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IMPACT OF BULLYING ON ACADEMIC PERFORMANCE.
A CASE STUDY FOR THE COMMUNITY OF MADRID [i]

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ABSTRACT: Bullying is a problem that affects children and teenagers around the world and its repercussions can endure throughout adult life. Its prevalence is, in part, a product of the lack of information and the paucity of studies which analyse the wide-ranging consequences for the individuals involved. The main objective of this research is to study the incidence of bullying on the academic performance of students in education centres in the Madrid Region. The databases used are those of Competency Tests carried out on all 10th grade students in Madrid during the year 2017. These external assessment tests evaluate Spanish language, English language, Mathematics, and Geography and History. Along with these tests, the students, their families, their teachers and head teachers complete comprehensive questionnaires. To analyse all these data, we carry out a multilevel methodological approach to identify the quantitative association of bullying with academic performance and to estimate the probability that performance is affected by the level of bullying that exists in the education centres. The results indicate that bullying has a negative impact on all the competencies evaluated, that the probability of a lower academic performance increases in environments where there is bullying and that bullying can affect students with low or high academic achievement in different ways, depending on what competency is evaluated.

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1.   Introduction

Bullying is a naturalized concept but about which little is really known. According to an Amnesty International report for Spain (2019), it often goes unnoticed since teachers and parents do not know how to identify it or how to act. With the growth of information and communication technology (ICT), the phenomenon has taken on new dimensions, identifying two specific typologies: face-to-face harassment or bullying itself and virtual harassment or cyberbullying. Save the Children (2018) published a report stating that 52% of Spanish children and adolescents had suffered some type of violence and humiliation, while 7% were victims of cyberbullying. These figures illustrate the extent of the problem in Spain.

The impact of this subtype of violence affects all students, especially the victims, causing physical, emotional and relational damage that can have lifelong consequences. One of the effects most mentioned, although little explored, is the worsening of academic performance. Nurturing academic performance is essential for ensuring any individual can reach their potential in the education system and ultimately access opportunities in the job market. Studying its relationship with bullying, therefore, is of great importance.

In 2019, Amnesty International warned Spain that thousands of cases of bullying remained hidden and that the system was "turning a blind eye" to the problem. It considered it necessary not only to implement a reporting system that was useful, but also to assist children and adolescents in the prevention of this widespread phenomenon. To do this, however, the problem must first be correctly identified and students, teachers and parents made more aware of the importance of preventing and reporting such cases. Showing the repercussions bullying can have on academic and work opportunities is a way of illustrating the impact that this phenomenon has on the social dimension.

Given that it is a phenomenon scarcely studied in the Spanish environment, our main objective is to carry out a case study of the Community of Madrid that involves an in-depth analysis-diagnosis of the prevalence of the phenomenon in this territory, to later determine the existence of effects on academic performance. In Spain, studies of bullying and cyberbullying, for the most part, focus on describing the prevalence of the

phenomenon and its association with sex, age and the sociometric or relational dimension. However, when studies look at the consequences they tend to focus on measuring those related to the degree of anxiety, depression or fear that students feel when they are bullied, but not the effects that these emotional disorders can have on academic performance. Our research aims to explore and quantify the effect that these asymmetric relationships have on students' ability to learn, an analysis that has not been carried out in depth for the Spanish environment.

The results of our study indicate that the problem of bullying is more prevalent in state and subsidized schools than in private schools, and that the size of the school is relevant, although it is more difficult to identify and depends on who reports the presence of bullying (student, teacher or head teacher). Regarding the impact on academic performance, our study verifies the existence of a negative relationship in all the evaluated competencies. Lastly, by means of the quantile approach, our study verifies that bullying affects students differently, depending on their academic level in each competency, showing that the impact of the studied phenomenon is clearly heterogeneous.

This article is set out as follows. The second section discusses a conceptual framework to develop and identify key concepts such as bullying and cyberbullying. The third section contains a review of the literature that links these phenomena with academic performance. The fourth section explains issues inherent to the databases and the methodology used. The fifth section shows the results obtained and, finally, the sixth section presents the conclusions.

2. Conceptual framework

2.1. Concept of bullying

Although bullying among students is not a recent phenomenon, the concept was not actually studied until the 1970s. It was in the Scandinavian countries where the first studies appeared, in the field of ethology, using the term *mobbing* to explain hostile behaviour by a group of individuals against another individual of a different species (Lorenz, 1966; Collell and Escumé, 2014).

The term bullying was coined by Dan Olweus in 1980 and has been widely accepted in subsequent international studies. In Spanish-speaking countries, in addition to using the Anglo-Saxon term of bullying, the terms harassment or peer abuse are also often used (Olweus, 1998).

Olweus defines a student as being a victim of bullying when "*... he is repeatedly exposed to negative actions by one or more students*" (Olweus, 1998, pp.25). According to Olweus, a negative action can be defined as any that is carried out with the purpose of inflicting or attempting to inflict, deliberately, harm or discomfort to another person. All physical and verbal actions and any intentional exclusion are considered negative actions (Olweus, 2019). The concept has been re-defined by multiple authors and has undergone a dynamic evolution adjusted to the changes that have occurred in recent decades, such as the appearance of ICT on a massive scale in daily life.

Despite diverse definitions, there are certain characteristics that are defined as essential for an action to be considered bullying or harassment: the existence of an imbalance of power or strength, of an asymmetric relationship, between the aggressor and the victim; recurrent and persistent behaviour over time and deliberate aggressive behaviour in order to harm the victim. Finally, bullying can be considered as a form of abuse that differs from other phenomena of domestic violence due to the context in which it occurs and the characteristics of the parties involved (Olweus, 2019).

Hernández and Saravia (2016) summarize the types of abuse and how it is exercised:
- Physical: direct damage to the victim or indirect damage to the victim's property.
- Verbal: through insults, teasing, slander.
- Social: involving isolation, marginalization and intimidation.
- Psychological: behaviours that affect self-esteem, creating insecurity and fear.
- *Cyberbullying*: the use of technology to harass a victim
- *Dating violence*: bullying between adolescent couples where emotional blackmail prevails.

Likewise, the motivation behind negative actions and the arguments with which bullies try to legitimize their behaviour have defined new types of bullying that differ from previous ones (Collell and Escumé, 2014):

- Racist bullying: the motivation revolves around the ethnicity or origin of the victim.

- Homophobic bullying: motivated by the sexual orientation of the victim, be it known or imagined.

- Bullying or sexual harassment: when the assaults have a sexual nature and are carried out physically, verbally and socially

2.2. The phenomenon of *cyberbullying*

Harassment through ICT is a negative act or action that responds to the same characteristics as harassment in person. It occurs in an unequal relationship, deliberate and perpetuating itself over time. It implies any aggressive, deliberate and repetitive action that is exercised through the use of electronic devices. This includes personal websites, blogs, email, text messages, social networks, chat, instant messaging, photographs etc. (Menay-López and De la Fuente, 2014).

The Ombudsman's report (2007) on school violence in Spain states that 5.5% of students recognized themselves as victims of bullying through new technologies, of which 92.7% were occasional victims and only 7.3% were frequent victims. However, 25% had witnessed abuse through the network or mobile phone and 5.4% recognized themselves as an aggressor (88.9% occasionally and 11.1% frequently).

In 2018, Save the Children recorded that 7% of students had suffered cyberbullying, 6% through photos and messages on WhatsApp and 4% through photos and messages on social networks. 4% had acknowledged participating in cyberbullying, while 26% witnessed it in some form or other. This shows that the phenomenon has prevailed over time and should therefore be analysed in parallel with traditional bullying.

Bullying and cyberbullying have a direct impact, by action, or by omission when cases are known but are not reported. Of all the possible known types of bullying, virtual harassment is characterized by excluding a physical presence (Cerezo, 2012).

Cyberbullying has particular characteristics that are not present in traditional bullying. Firstly, the aggressor can hide his/her identity (anonymity) and, secondly, the harassment can be carried out from a remote setting. Due to these very characteristics, cyberbullying is associated with an increase in the level of impunity of the aggressor, a high speed of diffusion and exponential growth in the number of aggressors, the accentuation of the public nature of the offence and an increase in the feeling of defencelessness by the victim, "since there is no place to hide" (Cerezo, 2012).

Like bullying, cyberbullying can be exercised in different ways (Willard, 2007):

- *Flaming*: network fights using electronic messages
- Harassment: repeated sending of offensive messages.
- Denigration: spreading rumours in order to damage a person's reputation.
- Violation of privacy: dissemination of information or images.
- Social exclusion: intentional exclusion from network groups.
- Identity theft: pretending to be someone else to post or send material or messages that may cause problems or damage someone´s reputation.
- *Cyberstalking*: combination of harassment and denigration with threats.

