The bilingual programme in Madrid and its effects on learning

El programa bilingüe en Madrid y sus efectos sobre el aprendizaje

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Abstract

The Community of Madrid's bilingual programme (MBP) has improved the English level of the students using the Content and Language Integrated Learning methodology (CLIL), by which various subjects of the curriculum are taught in English. Previous studies have analysed whether the MBP reduces the skills of bilingual students in these subjects. Our study completes the previous works using the latest data available with the Evaluation of Competences of the Community of Madrid (ECM) in 2017 and 2019. The ECM is a census test that assesses the competences in various subjects of 6th grade (primary education) and 10th grade (secondary education) students, in addition to obtaining various context questionnaires from students, families, teachers and principals. A database has been developed with the results of the ECM and the characteristics of the students that influence these results. By using the statistical technique difference-in-difference, our study confirms the main conclusions of previous studies, MBP students slightly worsen their skills in subjects taught in English in 6th grade, but this difference is compensated for by 10th grade. Our study also provides a novel conclusion, the significant improvement in English language skills of primary education students is reduced in secondary education.

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Key words: bilingual education, CLIL, second language instruction, Madrid Region, student evaluation, primary education, secondary education, Difference-in-Difference.

Resumen

El programa bilingüe de la Comunidad de Madrid (PBM) ha mejorado el nivel de inglés de los estudiantes mediante el uso de la metodología del Aprendizaje Integrado de Contenidos y Lenguas Extranjeras (CLIL), por la que se imparten en inglés varias asignaturas del currículo. Estudios previos han analizado si el PBM reduce las competencias de los alumnos bilingües en esas asignaturas. Nuestro estudio completa los trabajos anteriores al utilizar los últimos datos disponibles con la Evaluación de Competencias de la Comunidad de Madrid (ECM) de los años 2017 y 2019. La ECM es una evaluación censal que evalúa las competencias en varias asignaturas de los alumnos de 6º de Educación Primaria (EP) y 4º de la ESO, además de obtener varios cuestionarios de contexto de los alumnos, familias, profesores y directores. Se ha elaborado una base de datos con los resultados de la ECM y las características de los alumnos que influyen en esos resultados. Mediante el uso de la técnica estadística *Difference-in-Difference*, nuestro estudio confirma las principales conclusiones de los estudios anteriores, los alumnos del PBM empeoran ligeramente sus competencias en las asignaturas impartidas en inglés en 6º EP, pero esta diferencia se compensa en 4º ESO. Nuestro estudio ofrece además una conclusión novedosa, la importante mejora en lengua inglesa de los alumnos de EP se reduce en la ESO.

Palabras clave: educación bilingüe, CLIL, enseñanza de una segunda lengua, Comunidad de Madrid, evaluación del estudiante, enseñanza primaria, enseñanza secundaria, *Difference-in-Difference*

Introduction

Spain is one of the worst performing countries in foreign language as shown by the 2011 European Survey on Language Competences (Jones Kordes and Ashton, 2012), the EFI 2020 or Eurostat. One of the causes is the English teaching methodology employed for many years, which insists upon grammatical content, reading and writing comprehension couple with sparse use of application of the English language in real life

situations (INEE, 2012). One of the most effective educational strategies to improve this problem is the Content and Language Integrated Learning (CLIL), a language immersion method that uses the foreign language as a medium of instruction for some academic content (Eurydice, 2006). In Spain, CLIL programmes were introduced for the first time in 1996 in a few public schools following an agreement between the Spanish Ministry of Education and the British Council. Based on this experience, many autonomous communities have developed their own differentiated bilingual programmes in their territories1.

The Community of Madrid's bilingual programme (MBP) is one of the most developed in Spain, it has been extended to half of the schools and students, and it is highly demanded by Madrid's families. However, the MBP has been criticized mainly for the learning problems that students have in subjects taught in English. This article analyses these criticisms and performs a statistical analysis on the effect of CLIL in subjects taught in a foreign language. To do this, it uses a database derived from the internal tests that the Community of Madrid has carried out in recent years. The article begins by explaining how the MBP works and the criticisms it has received. After reviewing the existing literature, it presents the database and the difference-in-difference model, with the results of this statistical analysis. Finally, the conclusion is presented.

Characteristics of the Community of Madrid's bilingual programme

The MBP was implemented for the first time in public primary education schools in the 2004-2005 academic year. The implementation of this programme is carried out gradually, starting in the first year of primary education (first grade) and then extending to the remaining years of primary education, one academic year at a time. The first 26 bilingual public schools which began to teach the MBP in the 2004-2005 academic year became fully bilingual in the 2009-2010 academic year, reached six years later when bilingual children reached the sixth grade and

[1] Currently, eleven of the seventeen Spanish autonomous communities offer bilingual education programmes: Andalusia, Aragon, The Canary Islands, Cantabria, Castile and Leon, Extremadura, Madrid, Murcia, Navarre, and La Rioja. Extremadura, Madrid and Murcia started in 2004, and in 2017, the Autonomous cities of Ceuta and Melilla, under the Spanish Ministry of Education, were the last to join this trend.

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finished their primary education. The MBP in secondary education began in the next 2010-2011 academic year, following the same progressive implementation during the four years of compulsory secondary education (ESO, seventh to tenth grade). The bilingual programme has also been extended to non-compulsory education: post-compulsory secondary education (eleventh and twelfth grade) in the 2014-2015 academic year, vocational training (2016-2017) and pre-primary education (2017-2018). The grant-maintained private schools began the MBP in primary education in the 2008-2009 academic year and in ESO in 2015-2016[2]. However, in grant-maintained private schools and in non-compulsory education, the MBP is less demanding than the bilingual programme in the compulsory educational stages (primary and secondary) of public schools (Madrid, 2020).

