mahillo-Fernández & Ramírez (2020) point out that students from science specialty generally obtain better results during the first year than those who studied the specialty of social sciences and humanities. Considering that previous studies provide some evidence of a potential effect of the specialty, we believe it relevant to control this variable. The third confounding factor is the resident origin of the student, i.e., whether the student comes from a different place from where he/she is going to study the degree, in this case Madrid. Beltrán Barco & La Serna Studzinski (2008) point to a negative effect, due, among other factors, to adaptation to a new life situation, a result that coincides with the conclusions of Tejedor (2003). In contrast, Simón Pérez, Casado-Díaz, Castejón Costa, Driha & Martínez-Bernabéu (2018) do not observe significant differences in academic performance according to their type of residence. Due to this ambiguity, the corresponding variable has been incorporated. Finally, the fourth

confounding factor is the pre-university performance. In the existing literature, pre-university performance has been identified as one of the most relevant variables to predict university performance (McKenzie & Schweitzer, 2001; Tejedor, 2003; Garbanzo-Vargas, 2007), since it somehow synthesizes both a student's aptitudes and skills, as well as their basic knowledge (Beltrán Barco & La Serna Studzinski, 2008). This condition was verified by comparing the grade earned in the university admission tests (EvAU - Evaluación para el Acceso a la Universidad). In the Spanish university system, the EvAU is the equivalent of the SAT, in the sense that the score obtained is used by public universities to select their future students. It is composed of the score obtained in a test, designed and evaluated by the Spanish Ministry of Education, and the average score in the two years of high school. Due to the need to control these four confounding factors, multiple regression analysis was used in the first part of the paper. Thus, including all students enrolled in the Business Administration degree during the period 2013 - 2018 (table 2), we have used the academic performance of EMI and Non-EMI students at the end of the first year, considering the average grade in the 10 subjects of this course, as dependent variable.

Table 2. Basic statistics of the sample (cohorts 2013-14 to 2017-18)

	2013-14	2014-15	2015-16	2016-17	2017-18	2013-2018	Gender	
							Men	Women
Non-EMI	143	123	135	118	116	635	46.3%	53.7%
EMI	42	48	46	44	49	229	39.7%	60.3%
Total	**185**	**171**	**181**	**162**	**165**	**864**		

In the second part of the paper, the 2017-18 cohort has been specifically analyzed, carrying out a longitudinal study of its behavior during two academic years in four different subjects. This exercise complements the previous one, as it allows for the evaluation of the possible

evolution of the students over time. We have proceeded in a different way because the sample is significantly smaller, analyzing, one by one, each confounding factor to verify that they are equal in both groups. Firstly, it has been verified that the percentage of men and women is similar in both groups (table 3), that the percentage of students coming from a science specialty in high school is also similar, and that the same happens with the proportion of local students. In all cases two-proportions z-test show relatively high p-values, so that we can assume equality between both groups.

Table 3. Basic statistics of the sample (cohort 2017-18), including gender, specialty in High School and local Vs non local students

		Gender			High School			Local student		
	N	Men	Women	p-value	Science	Others	p-value	Madrid	Others	p-value
Non-EMI	116	44.8%	55.2%	1	37.9%	62.1%	0.641	71.6%	28.4%	0.245
EMI	49	44.9%	55.1%		32.7%	67.3%		81.6%	18.4%	

In relation to the fourth confounding factor, a comparison of the university entrance grades (EvAU) of both groups has been carried out. First, the hypothesis of normality of both EMI and non-EMI groups was checked by means of a Shapiro test, and then by verifying the requirement of homogeneity of variances. Specifically, a Brown-Forsythe Levene-type procedure was used (Brown & Forsythe, 1974), by considering the median as the function to compute the center of each group, because this procedure generally provides a more robust test. Having verified both hypotheses, a t-test for equality of means (table 4) was carried out, which confirmed that both groups are homogeneous in terms of their academic performance prior the university.