2.3. Causes and consequences of bullying

To understand the causes that promote bullying, first we must look at the asymmetry of the perpetrator/victim relationship and make a profile of both to understand how the dynamics and risk factors converge and lead to this behaviour.

Trautmann (2008), Cerezo (2009) and Olweus (2019) state that the victim is a passive or submissive person who usually has some or more of the following characteristics:

- Cautious, sensitive, introverted.
- Insecure, sad and with a low self-esteem.
- High levels of anxiety.
- Suffers from depression and increasingly susceptible to suicidal ideas.
- Tends not to have many friends and relates better to adults.
- In the case of bullying by force, is weaker than their peers.
- Academically strong.

These characteristics may be natural to the harassed individual and may be made worse by, or as a consequence of, the unequal relationship.

The bully is characterized by a combination of very specific characteristics (Trautmann, 2008; Cerezo, 2009; Olweus, 2019):

- Concentration problems, difficulty reading and writing.
- Behaviour that causes irritation or tension. Hyperactivity.
- Provocation, a strong need to dominate, subjugate and be right.
- Impulsiveness and irritability. Lack of empathy.
- Aggressiveness with adults, parents and teachers included.
- May be involved in antisocial or criminal activities, such as vandalism or drug addiction.
- If the bullying is by force, they are stronger than their victims.
- Low tolerance to frustration.
- Emotional lability.

Regarding the psychological sources behind the aggressor's behaviour, empirical evidence suggests that there are 3 interrelated motives: i) bullies seem to enjoy power and dominance; ii) they may have developed a certain degree of hostility towards the environment due to their family context; iii) there is a certain degree of exploitation in action since they tend to coerce their victims into giving money and other items of value, as a form of trophy (Dan Olweus, 1980, 1993, 2019). Rigby (2003) states that some people believe bullying is advantageous in that other actors show admiration for the bully and that position allows them to get what they want.

Cerezo (2009) raises a series of environmental factors that condition the asymmetric relationship. In the case of bullies, factors that can generate a greater predisposition to negative behaviour are the existence of a certain degree of family conflict, low level of affectivity, violent models (violent parents, victimization among siblings, history of school bullies in the family), self-protection and social status afforded within school as a collateral effect of the aggressive attitude. In the case of the individual being bullied, factors that can further aggravate the victim profile are over-zealous family control, overprotection, violent family models which naturalize negative attitudes, helplessness or

a passive attitude towards the problem at school, plus limited relationships of the child with their peers.

Regarding the interventions of the environment and sensitivity to the problem, there is a third actor that can be characterized and that exercises an indirect influence on the unbalanced power relationship between the harasser and the victim; the "witnesses, spectators or *bystanders*" (Trautmann, 2008). They represent the aggressor's audience, who can be motivated or inhibited by them. The witness can favour the harassment by taking an indifferent attitude or directly supporting the aggressor, or reducing the harassment with direct support for the victim or indirectly by communicating the situation to an adult.

The consequences derived from peer harassment are multiple and affect not only the victims but also the perpetrators. Guerra Escoda (2016) summarises the conclusions of the report by Save The Children (2014) and other authors on the consequences. In the case of victims: low self-esteem, depression, anxiety, fear of attending classes, submission, worsening school performance, learning difficulties and school integration, high levels of loneliness, suicidal thoughts, suicide attempt or suicide. Van Geel *et al*. (2014) suggest that between 5% to 20% of children are victims of bullying and that this is a risk factor for adolescent suicide. According to the authors, 20% of adolescents have considered suicide and, in addition, between 5% and 8% of adolescents in the United States have attempted suicide during an annual period.

Another consequence of being a persistent victim of a negative attitude on the part of peers is the reduction of empathy and the conversion to bullying. The bully-victim performs a double role: that of being harassed by their dominant peers and that of harassing peers or weaker individuals (Trautmann, 2008).

For bullies, bullying leads to violent behaviour, vandalism or crime that generates legal problems, moral disconnection, deepening lack of empathy, drug use, aggressive behaviour, truancy, school failure, difficulty abiding by the rules and laws, and conflict with authority figures. Both in aggressors, victims or bystanders, the internalization of violence and negative behaviours can become psychological disorders that carry over into adulthood (Collell and Escudé, 2014).

So far we have reviewed both the concepts and the characteristics of the phenomenon and have found multiple studies that observe and analyse the association between bullying and cyberbullying with relevant variables. This study, however, attempts to study one particular consequence of this phenomenon: the drop in academic performance. As a starting point, we review the pre-existing literature on this relationship in the next section.

3. Literature review: bullying and academic performance

The studies that we have reviewed attempt, through different methodologies, to approximate the relationship between bullying and students' academic performance and, for the most part, they have found a negative relationship between both variables.

Gronna and Chin-Chance (1999) study the impact of bullying on 2nd year (*Grade 8*) students in secondary education (ESO) in 46 schools in a province in western Canada. They use a 2-level model that includes student characteristics and school conditions. Students who feel safe have higher academic performance than those who do not feel safe. They find a significant negative effect on performance as the number of disciplinary infractions increases.

Bustamante *et al*. (2004) explore the correlation between these two variables under the hypothesis that they had an inverse or negative relationship. In their study of students from the city of Temuco (Chile), with a correlational descriptive method, they corroborate a moderate to weak negative correlation as well as no differences with reference to a student's sex.

Konishi *et al*. (2010) examine the relationship between the variables school bullying, the student-student relationship and performance based on PISA data with multilevel analysis. The result indicates that the level of school bullying is significantly and negatively related to mathematical performance and reading comprehension. Gutiérrez *et al*. (2012) carry out a study along the same lines for a Chilean sample of PISA data from 2009. In this case, bullying in schools only affects the maths test but not the reading test.

Piñero Ruiz *et al*. (2011) use an ANOVA analysis to look into the differences between roles in the dynamics of bullying (victim, harasser, neutral, bully-victim), attitude towards school and academic performance for a sample of secondary students from the Murcia region, Spain. The analyses reveal differences between the 4 roles and that the bully-victims show a lower academic performance.

Juvonen *et al*. (2011) study, with a multilevel method, if bullying experiences are related to low academic performance among middle school students in Los Angeles, United States, considering self-perceived and hetero-reported bullying and controlling for a series of individual variables such as gender and ethnicity. They find that victimization has a negative relationship with performance in each of the two cases, although the drop in marks is greater in the case of self-perceived victimization.

Strøm *et al*. (2012) investigate the academic performance among adolescents exposed to violence, sexual abuse and bullying from schools in Oslo, Norway. With multilevel analysis, they show that students in schools with high levels of bullying have a worse academic performance.

Along the same lines, Hammig and Jozkowski (2013), using a multinomial logistic regression, study adolescents who experienced victimization and academic performance using data from the 2009 *Youth Risk Behaviour Survey* for high school students in the United States. The results conclude that students who failed were 1.8 times more likely to have been injured in a fight the previous year, 1.5 times more likely to have been threatened in the previous year, and 1.6 times more likely to have been bullied, compared to those who got high marks.

Lacey and Cornell (2013) study the impact of bullying on academic performance with a sample of state high school students in Virginia, United States. When analysing, with a multiple regression, the pass rates of a series of subjects such as algebra, Earth Science, World History, Biology and Geometry, they concluded that individual victimization had a significant and negative effect only on Biology, although the prevalence of bullying reported by both students and teachers reduced grades in almost all subjects.

Gálvez-Sobral *et al*. (2014) identify factors that are related to the level of aggression among students and its incidence in academic performance in Mathematics and reading for a sample of high school students in Guatemala. With a multiple regression model and a series of variables such as socioeconomic index, grade repetition, pre-primary attendance, students with special educational needs, ethnic identification and sex, as well as reported aggression, they point out that as the latter variable increases the reading results are reduced.

Al-Raqqad *et al*. (2017) use a descriptive approach to study the impact of school bullying on student performance reported by teachers for schools in the west of Amman, Jordan. Their results indicate that the impact of bullying is negative on performance and that bullying in school is the factor that explains 19% of the changes in the academic performance of victims and 3.8% in the performance of bullies.

Ottem (2018) studies the impact of traditional bullying on the academic performance of 9,300 middle school students from the 50 states and the District of Columbia, United States. Three bivariate regression models are estimated by testing math scores and level of self-esteem in victimized and non-victimized students, controlling for a series of related variables. The results indicate that a female student who suffers bullying presents a reduction in self-esteem and marks, and that this reduction worsens for older students and in line with an increase in the frequency of bullying.