The operation of public bilingual schools is regulated by the Order 5958/2010 (December 7) in primary education, and the Order 972/2017 (April 7) in ESO. All public bilingual schools must teach fully in English subjects that represent at least 30% of the curriculum, including the subject of English as a foreign language, and it is recommended that the subjects of science, geography and history are also taught in English. The subjects of mathematics and Spanish language can only be taught in Spanish. In ESO, two levels of difficulty have been established in the development of the bilingual programme called "Section" and "Programme". The "Section" is the most demanding option, with more subjects taught in English and an advanced English course taught by specially qualified teachers.

Students do not have any special requirements to access bilingual schools in primary education, and when they finish 6th grade in a bilingual school, they automatically enter the bilingual secondary schools (if they want to). Students from non-bilingual primary schools must hold a CEFR level B1 to access a bilingual school in the first and second year of ESO, and a level B2 to access in the third and fourth year of ESO.

In both, primary and secondary education, teachers who wish to teach MBP subjects must hold a credential to teach in English granted by the Regional Ministry of Education, which is equivalent to level C1,

[2] Many grant-maintained private schools follow their own bilingual programme differentiated from the MBP, such as the BEDA programme of the Catholic Schools, which is also applied in other autonomous communities, or the CBC programme of UCETAM, a programme that can be complementary to the MBP.

for which they receive a productivity bonus[3]. Language Assistants are young graduates from English-speaking countries who support the MBP teachers in the classroom. Bilingual schools have special resources such as specific teaching materials, digital whiteboards, certificates of proficiency in English with international recognition for students, and participation in European programmes.

Each year, the Regional Ministry of Education selects the requesting schools that enter the MBP based on various criteria: number of teachers with the credential to teach in English, English level of the management team, acceptance of the educational community to participate in the programme, quality of the project, educational experience of the school, characteristics of the teaching staff, resources available in the school, number of units and students, and balanced geographical distribution of the bilingual schools in the Community of Madrid. The number of new schools included in the MBP has decreased considerably as the target of 50% bilingual schools has been reached. According to the legislation, all the new schools that are created in Madrid must belong to the MBP, so this bilingual programme has grown in recent years only with these new schools.

The main feature of the MBP is the use of the CLIL method. There is a consensus on the advantages that this method has for the effective learning of a foreign language. However, there have also been criticisms of this method and the way it is implemented in the classroom (Hemmi and Banegas, 2021; Cenoz, Genesee and Gorter, 2014; Bruton, 2013). A good part of these criticisms focusses on the intensity that the application of this model should have. Thus, it is discussed whether it is convenient to introduce CLIL in the first years of primary education or even earlier, in pre-primary education, taking advantage of the greater brain plasticity of young children in language learning, or whether, on the contrary, it is more efficient to start applying it only in more advanced courses (at the end of primary education or in secondary education) when students are more mature both in the knowledge of the subjects and in the mastery of the mother tongue (Huguet, Navarro, Chireac, and Sansó, 2009). There is also discussion about how many hours and how many subjects should be under CLIL learning in the total curriculum, as well as the suitability

[3] Primary education teachers receive 131.13 euros per month and secondary education teachers (teaching more than ten hours per week) receive 167.84 euros per month, in both cases this amount is approximately 5-6% of their salary.

of certain subjects for the application of CLIL learning, for example, the core and basic subjects of learning (mathematics or science) and the subjects related to the culture of the country (geography and history) (Acción Educativa, 2017). Another criticism is whether the entire subject should be taught exclusively in English, or whether it is better to teach parts of the subject in English and parts in the mother tongue (Antón, Thierry, Goborov, Anasagasti and Duñabeitia, 2016). One last criticism relates to the teachers. The need to teach classes in English implies that the teachers must have a very high level of language competence in addition to being competent in their subject. A balance needs to be struck between the two skills, as the option of recruiting new teachers proficient in the foreign language may have the danger of shedding teachers who are not proficient in the foreign language but who are very competent in their subject.

Of the many ways that there are to implement a CLIL programme, the MBP has chosen the following: to introduce bilingualism from the early educational stages; to seek a balanced percentage between the subjects taught in the mother tongue and in the foreign language (from 30% to 50%), although each subject is taught only in one language; to recommend the teaching in English of science, geography and history, and preventing it in mathematics and Spanish; and to improve the English language proficiency of existing teachers with the credential to teach in English system and the support for their teaching work with the Language Assistants. The question then arises, are these the best possible options to improve the linguistic and educational level of Madrid´s pupils? One way to answer this question is to analyse the practical effects of the MBP in the educational system, seeing whether it meets its objectives or whether it generates educational problems in its development.

Studies on the impact of MBP on academic performance

Subjects taught in English are a critical element of MBP because the academic level may be worsened by the fact that they are taught in a foreign language for both students and teachers. A comparison of the test outcomes between students from bilingual and non-bilingual schools would allow to measure the effect of the programme on the performance of the subjects. However, this comparison cannot be made

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directly because the students are not randomly assigned between the two groups (bilingual and no-bilingual schools) and because their personal characteristics are different. There are various statistical techniques which make possible this comparison between heterogeneous groups, applying quasi-experimental comparison techniques that allow to bring the data closer to what would have been a theoretical experiment (not real) where the students were randomly assigned between MBP and non-bilingual schools. The most used techniques are the difference-in-difference (diff-in-diff), matching students with the same characteristics, fixed effects models, and multinomial logit models.