Table 4. Independent samples T-test for EMI and non-EMI grades in university entrance tests (EvAU)

	University Entrance Tests		Shapiro's Test		Levene's Test		t-test for Equality of Means		
	Mean	SD	W	p-value	F	p-value	t	df	p-value
Non-EMI	7.90	0.88	0.98	0.145	1.51	0.2211	0.38	163.00	0.702
EMI	7.95	0.76	0.98	0.452					

Additionally, in the case of this longitudinal study, the specific choice of academic subjects significantly reduces any possible bias regarding the requirement level between the EMI and Non-EMI groups, i.e. the extent to which the two tracks place demands on students. On one hand, their belonging to the same area of knowledge and the fact of being taught by lecturers from the same department ensures homogeneity. On the other hand, while there are inevitable differences among lecturers, in each of the selected subjects a strong coordination is constantly implemented, which forces teachers to follow exactly the same evaluation system, to adopt similar intermediate evaluation tests and, most importantly, to use an identical final exam for all groups, where the language (Spanish versus English) is the only existing difference. This ensures an almost identical requirement level, at least within a given year. In the case of this paper, by using longitudinal data and, thus, by comparing the same final exam for all groups in each subject, we ensure that we are measuring performance under very similar conditions. Nevertheless, it is possible that courses in mathematics and statistics could be less sensitive to medium of instruction than many other subjects. For that reason, in addition to the individual analysis of the four selected subjects, we have also compared EMI and Non-EMI groups considering the first course as a whole, which includes 10 subjects. We do not think that it makes sense to perform individual analyses because we cannot ensure an identical exigency level in all of

them, but globally we think that the possible biases are compensated and that therefore the global comparison does make sense. As all the key confounding factors are controlled, a direct comparison can be performed.

To summarize, the quasi-experiment described in this paper, both in part 1 and 2, allows us to control key confounding factors, so that we can evaluate whether university performance varies according to the chosen language of instruction.

Statistical analysis

Statistical analysis was carried out in R, a free software environment for statistical computing. In the first part of this paper, the models estimation has been carried out by using basic functions included in such programing environment (R Core Team, 2013) and the "RCurl" (Lang and CRAN team, 2019) and "car" (Fox and Weisberg, 2019) packages. We detected the existence of heteroskedasticity, and therefore, robust standard deviations have been used. Additionally, we have checked the absence of multicollinearity problems, verifying that variance inflation factors (VIF) are far below 10.

Regarding the longitudinal study, two different tests for equality of means were used. Firstly, after the hypothesis of normality (via the Shapiro test) and homogeneity of means (via a Brown-Forsythe Levene-type procedure) were verified, a t-test was carried out. However, in most cases, even when the homogeneity of means is verified, it is not possible to assume normality, so it is necessary to resort to the non-parametric contrast by Mann-Whitney-Wilcoxon (MWW). The four subjects used in the longitudinal study are offered in the Quantitative Methods department, and all of them have a workload of 6 ECTS (European Credit Transfer System). Mathematics 1 is taught during the first semester of the first year, and it deals with the topics of Introduction to Linear Algebra and Integral

Theory. Mathematics 2, is taught during the second semester of the first year, and it focuses on Differential Calculus and Theory of Optimization. The subject of Statistics, is taught during the first semester of the second year, and it includes an introduction to Descriptive Statistics, Probability Theory and Inference. And finally, the subject of Financial Mathematics, is also taught during the first semester of the second year, deals with the Fundamentals of Financial Valuation. In all subjects, the final overall course grade in the first examination period, was considered as a measure of the academic performance of the students, evaluated on a 10-point scale (0 being the lowest and 10 the highest).

Results and Discussion

Global performance in the first course (2013-2017)

As mentioned in the previous section, the variables considered for the regression model are the four confounding factors, as well as whether or not the student belongs to the EMI group. Specifically, this research has included the variable EvAU (grade earned in the university admission tests), Specialty in High School (1 for science, 0 for social sciences and humanities), Local Student (1 for students from Madrid, 0 for students from other places), Gender (1 for women, 0 for men) and belonging or not to the L1 group (1 for Non-EMI students, 0 for EMI students). The results shown in table 5 indicate that the first three variables are highly significant.