4. Data base, descriptive analysis and methodological approach

4.1 Database: School Competency tests 2017 (4 ESO)

Organic Law 8/2013 for the Improvement of Educational Quality (LOMCE) established an individualized evaluation for students in 3rd and 6th year of primary education and 4th year of secondary education (ESO). These evaluations do not have academic repercussions for the students, their objective being to evaluate the achievement of competencies of the students and the educational performance of the education schools and administrations in the autonomous communities. In this evaluation, the central government establishes the general characteristics of the test while the autonomous

communities develop their own tests, following the general guidelines of the central government, although they can modify some characteristics such as their census or nature of the sample evaluation date.

In the 2014-2015 academic year, a pilot test of these evaluations established in the LOMCE was carried out, which were then fully applied in the academic years 2015-2016 (in this course, only to students of 3rd and 6th grade of primary schools), 2016 -2017, 2017-2018 and 2018-2019. The tests are given in the last term of class, before the end of the course. In the 2019-2020 academic year, due to the state of alarm resulting from the Covid-19 pandemic, the planned tests were not held.

From 2005 to 2015, the Community of Madrid carried out its own external evaluation test called the Indispensable Knowledge and Skills Test (CDI). While the CDI seeks to contrast the level of knowledge of the students, the new tests established in the LOMCE and applied since 2016 are more aimed at evaluating their skills. Thus, the purpose of the LOMCE assessments is to check the degree of acquisition of linguistic competency and Mathematical competency in all courses, of Science and Technology competencies in 6th grade of Primary, and of Social and Civic competency in 4th of ESO, as well as the achievement of the objectives of the education stages.

Linguistic competency assesses the degree of mastery of skills, capabilities and abilities in written expression and oral and reading comprehension, both in Spanish and in English. Mathematical competency assesses the degree of mastery of skills, capabilities and abilities in calculation and problem solving, application of knowledge and mathematical reasoning. Lastly, the test of Social and Civic competency, only for students of 4th ESO, assesses knowledge, application and reasoning in Geography and History content.

These tests are inspired by the competency tests that are carried out in the main international assessments, such as PISA, organized by the OECD for 15-year-old students, or PIRLS and TIMSS, promoted by the IEA for primary school students[1]. The questions are posed within a real-life context and, for their interpretation, a matrix of

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[1]In Spain these tests are only applied in primary education, although there are also IEA tests for secondary students in other countries.

technical specifications is made where the blocks of content are related to cognitive and competency processes.

The test is adapted for students with special needs, with some degree of disability, with psychopedagogical evaluation or with learning disorders. The head teacher of the school can determine which of these students can take the test or are exempt from it, although their average does not count in the means of the school and the entire region.

The Community of Madrid applies these tests on a census basis, that is, all schools and students at these education levels participate in them, except for those students indicated in the previous paragraph. However, for the last three tests (2017, 2018 and 2019) a mixed external and internal application was developed. On the one hand, a sample of 250 schools is selected for each course[2], where an external application and correction is made, that is, where teachers external to the school give and correct the test. On the other hand, every 3 years, in all the schools of one or several Territorial Areas of Madrid[3] the evaluation is given and corrected externally, and in the rest, unless they are part of the sample, internally. In the internal application, the examiners and checkers are teachers from the school itself, but they do not teach that particular group. This system guarantees that all schools have at least one external application every 3 years[4].

The database consists of two types of information; the results of the assessments and the context questionnaires. The results of the competency tests have been based on Item Response Theory (IRT), an appropriate model for large-scale education assessments. Specifically, the Rasch model is used, a one-parameter logistic model where the trait level of the student depends on their level of aptitude and the difficulty of the items. To transform the difficulty parameter, the same methodology used in the PISA assessment is followed, with a distribution mean of 500 and a standard deviation of 100. The above gives a score for each student and their performance level, from 1 to 6.

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[2]In the Community of Madrid there are approximately 1,300 schools of primary education and 800 schools of ESO.

[3] Madrid is divided into 5 territorial areas called DAT: Madrid Capital City, North, South, East and West.

[4] In the first year, 2017, it was applied externally in the Capital DAT, in 2018 in the North DAT and the South DAT, and in 2019 in the East DAT and the West DAT.

The above results can be interpreted based on numerous context variables that are obtained from the following questionnaires: a family context questionnaire filled out by the students' parents, a school context questionnaire by the head teacher, a questionnaire by the teachers who teach the subjects evaluated, and a context questionnaire for the 4th year ESO students. These surveys enable analysis of the differences in the results due to the social and family environment of the students, the environment of the education school and the type of teaching provided. The surveys were carried out on paper until the 2016-2017 academic year and, since then, the surveys have been conducted online. This has produced a significant decrease in the number of surveys completed, mainly by families.

The combination of results per student in the key competencies with context variables of the student and the school offers a rich and varied database of information on the competency results of the students and their background. It is for this reason that this database has been used in numerous studies, for example, García-Centeno *et al*. (2020) or Sanz and Tena (2020), among others.

For this study we use the database of the test carried out in the 2016-2017 academic year for 4th year ESO students. Firstly, we chose the 4th ESO test because it fits into the age at which bullying usually occurs, between 12 and 17 years old. The 6th grade Primary test, with 11 to 12 year old children, could only detect some initial cases of bullying at an early age, while the 4th Grade ESO test, with 15 to 16 year old children, collects a greater number of bullying activities. Secondly, we chose the test for the 2016-2017 academic year because it is the last year in which the surveys were carried out on paper. From then on, the surveys of parents, teachers, students and head teachers are conducted online. Online tests are cheaper to run, but there are two problems. The first is that the control that the head teacher of the school had in ensuring families handed in the surveys on paper is diluted with the online surveys. The families only receive instructions with a link to access the survey and a password, and the head teacher has no physical means of controlling completion of this process. Secondly, families feel less pressure to complete the survey online than when their children had to return the survey completed on paper. In addition, the online survey can produce a selection bias, since families or education schools with limited means or computer knowledge have more difficulties completing

these surveys. In fact, since 2018 when online surveys were introduced, the percentage of available surveys has decreased notably, especially in household surveys.

In the 2016-2017 academic year, 56,172 students from 785 schools participated in the evaluation of the 4th year of ESO[5]. Of these schools, 520 had external examiners and correction, while in the rest (265) this was internal[6]. Regarding the ownership of the schools, 303 were state schools (39%) and 482 were private (61%). However, state schools are larger than private ones, with 29,010 students from state schools (52% of the total), compared to 27,162 students from private schools (48%). In the analysis carried out in the following section, a distinction is made between the results of the four evaluated competencies: Competency in Spanish Language (CLE), Competency in English Language (CLI), Competency in Mathematics (CM) and Social and Civic Competency (CSC). The number of students in each competency may be different as there are students who did not take all the tests. Taking this into account and the fact that not all the students answered the questionnaires, the final number of students in the database, as shown in Table 1, is a maximum of 32,156 (57% of the total).

One last consideration is made regarding the Mathematics competency test. The Curriculum for 4th year of ESO differentiates between two mathematics subjects; i) Mathematics oriented towards Academic Teachings, aimed at achieving the necessary skills to study Baccalaureate, and; ii) Mathematics oriented to Applied Teaching, aimed at achieving the competencies necessary to study Vocational Training. Most of the students are enrolled in Academic Mathematics (48,820, 87% of the total), compared to 7,329 students enrolled in Applied Mathematics (13%). The tests are different for each student, the Academic Mathematics test being more demanding.

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[5]There were 12 international education schools that did not participate in the evaluation.

[6] The percentage of schools with external examiners and correction was very high that year (66%) because in that course all the schools of the DAT Madrid Capital participated externally, and the latter has a large number of schools in 4th year of ESO (370 which, representing 47%, is almost half of the total).

4.2 Descriptive analysis

4.2.1 Response variable

As mentioned previously, the response variable of this research is the marks obtained by the 4th year ESO students during the 2017 Competency Tests. There are four tests under analysis: Spanish language competency, English language competency, Mathematics competency[7] and Social and Civic competency. As can be seen in Table 1, with greater or lesser dispersion, the variables are grouped around a mean of slightly higher than 500 points, the competencies related to English and Spanish languages being higher than that of Mathematics or Social and Civic competency.