Table I shows the characteristics of the studies that have been carried out on the effects of MBP. These studies use different external tests, both those carried out by the Community of Madrid (CDI, ECM) and the international evaluations (PISA, PISA for Schools). Most of the studies use the diff-in-diff technique.

TABLE I. Studies on the effect of MBP on subjects taught in English

	Publication	Courses	Database	Statistical technique	Conclusions
[1]	Brindusa, Cabrales and Carro (2016)	6th PE	- CDI 6th EP (2009, 2010 and 2011)	Difference-in-difference: schools before and after entering the MPB, compared to non-bilingual schools	- Negative effect of learning a subject in English (no effect on subjects taught in Spanish) - Greater effect in the first cohort of bilingual students, which is reduced in the second cohort - Greater effect on students with parents of lower educational level
[2]	Ruiz (2017)	6th PE	- CDI 6th EP (2009, 2011, 2013 and 2015)	Difference-in-difference: schools before and after entering the MPB, compared to non-bilingual schools	- Negative but small effect of learning a subject in English (no effect on subjects taught in Spanish) - The negative effect is concentrated on the average students
[3]	Quecedo (2015)	6th PE	- CDI 6th EP (2008-2013)	Difference-in-difference: schools before and after entering the MPB, compared to non-bilingual schools	Negative but small effect of learning a subject in English (no effect on subjects taught in Spanish)
[4]	Sotoca and Muñoz (2015)	6th PE 4th ESO	- CDI 6th EP (2010) - Diagnostic test 4th ESO (2010) - Internal evaluation	Matching of students from bilingual centers with students from non-bilingual centers with similar characteristics (Nonequivalent Control Group) (only East of Madrid Este schools)	- No differences between schools in 4th ESO - Better results in Spanish language and mathematics in 6th PE - In the internal evaluation, teachers in non-bilingual schools score their students higher in knowledge of the environment (science) and in English

[5]	Tamariz and Blasi (2016)	6th PE 4th ESO	- CDI 6th EP (2009-2015) - PISA for Schools (2009 y 2013)	Mixed Effects Models: combines the inference of the main effects with estimates of the characteristics of secondary sources, such as the school or the municipality	- The MBP does not reduce the learning of contents in the rest of the subjects (whether taught in Spanish or English) - The slight worsening in the acquisition of knowledge in science in PE, is compensated later in ESO - The MBP does not explain the differences in the results of the evaluations, the explanation is in other elements (public or private school, and geographical area)
[6]	Montalbán (2016)	4th ESO	- PISA 2009 - PISA for Schools 2013	Difference-in-difference: schools before and after entering the MPB, compared to non-bilingual schools	The MBP neither improves nor worsens the learning of contents in Spanish language, mathematics (taught in Spanish) and science (taught in English) - Strong positive impact on the enjoyment time and reading habits of students in bilingual centers
[7]	García-Centeno, de Pablos, Rueda-López and Calderón (2020)	6th PE	- ECM 2017	Multinomial Logit Model: measures the variables that influence the probability of obtaining better results	- The MBP neither improves nor worsens the learning of content in Spanish language, mathematics (taught in Spanish) and science (taught in English) - Significant improvement of the level of English in bilingual centers

CDI: Essential Knowledge and Skills Test of the Community of Madrid
ECM: Evaluation of Competences of the Community of Madrid
MBP: Community of Madrid's Bilingual Programme
PE: Primary Education
ESO: Compulsory Secondary Education

Most of the studies conclude that bilingual schools obtain better results in the English subject, and similar results in the subjects taught in Spanish (mathematics and Spanish language). However, the conclusions of the studies are not unanimous on whether MBP has a negative effect on subjects taught in English, a lack of unanimity that also exists in studies conducted on other bilingual programmes in Spain (Lorenzo and Granados, 2020; Barrios and Milla, 2020) and in the rest of the world (Dallinger, Jonkmann, Hollm and Fiege, 2016; Surmont, Struys, Van Den Noort and Van De Craen, 2016; Bialystock, 2007).

All the studies, except for [6 and 7], use data from the CDI test that was carried out in the Community of Madrid between 2005 and 2015, focusing on the 6th year of primary education test. The articles [1, 2, 3 and 5] conclude that the MBP reduces the results of the science subject taught

in English in that course (Knowledge of the Environment), although it is a small effect. However, the rest of the articles [4, 6 and 7] draw the opposite conclusion, that is, the MBP has no effect, neither positive nor negative, in this subject. On the other hand, there is unanimity in the articles that analyse the 4th year of ESO evaluation [4, 5 and 6] that the MBP does not reduce the competences in the subjects taught in English. According to [5], although in primary education there is a slight reduction in the results of the science subject taught in English, in ESO the slight loss of knowledge of this subject is recovered. In other words, there is a temporary deterioration that is recovered in the long term, throughout the compulsory educational stage (primary education and ESO). In fact, [1] admit that the loss of knowledge is greater in the first cohort of bilingual students who reached 6th year of primary education (in the 2009-2010 academic year) than in the second cohort (2010-2011), due to the improvement in the development of the MBP, mainly in the English level of the teachers, whose demands were notably increased in 2005 after the first year of the programme's development.