Table 5. Regression analysis (2013 – 2017). Dependent variable: average grade in the 10 subjects of the first course

	Coef.	Std. Error	p_value	
EvAU	0.65	0.03	<.000	***
Specialty in High School	0.33	0.05	<.000	***
Local Student	0.35	0.05	<.000	***
Gender	0.05	0.05	0.30	

Non-EMI	0.00	0.05	0.98

R-squared: 0.44
F-statistic: 123 (p-value: <.000)

There is a clear positive correlation between EvAU and First course grade, which is also different according to the specialty studied in high school. Students from "science", *caeteris paribus* perform better than their counterparts from other specialties, even with the same EvAU. The same goes for the place of origin: *caeteris paribus*, local students perform better than their counterparts. However, neither gender nor membership to the EMI group, which is the variable of interest in this paper, are significant. In fact, the p-value associated to this last variable is very close to 1, which means that after having controlled for EvAU, specialty in high school, and being a local or non-local student, the effect of studying the degree in English is completely irrelevant. In fact, taking into consideration that a relatively high sample of 864 students has been used, and that the final course grade includes 10 different subjects, this result, with such a high p-value, confers a considerable robustness to the conclusions. This is a result that, although consistent with that of previous studies (Dafouz, Camacho-Millano, & Urquia, 2014; Dafouz & Camacho-Millano, 2016; Lin and He, 2018), provides a more general view, since the sample is significantly larger and all confounding factors have been controlled. Regarding the paper of Del Campo, Cancer, Pascual-Ezama, & Urquia-Grande (2015), who do control for key confounding factors, our results disagree with theirs. The reason might be, as the authors themselves admit, that their results are based on a very small sample (15 EMI Vs 15 Non-EMI students).

Longitudinal study (cohort 2017)

Firstly, we classified the sample students according to their level of performance: low performance (i.e. final grade between 0 and 4.99), medium performance (between 5 and

6.99), and high performance (between 7 and 10). It must be mentioned that the standardized grading system in Spain ranges from 1 to 10, with 5-10 representing a pass grade. Our findings, which are displayed in table 6, point to similar distributions between EMI and Non-EMI students, except in the case of Financial Mathematics, where EMI students obtain, on average, a higher grade. In fact, this is the only subject in which the majority group is not of "medium performance", which reveals a difference with respect to the remaining three subjects.

Table 6. EMI and non-EMI student distribution by level of achievement

		Low Performance		Medium Performance		High Performance	
		N	%	N	%	N	%
Math. I	Non-EMI	26	22.4%	64	55.2%	26	22.4%
	EMI	15	30.6%	27	55.1%	7	14.3%
Math. II	Non-EMI	16	13.8%	64	55.2%	36	31.0%
	EMI	5	10.2%	27	55.1%	17	34.7%
Statistics	Non-EMI	31	26.7%	58	50.0%	27	23.3%
	EMI	12	24.5%	26	53.1%	11	22.4%
Financial Math.	Non-EMI	49	42.2%	33	28.4%	34	29.3%
	EMI	12	24.5%	16	32.7%	21	42.9%

Performing the corresponding test for equality of means (table 7)[2], we can confirm that the means are not statistically different (5% confidence level) in any of the subjects. Neither can we find any observable pattern as students progress in their studies, since the results are similar in the considered subjects, which belong to different semesters and years: Mathematics I (first year, first semester), Mathematics II (first year, second semester),

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[2] Regarding the subject of Business Mathematics I, a *t*-test was carried out. However, in the rest of subjects it is not possible to assume normality, so a non-parametric contrast of Mann-Whitney-Wilcoxon has been used.

Financial Mathematics, and Statistics (second year, first semester). The three semesters considered are identical in terms of teaching load (30 ECTS), and very similar in terms of subject complexity. So, the lack of evolution in the grades suggests that there does not seem to be a negative effect of the language at the beginning of the studies. In other words, from the beginning of the studies, it does not seem that the performance of the EMI group is affected by the language, otherwise we would observe a gap with the Non-EMI students that would decrease as time goes by.