Table 1. Main descriptives in response variables

Competency	Number of observations	Mean	Standard deviation	Minimum	Maximum
Spanish language	32156	510.45	83.65	68.42	775.86
English language	32152	510.08	93.38	240.71	734.80
Mathematics	31817	505.08	98.72	159.87	1182.01
Social and Civic	31779	507.42	96.35	158.35	1015.61

Source: compiled by the authors from Competency tests, 2017.

Using these qualifications and with the criteria considered by the Community of Madrid, a second response variable is applied that orders the marks by categories. This criterion divides the test marks for the different skills into 7 groups and is adapted for each skill according to the marks obtained in the 2016-2017 tests. The objective of this variable is to estimate an ordinal logistic multilevel model. Table 2 shows information on the number of cases, mean and deviation for each category of the new ordinal response variable in each competency.

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[7] For the competency in Mathematics, the two types (Academic Mathematics and Applied Mathematics) are evaluated.

Table 2. Percentage of cases by level of competency and descriptive of ordinal response variables

Competency level	Spanish language	English language	Mathematics	Social and Civic
1 (Minimum)	2.5 %	3.0 %	9.2 %	4.7 %
2	4.2 %	12.5 %	10.8%	10.2 %
3	14.9%	19.6 %	19.0 %	21.3%
4	40.9 %	29.7 %	31.2%	26.9 %
5	27.2 %	25.5%	16.2%	20.5%
6 (Maximum)	10.3%	9.7 %	13.6%	16.4%
Mean	4.17	3.92	3.78	3.99
Standard deviation	1.10	1.29	1.50	1.42

Source: compiled by the authors from Competency tests, 2017.

Note: The values of the variables that have been stated as 1 to 6 correspond to categories of marks that begin with a minimum mark of 300 points and whose limits diverge depending on each competency in question.

4.2.2 Variable Treatment: Bullying

The variable *treatment* comes from 3 divergent sources of information. Given that the competency test involves surveys completed by head teachers, teachers and students, we are able to compile and code questions from their responses that can help us to better understand the phenomenon. The discussion about who best reports bullying cases is still inconclusive. Babarro *et al*. (2014) clearly show that the highest validity for this variable is obtained when it is hetero-informed, that is, informed by an external actor such as a head teacher or a teacher. Their argument is that there would be no "false positives" because head teachers and teachers correctly understand the concept of bullying and know how to identify it better than students. However, a head teacher will not always have information about the behaviour of the students directly, and there may be cases of underestimation of the problem, while the teacher is in greater contact with the conflict that could occur in the classroom. Therefore, having these 3 sources available offers the opportunity to create variables from each of them and explore whether or not there are significant differences in the perception of the phenomenon when changing from self-reported to hetero-reported.

Specific questions taken from the questionnaires are used to approximate the phenomenon: questions P9-B for students, P16-D for teachers and P14-F for head teachers.

In the case of students, they are asked to give a value to the statement "I feel safe at school". Responses can vary on a 4-point scale (totally disagree, slightly agree, agree, and strongly agree). In our opinion, this ordinal variable is a valid approximation of the problem since the feeling of insecurity is usually a common characteristic of people with a greater probability of being victimized.

With reference to the aforementioned questions on "Intimidation or insults between students or other types of school-related harassment (social networks, emails, etc.)", head teachers and teachers are asked: To what extent is each of the following situations a problem for your school? The answer is also ordinal with a 4-point scale (not a problem, a mild problem, a moderate problem, a serious problem).

When coding our variables we use 3 criteria to create 3 different variables. The first defines a student who answers feeling safe in their school is one who does not suffer bullying and is given a "0", while if the answer is any of the other categories the student is given a "1". In the case of teachers and head teachers, the answer "Not a problem" is coded as "0" and the others as "1". A binary bullying variable is produced for each data source.

The second criterion continues categorizing as zero the responses "Strongly agree" and "Not a problem", but coding as "1" intermediate responses and as "2" for "Not at all agree" and "a serious problem". In this way, those schools that have greater problems with bullying as well as students who feel less safe have the highest scale.

The third criterion uses the variables with their ordinal survey response from 0 to 3, where zero represents students who feel safe or schools where there are no bullying problems, and numbers 1-3 representing a greater presence of bullying. To summarize, we analyse bullying from 3 different perspectives and using 3 criteria to establish some exploratory relationships.

The information from the first criterion used, which is presented in Table 3, shows that 65.3% of students do not feel completely safe in their schools and that approximately 72% of head teachers and teachers assess that bullying is at least a minor problem.

Table 3. Binary Bullying

	Students	Teachers	Head teachers
Bullying = 0	34.7	28.3	28.3
Bullying = 1	65.3	71.7	71.7
Mean	0.65	0.72	0.72
Standard deviation	0.476	0.450	0.451

Source: compiled by the authors from Competency tests, 2017.

When we use the second criterion to analyse bullying, as shown in table 4, we see that 3.6% of the students register that they do not feel at all safe in their class and school, while 1.6% of head teachers estimate that the problem of bullying is very serious. However, 16.9% of teachers consider this an even greater problem. Most of the data are grouped on scale 2, which includes feeling quite safe to unsafe or being in a school with mild to moderate bullying problems.

Table 4. Bullying on 3-point scale

	Students	Teachers	Head teachers
Bullying = 0	34.7	28.3	28.3
Bullying = 1	61.7	54.3	70.0
Bullying = 2	3.6	16.9	1.6
Mean	0.69	0.88	0.73
Standard deviation	0.535	0.666	0.478

Source: compiled by the authors from Competency tests, 2017.

The third criterion for analysing bullying shows similar results to the second. The teachers´ response differs from that of the other informants. In Table 5, we see that in addition to 3.6% of the students being not at all sure, 12.6% feel unsafe and 49.2% quite safe. Of the head teachers, 17.9% consider bullying to be a very to moderately serious problem and another 52.2% see it as slightly serious. The teachers, however, identify that 16.5% of the schools have a moderate problem and 37.8% a slight problem.

Table 5. Bullying on 4-point scale

	Students	Teachers	Head teachers
Bullying = 0	34.7	28.3	28.3
Bullying = 1	49.2	37.8	52.2
Bullying = 2	12.6	16.5	17.9
Bullying = 3	3.6	16.9	1.6
Mean	0.85	1.22	0.93
Standard deviation	0.770	1.041	0.722

Source: compiled by the authors from Competency tests, 2017.

Association between the response variable and the bullying variable

For insight into the theoretically negative link between performance and the level of bullying that a student self-perceives or that prevails in a school, we perform a chi-square correlation and independence test between the variables. The correlation coefficients give negative values in all the associations and the test rules out the independence between the variables. This encourages us to continue exploring the relationship between these variables[8].

4.2.3 Control variables

For control variables, a series of variables are chosen at the student or student family level, at teacher level and at head teacher level that seem relevant for controlling the link between bullying and performance, either because one of the two variables, or both, are affected.

At the student level, variables such as sex, the nationality of the student, as well as that of the father and mother, and absenteeism in the previous quarter are chosen as a

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[8] The results of these tests are available to the reader by request.

dichotomous variable. Repetition of the course is measured on two different scale variables: the first collects the cases of repetition as 0 and 1, while the second has a scale from 0 to 2, being 0 for non-repetitions, 1 for a single repetition in either primary or secondary school and 2 for more than 1, regardless of level.

At teacher level, the variables chosen are the sex, the teacher's employment situation (permanent position, contract awaiting permanent placement, intern, open-ended contract, by course), years of experience and experience at the school, time commitment (full time, part time, shares the school), subject taught, training in the last 12 months especially if related to the management of student behaviour, and level of job satisfaction.

At head teacher level, we focus on the type of school (state, subsidized or private), number of teachers, pedagogical, administrative and managerial support staff at the school, number of students, and job satisfaction[9].

4.2. Study of the prevalence of bullying with respect to some of the characteristics of education schools

To study some characteristics of the prevalence of the phenomenon we use cross tables and tests of independence between the chosen control variables and the treatment variables. In the first instances, most of the variables show dependence on the treatment variable, except for the student's sex and the mother's nationality, which seem to have independence.

As we are interested in studying the prevalence of the phenomenon with greater specificity according to some characteristics of the school, we undertake a more significant exploration between bullying and some variables from the head teacher, such as the type of school and size, using the number of enrolled students. To simplify this variable we use the quartiles in order to indicate a scale of four sizes.

It can be seen that the phenomenon, measured as "the existence or not of cases" and reported by any of the 3 actors, which we can see in Table 6, is more prevalent in state education schools and subsidized schools than in private ones. In the case of students, 71.08% of those who attend state schools do not feel completely safe while in subsidized schools this is 62.77%, and in private schools just over 50%. Teachers and head teachers show similar trends, with them making the majority of reports of bullying, although it is

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[9]In the Annex, Table A2 shows all the variables used for the estimates made in this study.

remarkable that, in the survey, only 43% of head teachers of private schools report bullying as a mild to very serious problem, while approximately 57% do not see it as a problem. If we look at the head teachers of state education schools, 83% consider it a problem compared to 17% who do not.