Evaluation of Competences of the Community of Madrid Database

To complete all the previous studies, we will use the Evaluation of Competences of the Community of Madrid (ECM) database[4]. The Spanish Organic Law 8/2013 for the Improvement of Educational Quality (LOMCE) introduced these individualized assessment tests for all 3rd, 6th (primary education) and 10th (ESO) grade students. The tests have no academic effects on students. Each autonomous community prepares its own tests, following the general guidelines of the central government. In the Community of Madrid, these tests have been held from the 2015-2016 academic year to the 2018-2019 academic year. For our analysis, we will use the tests carried out in public schools in 6th (primary education) and 10th (ESO) grade in 2017 and 2019[5]. The tests evaluate Spanish

[4] More detailed information on these tests can be found on the website of the Community of Madrid: https://www.comunidad.madrid/servicios/educacion/educacion-cifras

[5] From the academic year 2019-2020, these tests are no longer carried out, except in the 3rd year of primary education, where subjects taught in English are not assessed. Of the four years in which the test was conducted, the first year (2016) it was only conducted in primary education, and in the third year (2018), the database does not allow to connect the results of the students with their questionnaires, so only the 2017 and 2019 tests are suitable for this study.

language, English language, mathematics, science (only in 6th grade), and geography and history (only in 10th grade). The ECM has several advantages over the CDI: it includes an English test; assesses 10th grade students, in addition to 6th grade students, which allows analysing the entire period of application of the PBM; it is a test of competencies and not a test of knowledge and contents like the CDI, so it reduces the influence of the language as it is carried out in Spanish, specifically the possible lower command of the specialized vocabulary in Spanish of the MBP students; and finally includes numerous context questionnaires much richer in information than in the CDI. From these questionnaires, 4 databases have been prepared (6th and 10th grade in 2017 and 2019) with the following variables:

- Personal characteristics of the students and their families
  - Female: 1 if female and 0 if male.
  - Birth quarter: from 1 (January to March) to 4 (October to December).
  - Immigrant: the student's country of birth as an approximation to the immigrant status, 1 if they were born outside of Spain and 0 if they were born in Spain.
  - Early education: 1 for pupils entering pre-primary education before the age of 3 (first cycle of pre-primary education), 2 if they enter at the age of 3 to start the second cycle of pre-primary education, and 3 if they enter later.
  - ESCS: Economic, Social and Cultural Status (PISA), is calculated with three variables related to family background: parents' highest level of education, parents' highest occupational status, and material and cultural possessions at home (books, digital devices, computer, internet, press). Positive values indicate above average status, negative values indicate below average status.
  - Absence: takes values 1 to 4 from lowest to highest level of absenteeism; in 6th grade, the frequency of missing class is asked (1 never or almost never, 2 once a month, 3 once every 2 weeks, and 4 once a week) and in 10th grade, full days that the pupil has missed during the term without justification (1 less than 2 days, 2 between 2 and 4, 3 between 4 and 6, and 4 more than 6 days).

- Homework: weekly time spent by the pupil on school work (study or homework) outside school hours, with a value of 1 if less than 4 days a week, 2 from 4 to 5 days, and 3 more than 5 days.
- Repetition: 1 if the pupil has repeated 1 or more years, and 0 if the pupil has never repeated a year.
- Bilingual: 1 if the pupil attends a MBP school in the year being assessed, and 0 if the student's school is not part of a bilingual programme.

■ Students' academic outcomes
- The average score of each student has been obtained through the Item Response Theory (IRT), similar to PISA, which gives a result of mean 500 and standard deviation 100. The competences are Spanish, English, mathematics, science (in 6th grade) and history (in 10th grade).

Tables II and III show a descriptive analysis of the variables for the 6th (primary education) and 10th (ESO) grade courses in 20196.

TABLE II. Descriptive statistics of the 6th grade (primary education) test, academic year 2018-2019

	All schools	Mini-mum	Maxi-mum	Bilin-gual	No bi-lingual	Bilingual vs. No bilingual
	(1)	(2)	(3)	(4)	(5)	(6)
A. Student characte-ristics						
Female	0.48	0	1	0.48	0.47	-0.32***
	[0.50]			[0.50]	[0.50]	(-0.05)
Birth quarter	2.52	1	4	2.50	2.54	-0.03
	[1.10]			[1.11]	[1.10]	(-0.02)
Immigrant	0.06	0	1	0.04	0.07	-0.19*
	[0.29]			[0.21]	[0.25]	(-0.11)

[6] The same analysis has been performed for the 2017 database, which is not included due to lack of space, whose results are similar to those of 2019.

Early education	1.81	1	3	1.71	1.91	-0.13***
	[0.94]			[0.90]	[0.97]	(-0.03)
ESCS	-0.27	-3.57	1.75	-0.11	-0.43	0.07***
	[1.05]			[0.98]	[1.09]	(-0.03)
Absence	1.24	1	4	1.19	1.27	0.09*
	[0.67]			[0.60]	[0.72]	(-0.05)
Homework	2.26	1	3	2.28	2.25	-0.05
	[0.76]			[0.75]	[0.77]	(-0.03)
Repetition	0.17	0	1	0.13	0.20	0.38***
	[0.37]			[0.34]	[0.40]	(-0.09)
Bilingual	0.43	0	1	1	0	
	[0.49]					
B. Student outcomes						
Spanish	486.45	-108.48	1,001.73	497.28	477.29	-0.0049***
	[100.46]			[95.56]	[103.55]	(-0.0003)
Mathematics	480.04	0	955.68	494.36	468.05	-0.0004
	[94.07]			[94.81]	[91.75]	(-0.0003)
English	481.74	23.59	792.20	531.11	439.49	0.0165***
	[101.18]			[87.95]	[92.24]	(-0.0004)
Science	483.25	-104.08	1,007.46	487.89	479.36	-0.0045***
	[98.91]			[96.14]	[101.01]	(-0.0003)
Observations	46,141			19,610	26,531	46,141