Table 7. Test for Equality of Means for EMI and non-EMI final grades of the four considered subjects

| | | Mean | SD | Shapiro's Test | | Levene's Test | | Test for Equality of Means | | |
				W	p-value	F	p-value	Statistic	df	p-value
Math. I	Non-EMI	5.79	1.57	0.99	0.560	0.19	0.660	-1.64	163	0.103
	EMI	5.34	1.67	0.97	0.154					
Math. II	Non-EMI	6.05	1.52	0.99	0.376	0.78	0.378	2575.00		0.340
	EMI	6.23	1.35	0.96	0.066					
Statistics	Non-EMI	5.70	1.79	0.98	0.097	0.24	0.626	2899.5		0.839
	EMI	5.54	2.03	0.94	0.015					
Financial Math.	Non-EMI	5.33	2.29	0.98	0.040	0.02	0.887	2357.5		0.084
	EMI	5.87	2.47	0.91	0.002					

Finally, comparing the overall performance of students in the first year of the degree, i.e. considering the 10 subjects of the first course, it can also be seen that there are no statistically significant differences (table 8), although, as above mentioned, this grade is considerably higher than those obtained in the four subjects of Quantitative Methods that were analyzed in this paper.

Table 8. Test for Equality of Means for EMI and non-EMI grades in the first course (across all subjects).

	First Course Grade		Shapiro's Test		Levene's Test		t-test for Equality of Means		
	Mean	SD	W	p-value	F	p-value	t	df	p-value
Non-EMI	6.87	0.81	0.99	0.328	0.69	0.407	1.64	163	0.104
EMI	7.08	0.76	0.99	0.979					

These results, again, coincide with those produced by Dafouz, Camacho-Millano, & Urquía (2014), Dafouz & Camacho-Millano (2016) and Lin and He (2018). This confirms that, at least in quantitative subjects of a degree in Business Administration, the language of instruction has no influence on academic results.

Limitations

The main limitation of this work is that, regarding the longitudinal study, the four considered subjects correspond to the area of Quantitative Methods and would be what Yang & Farley (2019: 14) call "less conceptually oriented (LC) subjects". These authors found that non-native students had a disadvantage in more conceptually oriented subjects versus less conceptual ones, due to linguistic and psychological effects. For this reason, subjects of the first type should be included in the comparison in future research. However, in the first course of the degree there is a considerable amount of more conceptually oriented subjects, and as already indicated, there are also no differences in the overall performance of students when considering all of them.

Conclusions

Throughout this paper we analyzed the differences in academic performance of university students enrolled in the degree of Business Administration, depending on the language of instruction. In the first part, using regression analysis to control key confounding factors, we have compared the performance of 229 EMI Vs 635 Non-EMI students, corresponding to cohorts 2013-14 to 2017-18, considering the average grade in the 10 subjects of the first

course. In the second part, we focus on the 2017-18 cohort (49 EMI Vs 116 Non-EMI students), carrying out a longitudinal study of its behavior during two academic years in four different subjects. This exercise complements the previous one, as it allows for the evaluation of the possible evolution of the students over time.

In both cases results show that there are no statistically significant differences among groups neither in any of the subjects nor in the global average grade. Additionally, since in the second part we adopted a longitudinal perspective on student academic performance over time, we were able to confirm that as students progress in their studies, no differences appear either. It would be expected that, as EMI students progress through the grade, and therefore become more comfortable studying in a language other than their mother tongue, their academic results would improve. However, this is not the case, since the grades obtained in the four subjects, which correspond to three different semesters, are relatively similar. Bearing in mind that the three semesters considered are identical in terms of teaching load (30 ECTS), and very similar in terms of subject complexity, the lack of evolution in the grades suggests that there does not seem to be a negative effect of the language at the beginning of the studies. Additionally, the absence of differences with respect to the Non-EMI group remains in all cases. In other words, from the beginning of the studies, it does not seem that the performance of the EMI group is affected by the language, otherwise we would observe a gap with the Non-EMI students that would decrease as time goes by.

In view of the results, and by taking into account the way in which this quasi-experiment was carried out, our conclusion is that the language of instruction does not play a relevant role in academic performance, at least in the degree of Business Administration, assuming

that students have an adequate level of knowledge in the language for which they are

going to receive instruction. In future research, we would consider it interesting to analyze

to what extent this is due to the greater efforts that EMI students are expected to make in

acquiring new knowledge in a non-native language, compared to a non-EMI group. It is

relevant to analyze the additional effort required to achieve similar results than the Non-

EMI students, which probably is related with the more mature learning strategies of these

undergraduates (Rivero-Menéndez, Urquía-Grande, López-Sánchez & Camacho-Miñano,

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