Table 6. Bullying by type of education school

School/Bullying	Student (%Yes)	Teacher (%Yes)	Head teacher (%Yes)
State	71.08%	75.53%	83.02%
Subsidized	62.77%	69.99%	65.11%
Private	50.12%	62.06%	43.07%

Source: compiled by the authors from Competency tests, 2017.

Lastly, comparing whether or not size could be a variable for consideration, we carry out a frequency table (Table 7) and an independence test, which reveal the existence of a relationship between the variable, rejecting the null hypothesis of independence in each of the approximations. The frequency table shows that the influence of size of the school on the presence of bullying varies, depending on the person who reports it. In the case of students, the proportion of students who feel unsafe is above 59%. In the case of teachers aware of bullying, the proportion increases in education schools of all sizes, to over 64% and, in particular in sizes 2 and 4, over 75%. The proportion of head teachers aware of student bullying is above 63% in all sizes, but in size 3, more than 80% of head teachers consider bullying a problem.

Table 7: Bullying by size of education school

Size/ Number of students	Student (%Yes)	Teacher (%Yes)	Head teacher (%Yes)
Size 1: < 587	65.06%	64.43%	63.73%
Size 2: 587-786	69.08%	75.45%	75.55%
Size 3: 787-1017	68.27%	68.88%	80.72%
Size 4: > 1017	59.37%	75.23%	63.60%

Source: compiled by the authors from Competency tests, 2017.

Although the impact of size is less precise than that of the type of school, the independence tests show a relationship and we therefore consider both variables relevant in the analysis.

4.3. Methodological approach

Multilevel Methodology

Multilevel models are an extension of linear regression models that enable estimation of submodels that independently consider information about the individual and that of the group to which they belong. Linear regression considers that individual variables are those that can explain the behaviour of a person, omitting the influence that belonging to a specific group could have on their behaviour. Multilevel models emerged to correct this. They consider multiple levels within a hierarchy and each of them provides information independently (Martínez-Garrido and Murillo, 2013; Murillo, 2005). In this way, it is possible to control a series of variables at the individual and group level that allow us to isolate the effect of bullying on the assessment marks of young people in the sample.

More specifically, with regard to educational research, multilevel models allow the information coming from the student to be considered as level 1, information from the class as level 2 and that from the education school as a third hierarchical level (Martínez-Garrido and Murillo, 2013). In our approach, a hierarchical variable is created in line with this idea. With the interaction of the variables Type of school (State, Subsidized and

Private) and the variable Size of school, which divide the schools into 4 groups according to the number of students enrolled, 12 different groups are identified.

In the approximation the Multilevel Fixed Effects Model is used, which provides a fixed coefficient for all subjects. The model responds to the following equation:

$$Y_{ij} = \gamma_0 + \gamma_1 x_{ij} + \gamma_j z_j + \mu_{0j} + \varepsilon_{ij}$$

where γ_0 represents the overall intercept or common average of all the observations, $\gamma_1 x_{ij}$ brings together the fixed effects of the chosen level 1 variables, $\gamma_j z_j$ the fixed effects of the higher level variables and, finally, μ_{0j} and ε_{ij} estimate residues at the group and individual level (Snidjer and Bosker, 2011).

We use the xtmixed command to estimate the approximation of the aforementioned models with bullying as the central variable to be considered in the different criteria analysed. In this way we can study the impact of the variable on the qualifications of the competencies and we can analyse it with respect to the mean of the tests.

A multilevel model with a random slope and has also been estimated, using Bullying 4-level Students as a treatment variable, to identify differences in impact according to the type and size of schools. A random slope model allows a explanatory variable to have a different effect for each group.

$$Y_{ij} = \gamma_0 + \gamma_{1ij} x_{1ij} + \mu_{0j} + \mu_{1ij} x_{1ij} + \varepsilon_{ij}$$

where γ_{1ij} varies for each group and μ_{1ij} represents a new type of group residuals that also depend on the explanatory variable (Snidjer and Bosker, 2011).

After performing the post-estimation of the model, we can estimate the random slopes for the different groups based on the impact of the 4-level bullying variable in order to reflect how the effect of the variable changes based on the type and size of education school in which the student is enrolled. We also use *xtmixed* to estimates this approximation.

We then perform an estimation of an ordered logistic multilevel model which we compare, with a multilevel model similar to the previous one, the response variable in categories to determine, through the ODDS values obtained from the estimation with the binary bullying variable, the relative probability of student marks being affected in an environment where bullying prevails compared to a student who is in a school where there is no bullying. To estimate this we use the *meologit* command. For all estimates we use STATA version 14 software.

Quantile Regression

We are also interested in studying whether there are divergences in the impact of bullying on students who show lower and higher academic performance. In order to study this question, we propose the use of Quantile Regression. This methodology consists of estimating a model that is specified as follows:

$$Y_i = X_i \beta_0 + \mu_{qi} \; Quant_q(yi/xi): X_i \beta_0 \; donde \; q \bullet \; (0,1)$$

where q represents the value of the quartile that is specified as a function of covariates (Buchinsky, 1998). Y_i, in our case, is the value of the tests in the 4 different competencies and $X_i \beta_0$ is the vector of explanatory variables which have been used at different levels (student, teacher, head teacher). The error term is a zero mean error whose distribution is not specified, but is assumed to satisfy the constraint $Quant_q (\mu_{qi}/x_i) = 0$. The command for the estimation of this model will be *qreg* and it is estimated with STATA 14 software.

5. Results

5.1 Results of multilevel regression with fixed effects and random slope.

Table 8 shows, in a summarized way, the results obtained for all the treatment variables created, explaining the coefficient that accompanies the variables of interest. The results indicate that the impact of the response variables has a negative association with bullying, which would verify the general hypothesis of researchers that one of the consequences of bullying is the reduction of academic performance. In addition, it would correspond to

the results presented by the articles mentioned above. To give a practical example of the results, a student who is in an environment of bullying may see his/her Spanish language score reduced by between 9.26 and 11.97 points, depending on the criterion with which the bullying variable is defined.

Table 8: Results of the multilevel estimation[10]

Variables	Spanish language	English language	Mathematics	Social and Civic
Binary bullying students	-10.91**	-10.73**	-10.19**	-13.96**
Binary bullying teacher	-7.44**	-8.71**	-5.47**	-3.55
Binary bullying head teacher	-2.25**	-8.80**	-6.16**	-13.09**
Bullying 3 levels students	-11.97**	-10.43**	-9.47**	-15.32**
Bullying 3 levels teacher	-2.22**	-1.39	-2.17	-8.03**
Bullying 3 levels head teacher	-3.06**	-8.05**	-5.41**	-3.99**
Bullying 4 levels students	-9.26**	-7.61**	-6.16**	-11.55**
Bullying 4 levels teacher	-0.86	-8.34**	-2.66**	-5.32**
Bullying 4 levels head teacher	-2.71**	-6.29**	-4.45**	-6.35**
Control Variables	Yes	Yes	Yes	Yes
N	32.156	32.152	31.817	31.779

(**): Coefficients significant at 95%

It is also worth noting the way in which the three perspectives (student, teacher, head teacher) can diverge. If we observe, for example, the impact of bullying on the Spanish language competency, we can see that, when considering the variable as binary, the coefficient corresponding to the student shows greater intensity, followed by the teacher and then the head teacher. However, when treating the variable as frequencies of 3 or 4 categories, we see how the student's perspective continues to show a greater impact on the marks than the others, while the head teachers and teachers change positions. It cannot be inferred with certainty which one of the three perspectives is more accurate, but it is

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[10] A different multilevel estimation has been made for each coefficient shown in table 8 and the complete results are available upon request.

clear that there are differences when it comes to perceiving the phenomenon and the impact it can generate.

To gain a better perspective on this reduction in marks, we calculate the percentage that each would represent for the average of each competency. In the case of students, the percentages vary between 2% and 3.8%, while in the case of teachers and head teachers the value falls to 0.5% and 2.6%. However, these values may increase depending on the criterion with which the bullying variable has been constructed, and may intensify as the violence escalates. It must be remembered that these values only correspond to the isolated bullying factor and do not consider other factors that could reduce performance such as socioeconomic, family or cultural factors.