Notes: Column 1: mean and variance (standard deviation of the mean in brackets) of the students' characteristics and their outcomes. Columns 2 and 3: minimum and maximum. Columns 4 and 5: mean and standard deviation (in square brackets) of each group of students in bilingual and non-bilingual schools. Column 6: estimates of the coefficients of one logistic regression of the students' personal characteristics and their outcomes, on the indicator of their belonging to a MBP school in the year studied. Standard errors in parentheses. ***, ** and * reflect a significance level of 1%, 5% and 10% respectively.

TABLE III. Descriptive statistics of the 10th grade (ESO) test, academic year 2018-2019

	All schools	Minimum	Maximum	Bilingual	No bilingual	Bilingual vs. No bilingual
	(1)	(2)	(3)	(4)	(5)	(6)
A. Student characteristics						
Female	0.50	0	1	0.51	0.50	0.21***
	[0.50]			[0.50]	[0.50]	(0.04)
Birth quarter	2.52	1	4	2.52	2.53	-0.01
	[1.11]			[1.11]	[1.10]	(0.02)
Immigrant	0.14	0	1	0.12	0.17	-0.14**
	[0.35]			[0.32]	[0.37]	(0.07)
Early education	1.51	1	3	1.46	1.56	-0.09**
	[0.62]			[0.59]	[0.64]	(0.04)
ESCS	-0.24	-4.22	2.02	-0.05	-0.41	0.07***
	[0.97]			[0.93]	[0.97]	(0.02)
Absence	1.72	1	4	1.66	1.76	0.07***
	[0.98]			[0.94]	[1.01]	(0.03)
Homework	1.86	1	3	1.92	1.80	0.01
	[0.91]			[0.91]	[0.91]	(0.02)
Repetition	0.10	0	1	0.07	0.12	0.24***
	[0.30]			[0.26]	[0.32]	(0.08)
Bilingual	0.45	0	1	1	0	
	[0.50]					
B. Student outcomes						
Spanish	476.14	-126.53	946.46	485.52	467.09	-0.0019***
	[98.21]			[96.52]	[98.97]	(0.0003)
Mathematics	476.33	87.30	968,92	482.35	470.59	-0.0011***

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	[94.18]			[93.86]	[94.13]	(0.0003)
English	479.08	149.94	813.12	515,43	444.18	0.0118***
	[101.45]			[94.05]	[95.90]	(0.0003)
History	474.69	105.45	983.02	477.80	471.70	-0.0037***
	[97.67]			[95.10]	[99.99]	(0.0003)
Observations	32,683			14,544	18,139	32,683

Notes: Column 1: mean and variance (standard deviation of the mean in brackets) of the students' characteristics and their outcomes. Columns 2 and 3: minimum and maximum. Columns 4 and 5: mean and standard deviation (in square brackets) of each group of students in bilingual and non-bilingual schools. Column 6: estimates of the coefficients of one logistic regression of the students' personal characteristics and their outcomes, on the indicator of their belonging to a MBP school in the year studied. Standard errors in parentheses. ***, ** and * reflect a significance level of 1%, 5% and 10% respectively.

The above tables show that students in bilingual schools perform better in all the skills assessed, with very high differences in English and lower differences in the other subjects; these differences decrease as the MBP develops, since they are greater in primary education than in secondary education (section B, columns 4 and 5). However, the above outcomes comparison is not related to whether the students attend the MBP, because they have not been randomly assigned between bilingual and non-bilingual schools, and because the student characteristics that influence their outcomes are different and statistically significant between both groups, as reflected in the logistic regression (section A, column 6). In order to infer a relationship between bilingual education and students' academic outcomes, it is necessary to use statistical techniques to correct endogeneity problems, such as the difference-in-difference technique.

Difference-in-difference Model

To develop the difference-in-difference technique, we use a database that brings together the 2017 and 2019 tests. We only use students from non-bilingual schools in 2017. Of all these students, the treatment group is the students at the schools that received the "treatment" because they enter the MBP in 2018 and 2019. The control group is the remaining students in non-bilingual schools. Tables IV and V show the averages of

the two groups (treatment and control) in the year before the treatment (2017) and in the year after this treatment (2019).

TABLE IV. Descriptive statistics (means) of the treatment and control groups for the diff-in-diff regression (6th grade primary education)

	2017 (before Treatment)		**2019 (after Treatment)**		**Diff-in-Diff**
	Mean of Treatment group	**Mean of Control group**	**Mean of Treatment group**	**Mean of Control group**	
A. Student characteristics					
Female	0.48	0.48	0.48	0.47	0.01
Birth quarter	2.52	2.52	2.54	2.54	0.00
Immigrant	0.09	0.08	0.04	0.07	-0.03
Early education	1.90	2.01	1.66	1.91	-0.14
ESCS	-0.25	-0.41	-0.06	-0.43	0.21
Absence	1.22	1.26	1.16	1.27	-0.06
Homework	2.19	2.27	2.17	2.25	0.00
Repetition	0.16	0.20	0.10	0.20	-0.06
B. Student outcomes					
Spanish	482.59	471.97	495.64	477.29	7.74
Mathematics	473.01	466.41	491.58	468.05	16.93
English	447.66	438.42	529.67	439.49	80.95
Science	485.49	476.88	484.07	479.36	-3.90
Observations	1,418	20,728	2,113	21,882	