When estimating the slopes for each hierarchical group using Binary 4-levels Students as treatment variable (Table 9), we see that these vary according to the type and size of the school, as well as the competency analysed. In the case of the Spanish language competency, the impact of bullying is greater for certain sized state and subsidized schools than it is for any private education school regardless of its size. The English language competency accentuates this pattern even more, showing a greater effect in state and subsidized schools as they increase in size, than in private schools in general. This behaviour changes radically in the Mathematics competency where, for any size, the reduction in the score is greater in private schools compared to the other two types of schools. The Social and Civic competency, on the other hand, shows greater reductions in marks in private and subsidized schools than in state schools, regardless of size.

Table 9: Estimation table of the random slopes for each hierarchical group[11]

Hierarchical Group	Spanish language	English language	Mathematics	Social and Civic
State - less than 587 students	-7.46	-10.83	-5.99	-9.33
State - between 587-787 students	-5.81	-10.82	-5.61	-9.11
State - between 787-1017 students	-14.49	-10.88	-5.66	-10.34
State – more than 1017 students	-4.95	-11.37	-5.26	-10.16
Subsidized – less than 587 students	-9.01	-11.37	-6.75	-11.97
Subsidized – between 587-787 students	-12.95	-11.31	-6.79	-12.96
Subsidized - between 787-1017 students	-9.30	-11.42	-6.48	-11.33
Subsidized – more than 1017 students	-8.32	-10.17	-7.34	-13.42
Private – less than 587 students	-8.65	-8.52	-9.08	-14.41
Private - between 587-787 students	-7.34	-7.36	-11.46	-17.13
Private - between 787-1017 students	-7.36	-7.79	-12.36	-16.62

[11] The complete results are available upon request.

Private – more than 1017 students	-8.87	-7.73	-8.59	-15.91
Control Variables	Yes	Yes	Yes	Yes
N	32.156	32.152	31.817	31.779

5.2 Results of Ordinal Multilevel Regression

We now present Table 10 with the coefficients and the ODDS associated with the multilevel estimates with the response variable in categories, including control variables.

Table 10: Coefficients and ODDS associated with the Ordered Multilevel Estimation[12].

Variables	Spanish language	English language	Mathematics	Social and Civic
ODDS Bullying student	0.70**	0.77**	0.83**	0.73**
ODDS Bullying teacher	0.79**	No sig.	No sig.	0.87**
ODDS Bullying head teacher	0.75**	0.81**	0.83**	0.89**
Control Variables	Yes	Yes	Yes	Yes
N	32.156	32.152	31.817	31.779

(**) Coefficients significant at 95%

The results show negative coefficients. This confirms the inverse relationship between the variables. In this analysis we focus on the ODDS values which give the probability that a student will reduce his/her performance due to the effect of bullying compared to a student who is in an environment where there is no bullying. The relationship of the English Language and Mathematics grades with the bullying reported by teachers is not significant.

From these ODDS, we can conclude that a student in an environment of bullying is 29.95% (1-0.7005) more likely to reduce their performance in Spanish, according to the students themselves, and by a percentage greater than 20.85% and 24.95% according to teachers and head teachers, respectively. In the case of English language, the probability

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[12] The complete results are available upon request.

of reducing marks is 23.28%, according to students, and 19.03% according to head teachers. The percentages of reduction in marks for Mathematics are 17.14% and 16.84%, respectively. Finally, for the score in Social and Civic studies, the percentages are 27.27% (students), 22.66% (teachers) and 21.51% (head teachers).

5.3 Quantile Regression Results

In order to carry out this regression and to be able to make comparisons between the different groups, the 25, 50 and 75 quartiles of the sample were taken as reference with all the observations that had been used in the two previous estimates. As a variable of interest we take Binary bullying students and including control variables. Table 11 shows the main results.

Table 11: Quantile Regression Results[13]

	Spanish language	English language	Mathematics	Social and Civic
0.25	-8.28**	-16.22**	-8.83**	-19.17**
0.50	-13.52**	-17.17**	-12.22**	-19.17**
0.75	-11.80**	-18.15**	-17.88**	-18.38**
Control Variables	Yes	Yes	Yes	Yes
N	32.156	32.152	31.887	31.779

(**) Coefficients significant at 95%

As can be seen in the results, the marginal effect of the coefficient of the bullying variable has a negative effect in the 3 reference quartiles, although its behaviour varies according to the competency evaluated.

In the case of Spanish language, the impact seems greater on students who are in the school of the distribution than on those who are at the edges, increasing between the 25th and 50th quartile and decreasing by the 75th. In the case of proficiency in English language, the effect of the impact increases with the quartiles, showing a greater impact on students who have better performance than on those who have lower performance.

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[13] The complete results are available upon request.

In the Mathematics competency, we see a situation similar to that which occurs in English language, showing a greater decrease in performance in the upper quartiles. Social and Civic competency is the competency that shows the least divergences between the analysed quartiles, with a slight reduction in impact among the best performing students. In conclusion, although the impact is always negative, the marginal effect of bullying, taking quartiles as a reference, varies depending on the competency analysed.

6. Conclusions

Bullying is a situation of violence that affects all students, especially victims, and that causes physical, emotional and relational damage that can have lifelong repercussions. One of the most important effects of bullying, although little explored, is the reduction in academic performance, a reduction that decisively affects the development of students and future opportunities to access the labour market.

This article analyses the effect that bullying has on a student´s ability to learn, an analysis that, to date, has not been carried out in depth in the Spanish environment. For this, a database is used that has two sets of information. The first includes the results of the evaluations carried out on all 4th year ESO students on their skills in language (Spanish and English), Mathematics, Science and History. The second includes numerous variables of the context of the school and the economic and social contexts of these students, obtained through questionnaires that, together with the evaluations on academic competencies, are given to the students themselves, their parents, their teachers and the head teacher of the school. The combination of both sets of information allows the academic performance of students to be related to their personal and social characteristics, among which is the presence of bullying. An added advantage of this database is that three actors are asked about the existence of bullying; students, teachers and the head teacher of the school. The literature to date disputes who, among these three actors, best reports bullying cases. Having such information for the three actors allows us to better analyse this phenomenon and explore whether or not there are significant differences in the perception of the phenomenon when changing from self-reported to hetero-reported.

One of the main conclusions of this study is that it confirms the negative relationship between bullying and students' academic performance. Numerous studies had already confirmed this, although our study is one of the first to be carried out in the Spanish educational environment and our statistical analyses has enabled more detailed conclusions to be drawn. Thus, regarding the impact on academic performance, our study verifies the significant existence of a negative impact on all the evaluated competencies. Our analysis enables us to measure the probability of a reduction in a student's academic performance due to the existence of bullying in the environment, a probability that varies depending on the competency evaluated. Thus, in the Spanish language competency, the probability varies between 20-30%, in the English language competency between 19-23%, in the Mathematics competency the probability is 17% and, finally, in the Social and Civic competency, it varies between 21-27%. In addition, differences are seen on the level of impact on a student´s performance, depending on the competency analysed and the previous ability of the student. It is worth noting that, in the case of English language or Mathematics, the effect could be greater among the best-performing students, while Spanish language has a greater impact on quartile 50 and Social and Civic competency is mostly homogeneous.

Our study also shows that the problem of harassment is more prevalent in state and subsidized education schools than in private schools. Thus, regardless of the informant, in more than 70% of state schools there is bullying, the same happens in more than 60% of subsidized schools, compared to only 50% in private ones. Another conclusion is that the size of the school is related to this problem, although it is more difficult to identify and depends on who reports the presence of bullying (student, teacher or head teacher), that is, the influence of size changes according to who reports the bullying. This confirms that there are differences when it comes to perceiving the phenomenon between the different actors involved (students, teachers, head teachers) and the impact it can generate. Specifically, it appears that the effect on performance is less if bullying is hetero-reported (teachers and head teachers) than if it is self-perceived (students), a result in line with the conclusions obtained in other articles.

One aspect to be taken into account in future research is to investigate the mechanisms that teachers have for detecting bullying, and whether or not they have received training to do so. Another issue to analyse is the effect that confinement and suspension of face-

to-face classes in favour of virtual classes may have caused on the prevalence of bullying and cyberbullying. Intuitively, we can assume that there would be a reduction in the bullying and a potential growth of virtual bullying, an aspect that will have to be corroborated with databases of future surveys or tests.