Treatment group: students in non-bilingual schools in 2017 and in bilingual schools in 2019
Control group: students in non-bilingual schools in 2017 and 2019
Diff-in-Diff: (Mean 2019 - Mean 2017 of the treatment group) - (Mean 2019 - Mean 2017 of the control group)

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TABLE V. Descriptive statistics (means) of the treatment and control groups for the diff-in-diff regression (10th grade ESO)

	2017 (before Treatment)		2019 (after Treatment)		Diff-in-Diff
	Mean of Treatment group	Mean of Control group	Mean of Treatment group	Mean of Control group	
A. Student characteristics					
Female	0.47	0.49	0.51	0.50	0.02
Birth quarter	2.51	2.52	2.53	2.53	0.01
Immigrant	0.19	0.18	0.15	0.17	-0.03
Early education	1.54	1.58	1.52	1.56	0.01
ESCS	-0.24	-0.37	-0.20	-0.41	0.08
Absence	1.64	1.62	1.79	1.76	0.01
Homework	2.02	1.94	1.82	1.80	-0.06
Repetition	0.09	0.10	0.11	0.12	0.01
B. Student outcomes					
Spanish	490.77	475.80	475.13	467.09	-6.92
Mathematics	486.12	477.57	479.86	470.59	0.72
English	465.94	450.58	458.98	444.18	-0.56
History	488.61	471.68	486.67	471.70	-1.96
Observations	2,990	16,664	3,128	18,106	

Treatment group: students in non-bilingual schools in 2017 and in bilingual schools in 2019
Control group: students in non-bilingual schools in 2017 and 2019
Diff-in-Diff: (Mean 2019 - Mean 2017 of the treatment group) - (Mean 2019 - Mean 2017 of the control group)

The difference-in-difference technique overcomes two endogeneity problems. The first is the non-random selection of the schools that enter the MBP, which is overcome by comparing a centre with itself. This is reflected in section B of the "Diff-in-Diff" column. However, a second problem of endogeneity remains, since the announcement that a school

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is going to enter the MBP may alter the type of student that is enrolled in that school. Indeed, section A of the "Diff-in-Diff" column shows that the characteristics of students in schools who entered the MBP in 2018 or 2019 have changed slightly after entering its school in the programme, compared with students in non-bilingual schools (control group). To correct this problem, the diff-in-diff technique allows the incorporation of the students' characteristics that influence their academic results. For this purpose, the following Ordinary Least Squares (OLS) regression is estimated:

$$Y\,i = \alpha 2019 + \beta T\,i + \gamma\,(2019\,x\,T\,i\,) + \delta X\,i + \zeta\,0 \qquad (1)$$

We have estimated four regressions on the academic outcomes of each student (Yi). The four groups of students are determined with 2 dichotomous variables: *T* takes a value of 1 if the student belongs to the treatment group and 0 for the control group; *2019* takes a value of 1 for the treatment group and the post-treatment control group (test of 2019), while 0 are those students who took the test before the treatment (in 2017). We want to estimate the effect that entering the MBP had on the academic outcomes, considering the existing changes in these results, both between the treatment and control groups (*T*), and from one year to another (*2019)*. The variable that reflects these effects is γ, which is obtained by multiplying the 2 previous variables, so that this variable takes a value of 1 for the treatment group that performs the assessment in 2019. X*i* are the observable characteristics of the students and their families. Tables VI and VII show the results of the estimations of the model expressed in equation (1).

TABLE VI. Diff-in-diff estimation in 6th grade (primary education)

	Spanish	Mathema-tics	English	Science
2019	2.23	-4.61***	-1.63	-1.75
	(1.66)	(1.64)	(1.57)	(1.70)
Treatment group 2017 and 2019	9.77**	12.87***	9.96**	7.29*
	(4.21)	(4.18)	(3.98)	(4.34)

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Treatment group 2019	**-11.44****	**-6.40**	**61.17*****	**-21.57*****
	(5.52)	(5.46)	(5.21)	(5.68)
Female	44.48***	-19.11***	22.49***	-0.98
	(1.564	(1.54)	(1.48)	(1.61)
Birth quarter	-6.10***	-5.17***	-4.63***	-6.14***
	(0.71)	(0.70)	(0.67)	(0.73)
Immigrant	-3.63	-0.27	3.74	-6.17*
	(3.25)	(3.22)	(3.08)	(3.34)
Early education	-2.87***	-3.27***	0.22	-1.57*
	(0.90)	(0.88)	(0.85)	(0.92)
ESCS	22.40***	21.18***	26.89***	22.69***
	(0.82)	(0.81)	(0.78)	(0.85)
Absence	-12.01***	-13.48***	-12.76***	-12.95***
	(1.63)	(1.60)	(1.54)	(1.67)
Homework	6.06***	7.65***	4.75***	5.59***
	(1.08)	(1.07)	(1.02)	(1.11)
Repetition	-53.50***	-46.62***	-58.32***	-42.31***
	(2.77)	(2.73)	(2.61)	(2.85)
Constant	507.2***	528.6***	482.6***	533.5***
	(4.21)	(4.16)	(3.98)	(4.32)
Observations	13,273	13,329	13,249	13,317
R square	0.19	0.14	0.22	0.12

Standard errors in parentheses. ***, ** and * reflect a significance level of 1%, 5% and 10% respectively.

TABLE VII. Diff-in-diff estimation in 10th grade (ESO)

	Spanish	**Mathema-tics**	**English**	**History**
2019	-13.48***	-6.84***	-3.96***	-8.30***
	(1.61)	(1.61)	(1.52)	(1.64)
Treatment group 2017 and 2019	9.03***	5.04*	6.70***	6.04**
	(2.74)	(2.77)	(2.60)	(2.81)

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Treatment group 2019	**-3.26**	**2.02**	**-7.11***	**6.66**
	(4.24)	(4.21)	(3.98)	(4.32)
Female	19.91***	-26.16***	9.56***	-18.37***
	(1.49)	(1.49)	(1.40)	(1.52)
Birth quarter	-2.37***	-1.21*	-1.56**	-3.00***
	(0.67)	(0.67)	(0.63)	(0.68)
Immigrant	-8.88***	-10.65***	2.65	-1.21
	(2.23)	(2.22)	(2.10)	(2.27)
Early education	-3.40***	-4.31***	-2.69**	-2.77**
	(1.29)	(1.29)	(1.22)	(1.32)
ESCS	14.55***	14.78***	26.53***	19.22***
	(0.73)	(0.73)	(0.69)	(0.74)
Absence	-8.75***	-7.30***	-9.58***	-8.95***
	(0.87)	(0.86)	(0.81)	(0.89)
Homework	10.22***	6.56***	9.14***	9.46***
	(0.84)	(0.84)	(0.79)	(0.86)
Repetition	-39.43***	-17.72***	-52.25***	-32.11***
	(2.65)	(2.63)	(2.48)	(2.71)
Constant	497.9***	515.3***	483.7***	510.9***
	(3.69)	(3.68)	(3.47)	(3.76)
Observations	13,865	14,007	14,075	13,826
R square	0.13	0.10	0.21	0.13

Standard errors in parentheses ***, ** and * reflect a significance level of 1%, 5% and 10% respectively.

The variables of the students and their families' characteristics are mostly statistically significant and take the expected values according to the literature that analyses the influence of these characteristics in the students' academic outcome. Female students obtain better results in language skills (Spanish and English) and worse in the rest, a result in line with previous research that points to a greater predisposition of women towards language skills and of men towards mathematics and science (OECD, 2019; Baye and Monseur, 2016; Knollenberger, Rodriguez-

Planas and Sevilla, 2016). Being born in a late term, that is, being one of the youngest in the class, has a negative effect on academic results, and this effect is greater in primary education than in ESO because this disadvantage is diluted over time, a conclusion already confirmed by previous literature (Attar and Cohen-Zada, 2017; Kawaguchi, 2011; Puhani and Weber, 2007). Immigrant status reduces academic results, although its effect is not statistically significant in primary education, while in ESO it is statistically significant in Spanish and mathematics. OECD research using PISA data shows this ambiguous effect of immigration on students' academic performance (OECD, 2015)7. Later attendance in pre-primary education negatively influences outcomes, and this effect is maintained over time, although the magnitude of the effect is not very large, a similar conclusion to the previous literature (Gutiérrez-Domenech and Adserá, 2012; Elder and Lubotsky, 2009). The student's attitude, measured both by their level of absenteeism and by the completion of homework, has the expected effect on the outcomes, negative if the absence is higher and positive if the student does more homework, although the magnitude of both effects is not very big**.** The influence of doing homework at home on school performance has been verified with PISA data (OECD, 2014), as well as the decrease in academic outcomes when students accumulate unexcused absences (Santibanez and Guarino, 2020; Choi and Calero, 2013; Calero, Choi and Waisgrais, 2010).

The two variables that most influence academic results are, in the first place, the social, economic, and cultural level of the families (ESCS), with a positive and very large influence on the students' outcomes, only surpassed by the repetition. The PISA reports have highlighted this important influence (OECD, 2019). Finally, repetition is the variable with the most important influence on outcomes, negatively affecting the academic performance of the students, as indicated in the previous literature (OECD, 2020 and 2011; Miñaca and Hervas, 2013; Fernández-Enguita, Mena and Riviere, 2010).

The variable of most interest, highlighted in the two previous tables (*Treatment group 2019)*, measures the effect that the introduction of the MBP has on the students' outcomes. The results are different in primary

[7] In Madrid, being an immigrant does not significantly reduce the academic result due to the degree of motivation of these students and their origin, since many immigrants in Madrid are children of expatriate workers with a high-income level, and it is this income level, captured by the ESCS explained below, the determinant of their academic results.

education than in ESO. In primary education, the MBP improves the students' level of English very significantly, more than 60 points (60% of the standard deviation). Regarding the subjects taught in Spanish, the difference between MBP students and those who do not participate in this programme is not significant in mathematics, and in Spanish it is significant and negative for MBP students, although the magnitude of the difference is not very big. Finally, the subject taught in English (science) shows a negative and significant effect for participating in the MBP. In summary, the MBP in primary education improves language skills in English at the cost of slightly reducing skills and knowledge of subjects taught in English and reducing skills in Spanish language even more slightly. These conclusions are similar to those of previous studies (Table I).

In secondary education, the effect of the MBP on the academic outcomes is not statistically significant in all subjects, except in English language, where the statistical significance is low (10%), and the magnitude of the difference is very small. These results are different from those obtained in primary education. Although the subjects taught in English are different in ESO (geography and history) than in primary education (science), other previous research had reached the conclusion that the MBP does not reduce competencies in science in ESO (Sotoca and Muñoz, 2015; Tamariz and Blasi, 2016; Montalbán, 2016). All of this only confirms that, although there may be a slight worsening of results in bilingual schools for subjects taught in English, this worsening is temporary, limited to primary education, but in the long term, throughout the entire period of the compulsory education stage (primary education and ESO), the MBP does not reduce knowledge and skills in these subjects.