Bullying is a phenomenon that is causing increasing concern among students, parents, teachers and head teachers. As a result, academic authorities are beginning to develop programs to confront this phenomenon of violence in schools. The conclusions of this study could be a very useful guide for future educational policy actions. One of the main advantages of the database used in this study is that, as bullying is a phenomenon that affects different actors, having the point of view of the three main actors in this problem (students, teachers and head teachers) enriches the analysis. The wealth of this database allows new research to be carried out in the future, delving into other characteristics or opinions of these actors, seeing the evolution over time of the bullying problem (since these evaluations are carried out every year), or evaluating the effectiveness of educational policies to combat bullying.

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Annex

Table A1: Summary of the Literature Review

Year	Authors	Country	Methodology	Conclusion
1999	Gronna and Chin-Chance	Canada	Multi-level	Negative effect on academic performance in less safe environments
2004	Bustamante *et al.*	Chile	Descriptive-Correlational	Existence of an inverse relationship
2010	Konishi *et al.*	Various countries	Multi-level	Negative relationship seen in maths performance and reading comprehension
2011	Piñero Ruiz *et al.*	Spain	ANOVA	Performance differences depending on the role played
2011	Juvonen *et al.*	USA	Multi-level	Negative relationship between victimization and performance
2012	Gutiérrez *et al.*	Chile	Multi-level	Negative relationship seen in maths performance
2012	Frugård Strøm *et al.*	Norway	Multi-level	Relationship between schools with a high level of bullying and poorer performance
2013	Hammig and Jozkowski	USA	Multinomial Logistic Regression	Suspended students more likely to have been bullied in the previous year
2013	Lacey and Cornell	USA	Multiple Regression	Prevalence of bullying reduced grades in almost all subjects
2014	Gálvez-Sobral *et al.*	Guatemala	Multiple Regression	As the aggression reported increases, reading results decrease
2017	Al-Raqqad *et al.*	Jordania	Descriptive Analysis	Significant negative impact on performance
2018	Ottem	USA	Bivariant Regression	Negative impact on marks and self-esteem in Mathematics

Table A2: Control variables

Variable	Level / Who Responds	Type	Description of options	Mean	Standard deviation	Min.	Max.
Marks in Spanish language competency	Response	Continuous		510.45	83.65	68	775
Marks in English language competency	Response	Continuous		510.08	93.38	240	734
Marks in Mathematics competency	Response	Continuous		505.08	98.72	159	1182
Marks in Social and Civic competency	Response	Continuous		507.42	96.35	0	1015
Binary bullying students	Treatment	Nominal	0: I feel safe; 1: I feel a little to very unsafe	0.65	0.476	0	1
Binary bullying teacher	Treatment	Nominal	0: not serious; 1: is mild to serious	0.72	0.45	0	1
Binary bullying head teacher	Treatment	Nominal	0: not serious; 1: is mild to serious	0.72	0.451	0	1
Bullying 3 levels students	Treatment	Ordinal	0: I feel safe; 1: I feel little to quite safe; 2: I feel unsafe	0.69	0.535	0	2
Bullying 3 levels teacher	Treatment	Ordinal	0: not serious; 1: mild to moderate problem; 2: serious	0.88	0.666	0	2
Bullying 3 levels head teacher	Treatment	Ordinal	0: not serious; 1: mild to moderate problem; 2: serious	0.73	0.478	0	1
Bullying 4 levels students	Treatment	Ordinal	0: I feel safe; 1: I feel quite safe; 2: I feel a little unsafe; 3: I feel unsafe	0.85	0.77	0	3
Bullying 4 levels teacher	Treatment	Ordinal	0: not serious; 1: slight problem; 2: moderate problem; 3: serious	1.22	1.041	0	3
Bullying 4 levels head teacher	Treatment	Ordinal	0: not serious; 1: slight problem; 2: moderate problem; 3: serious	0.93	0.722	0	1
Sex	Students	Nominal	0: Male, 1: Female	0.51	0.5	0	1
Nationality student	Students	Nominal	1: Spain, 2: other country	1.09	0.25	1	2
Nationality mother	Students	Nominal	1: Spain, 2: other country	1.2	0.402	1	2
Nationality father	Students	Nominal	1: Spain, 2: other country	1.19	0.395	1	2
Repetition of course_1	Students	Ordinal	0: No, 1: Yes	0.13	0.339	0	1
Repetition of course_2	Students	Ordinal	0: No, 1: Yes, one course, 2: Yes, two courses	0.18	0.485	0	2
Absentism	Students	Ordinal	No Absence: 0; Absence: 1	0.28	0.451	0	1
Sex	Teacher	Nominal	0: Male, 1: Female	0.61	0.488	0	1

Labour situation as a teacher	Teacher	Ordinal	1: permanent position, 2: contract awaiting permanent placement, 3: intern, 4: open-ended contract, 5: by course	2.95	1.375	1	5
Years of experience	Teacher	Discrete quantity		17.3	10.216	0	47
Years of experience in the school	Teacher	Discrete quantity		10.4657	9.52218	0	43
Time commitment	Teacher	Ordinal	1: full time, 2: part time, 3: shares the school	1.1	0.321	1	3
Subject	Teacher	Nominal	Competence in Applied Mathematics, Competence in Academic Mathematics; Linguistic competence in Spanish, Linguistic competence in English, Social and Civic Competence	Competency in Applied Mathematics: 21.9, Competency in Academic Mathematics: 5.2; Linguistic competence in Spanish: 21.4, Linguistic competence in English: 22.9, Social and Civic Competence: 23.3			
Training in the last 12 months	Teacher	Nominal	1: YES; 2; NO	1.2	0.399	1	2
Type of training	Teacher	Ordinal	In particular, P10_F: Training related to student behaviour. 1: Yes, 2: No	1.48	0.499	1	2
Self-perception at work	Teacher	Ordinal	From do not agree to strongly agree (1-4): Overall, am I satisfied with my work?	3.15	0.82	1	4
Type of school	Head teacher	Ordinal	1: State; 2: Subsidized; 3: Private	1.60	0.65	1	3
Number of teachers	Head teacher	Discrete quantity		43.93	21.1	0	99
Other positions: Teachers of Pedagogical Support	Head teacher	Discrete quantity		3.38	4.979	0	64
Other positions: Administrative Teachers	Head teacher	Discrete quantity		3.49	2.405	0	21
Other positions: Management team	Head teacher	Discrete quantity		5.51	1.917	0	16
Number of students	Head teacher	Discrete quantity		823.45	500.59	4	2638
Use of Books-Home Computer	Families	Ordinal	Choose on a scale of 1-4 (never or almost never to almost every day or every day) the use of: reading books (paper or digital)	3,17	0.976	1	4
Use of Books-Home Computer	Families	Ordinal	Choose on a scale of 1-4 (never or almost never to almost every day or every day) the use of: daily press (paper or digital)	3,15	1.114	1	4

Use of Books-Home Computer	Families	Ordinal	Choose on a scale of 1-4 (never or almost never to almost every day or every day) the use of: encyclopedias or reference books (paper or digital)	2.76	1.042	1	4
Use of Books-Home Computer	Families	Ordinal	Choose on a scale of 1-4 (never or almost never to almost every day or every day) the use of: Computer or tablet, internet	3.88	0.418	1	4
Use of Books-Home Computer	Families	Ordinal	Choose on a scale of 1-4 (never or almost never to almost every day or every day) the use of: internet	3.96	0.266	1	4
How many ICT devices do you have?	Families	Discrete quantity		7.81	3.334	0	20
Number of people living at home	Families	Discrete quantity		5.02	1.007	2	15
Books at home	Families	Ordinal	(1): 0-10 books, (2): 11-50 books, (3): 51-100 books, (4): 101-200 books, (5):over 200				
Hours spent studying and doing homework	Families	Discrete quantity		11.6633	7.90527	0	50
Level of studies: Mother	Families	Ordinal	Levels of study for Mother and Father offers 10 categories from did not go to school to doctorate and not applicable	5.25	1,821	1	10
Level of studies: Father	Families	Ordinal	Levels of study for Mother and Father offers 10 categories from did not go to school to doctorate and not applicable	5.11	1.917	1	10
Work situation: Mother	Families	Ordinal	1: Full-time salaried worker, 2: part-time salaried worker, 3: unemployed looking for work, 4: Retired, pensioner or rentier, 5: not having nor looking for paid employment, 6: not applicable	2	1.51	1	6
Work situation: Father	Families	Ordinal	1: Full-time salaried worker, 2: part-time salaried worker, 3: unemployed looking for work, 4: Retired, pensioner or rentier, 5: not having nor looking for paid employment, 6: not applicable	1.62	1.386	1	6