The difference-in-difference analysis in ESO also shows that the MBP students do not improve their English level compared to the other students, even their result is slightly lower, while in primary education the improvement was very big. This is a novel and quite surprising result, that the previous literature had not studied, and that has several explanations. One is that the power to improve the English language in MBP is greater in primary education than in ESO, when students are already more concerned with other subjects, or already have a high level of English achieved in primary education. In addition, ESO students in bilingual schools are divided into two groups, "Section" and "Programme", being "Programme" the least demanding option and the one chosen by the

students with the worst academic results. For this reason, if Section and Programme students could be differentiated (which the database used cannot do), probably Section students would comparatively improve their results in English, being the Programme students those who reduce the average of all MBP students. Another explanation would be that students from non-bilingual schools make more effort in the ESO stage to improve their English level, compared to students who already have a higher English level. There is also a group of students who drop out of the MBP at the end of the 6th grade to attend a non-bilingual school, among other reasons, because they consider that their English level is already very high, and they prefer to focus on studying the rest of the subjects in Spanish. These students would raise the English level in ESO schools that do not belong to the MBP.

Conclusions

The Community of Madrid's bilingual programme improves the English level of the students by using the CLIL system in which various subjects of the programme are taught in English. However, this system may reduce students' outcome in those subjects taught in a non-mother tongue. The statistical analysis carried out in this article, using the difference-in-difference technique, confirms the results already obtained in previous studies: the MBP causes a slight decrease in competences in the subjects taught in English in primary education, but in the long term, upon finishing compulsory education at the end of ESO, this decrease is offset. Our analysis has yielded a novel conclusion that previous studies had not detected: the improvement in English of the MBP occurs mainly in primary education and not in secondary education.

The MBP is part of an educational policy of the Madrid Regional Ministry of Education, to offer differentiated and specialized educational centres so that each student can choose the centre that best suits his or her circumstances. Thus, Madrid has developed centres with a Baccalaureate of Excellence, Technological Innovation Institutes, Sports Specialization Institutes, Integrated Music Centres, and Integrated Professional Training Centres. At the same time, educational policies in Madrid promoted that all schools could offer their own programmes, changing the curriculum to suit the characteristics of their students. All

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the above, combined with greater freedom of school choice to introduce a certain degree of competition between schools, seeks to achieve a varied educational supply that will adapt and better meet the needs and demands of students.

The MBP fits into this educational policy of the Community of Madrid. If a student can improve his or her level of English outside the school, for example, with private classes, he or she can choose not to go to a bilingual school in order not to reduce the academic level in certain subjects such as science or history, while students who value more to acquire a higher level of English, although there is a possible loss of academic level in some areas, can opt for the MBP schools. In fact, this seems to be one of the reasons why the English level of the MBP in secondary education does not improve as much as in primary education, namely the option to choose between the "Section" and the "Programme", and the fact that some students in MBP primary schools decide to attend a non-bilingual school in ESO because they have already acquired a high level of English and prefer to concentrate on the competences of the rest of the subjects.

The comparative analysis of the students' academic outcomes of bilingual and non-bilingual schools is not the only way to analyse the MBP. Thus, there are several studies on the satisfaction of students, families and teachers with the MBP expressed through surveys (Chaieberras and Rascón, 2018; Gerena Ramírez-Verdugo, 2014; Halbach and Fernández, 2011). These studies generally find a high degree of satisfaction with the MBP of most of the respondents, especially in its ability to improve the level of English and in the degree of motivation and improvement of the self-esteem of the students when using English, with teachers who are also highly motivated and enthusiastic about the development of the programme. But these studies also reflect some complaints from respondents regarding the development of the MBP. Teachers complain about the few opportunities to participate in exchange programmes, the scarcity of training in the English language and the teaching methodology to carry out their work, the lack of materials and time to prepare and develop their teaching in English and, in general, they highlight the need for more support and training for their work in the MBP. The students reflect some doubts about their competences in their mother tongue (Spanish), and many of them are not interested in using more English in the classes because they consider that they already have a very high English level. This is related to one of the conclusions of our article,

that the MBP does not comparatively improve the level of English in the MBP secondary education with respect to the students in non-bilingual schools, because if the programme achieves a high level of English in primary schools, this gives less room for improvement in ESO, so some students will prioritize the competencies of other subjects over the English they already master, and the room for improvement for students who have not been to a MBP school is greater.

A final element of criticism about MBP is its effects on the global educational system. Even if students in bilingual schools improve their English skills without reducing their grasp of other subjects taught in English, the bilingual programme can negatively affect the entire education system. If the bilingual programme is not applied to all students (the MBP only applies to half of them), the programme may cause an increase in the segregation of students based on their membership in the MBP and an overall reduction in the quality of the education system. Several studies have analysed school segregation in the Community of Madrid, relating it to the MBP (Cortázar and Taberner, 2020; Mediavilla, Mancebón, Gómez-Sancho and Pires, 2019; Sanjuán, Martínez and Ferrer, 2019). However, these studies only show a correlation between the development of MBP and increased segregation, but do not perform statistical analysis that demonstrate causality. This causal analysis is a promising future element of MBP research.

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