Job: Mother	Families	Ordinal	There are 13 categories ranging from never had a job to professionals, through unskilled or specialized workers, operators, small business owners, administrative, executive, etc. until not applicable (this question is answered by families as well)	8.53	3.383	1	13
Job: Father	Families	Ordinal	There are 13 categories ranging from never had a job to professionals, through unskilled or specialized workers, operators, small business owners, administrative, executive, etc. until not applicable (this question is answered by families as well)	8.39	3.428	1	13

2016

2016/1, Galletta, S.: "Law enforcement, municipal budgets and spillover effects: evidence from a quasi-experiment in Italy"

2016/2, Flatley, L.; Giulietti, M.; Grossi, L.; Trujillo-Baute, E.; Waterson, M.: "Analysing the potential economic value of energy storage"

2016/3, Calero, J.; Murillo Huertas, I.P.; Raymond Bara, J.L.: "Education, age and skills: an analysis using the PIAAC survey"

2016/4, Costa-Campi, M.T.; Daví-Arderius, D.; Trujillo-Baute, E.: "The economic impact of electricity losses"

2016/5, Falck, O.; Heimisch, A.; Wiederhold, S.: "Returns to ICT skills"

2016/6, Halmenschlager, C.; Mantovani, A.: "On the private and social desirability of mixed bundling in complementary markets with cost savings"

2016/7, Choi, A.; Gil, M.; Mediavilla, M.; Valbuena, J.: "Double toil and trouble: grade retention and academic performance"

2016/8, González-Val, R.: "Historical urban growth in Europe (1300–1800)"

2016/9, Guio, J.; Choi, A.; Escardíbul, J.O.: "Labor markets, academic performance and the risk of school dropout: evidence for Spain"

2016/10, Bianchini, S.; Pellegrino, G.; Tamagni, F.: "Innovation strategies and firm growth"

2016/11, Jofre-Monseny, J.; Silva, J.I.; Vázquez-Grenno, J.: "Local labor market effects of public employment"

2016/12, Sanchez-Vidal, M.: "Small shops for sale! The effects of big-box openings on grocery stores"

2016/13, Costa-Campi, M.T.; García-Quevedo, J.; Martínez-Ros, E.: "What are the determinants of investment in environmental R&D?"

2016/14, García-López, M.A; Hémet, C.; Viladecans-Marsal, E.: "Next train to the polycentric city: The effect of railroads on subcenter formation"

2016/15, Matas, A.; Raymond, J.L.; Dominguez, A.: "Changes in fuel economy: An analysis of the Spanish car market"

2016/16, Leme, A.; Escardíbul, J.O.: "The effect of a specialized versus a general upper secondary school curriculum on students' performance and inequality. A difference-in-differences cross country comparison"

2016/17, Scandurra, R.I.; Calero, J.: "Modelling adult skills in OECD countries"

2016/18, Fernández-Gutiérrez, M.; Calero, J.: "Leisure and education: insights from a time-use analysis"

2016/19, Del Rio, P.; Mir-Artigues, P.; Trujillo-Baute, E.: "Analysing the impact of renewable energy regulation on retail electricity prices"

2016/20, Taltavull de la Paz, P.; Juárez, F.; Monllor, P.: "Fuel Poverty: Evidence from housing perspective"

2016/21, Ferraresi, M.; Galmarini, U.; Rizzo, L.; Zanardi, A.: "Switch towards tax centralization in Italy: A wake up for the local political budget cycle"

2016/22, Ferraresi, M.; Migali, G.; Nordi, F.; Rizzo, L.: "Spatial interaction in local expenditures among Italian municipalities: evidence from Italy 2001-2011"

2016/23, Daví-Arderius, D.; Sanin, M.E.; Trujillo-Baute, E.: "CO2 content of electricity losses"

2016/24, Arqué-Castells, P.; Viladecans-Marsal, E.: "Banking the unbanked: Evidence from the Spanish banking expansion plan"

2016/25 Choi, Á.; Gil, M.; Mediavilla, M.; Valbuena, J.: "The evolution of educational inequalities in Spain: Dynamic evidence from repeated cross-sections"

2016/26, Brutti, Z.: "Cities drifting apart: Heterogeneous outcomes of decentralizing public education"

2016/27, Backus, P.; Cubel, M.; Guid, M.; Sánchez-Pages, S.; Lopez Manas, E.: "Gender, competition and performance: evidence from real tournaments"

2016/28, Costa-Campi, M.T.; Duch-Brown, N.; García-Quevedo, J.: "Innovation strategies of energy firms"

2016/29, Daniele, G.; Dipoppa, G.: "Mafia, elections and violence against politicians"

2016/30, Di Cosmo, V.; Malaguzzi Valeri, L.: "Wind, storage, interconnection and the cost of electricity"

2017

2017/1, González Pampillón, N.; Jofre-Monseny, J.; Viladecans-Marsal, E.: "Can urban renewal policies reverse neighborhood ethnic dynamics?"

2017/2, Gómez San Román, T.: "Integration of DERs on power systems: challenges and opportunities"

2017/3, Bianchini, S.; Pellegrino, G.: "Innovation persistence and employment dynamics"

2017/4, Curto-Grau, M.; Solé-Ollé, A.; Sorribas-Navarro, P.: "Does electoral competition curb party favoritism?"

2017/5, Solé-Ollé, A.; Viladecans-Marsal, E.: "Housing booms and busts and local fiscal policy"

2017/6, Esteller, A.; Piolatto, A.; Rablen, M.D.: "Taxing high-income earners: Tax avoidance and mobility"

2017/7, Combes, P.P.; Duranton, G.; Gobillon, L.: "The production function for housing: Evidence from France"

2017/8, Nepal, R.; Cram, L.; Jamasb, T.; Sen, A.: "Small systems, big targets: power sector reforms and renewable energy development in small electricity systems"

2017/9, Carozzi, F.; Repetto, L.: "Distributive politics inside the city? The political economy of Spain's plan E"

2017/10, Neisser, C.: "The elasticity of taxable income: A meta-regression analysis"

2017/11, Baker, E.; Bosetti, V.; Salo, A.: "Finding common ground when experts disagree: robust portfolio decision analysis"

2017/12, Murillo, I.P; Raymond, J.L; Calero, J.: "Efficiency in the transformation of schooling into competences: A cross-country analysis using PIAAC data"

2017/13, Ferrer-Esteban, G.; Mediavilla, M.: "The more educated, the more engaged? An analysis of social capital and education"

2017/14, Sanchis-Guarner, R.: "Decomposing the impact of immigration on house prices"

2017/15, Schwab, T.; Todtenhaupt, M.: "Spillover from the haven: Cross-border externalities of patent box regimes within multinational firms"

2017/16, Chacón, M.; Jensen, J.: "The institutional determinants of Southern secession"

2017/17, Gancia, G.; Ponzetto, G.A.M.; Ventura, J.: "Globalization and political structure"

2017/18, González-Val, R.: "City size distribution and space"

2017/19, García-Quevedo, J.; Mas-Verdú, F.; Pellegrino, G.: "What firms don't know can hurt them: Overcoming a lack of information on technology"

2017/20, Costa-Campi, M.T.; García-Quevedo, J.: "Why do manufacturing industries invest in energy R&D?"

2017/21, Costa-Campi, M.T.; García-Quevedo, J.; Trujillo-Baute, E.: "Electricity regulation and economic growth"

2018

2018/1, Boadway, R.; Pestieau, P.: "The tenuous case for an annual wealth tax"

2018/2, Garcia-López, M.À.: "All roads lead to Rome ... and to sprawl? Evidence from European cities"

2018/3, Daniele, G.; Galletta, S.; Geys, B.: "Abandon ship? Party brands and politicians' responses to a political scandal"

2018/4, Cavalcanti, F.; Daniele, G.; Galletta, S.: "Popularity shocks and political selection"

2018/5, Naval, J.; Silva, J. I.; Vázquez-Grenno, J.: "Employment effects of on-the-job human capital acquisition"

2018/6, Agrawal, D. R.; Foremny, D.: "Relocation of the rich: migration in response to top tax rate changes from spanish reforms"

2018/7, García-Quevedo, J.; Kesidou, E.; Martínez-Ros, E.: "Inter-industry differences in organisational eco-innovation: a panel data study"

2018/8, Aastveit, K. A.; Anundsen, A. K.: "Asymmetric effects of monetary policy in regional housing markets"

2018/9, Curci, F.; Masera, F.: "Flight from urban blight: lead poisoning, crime and suburbanization"

2018/10, Grossi, L.; Nan, F.: "The influence of renewables on electricity price forecasting: a robust approach"

2018/11, Fleckinger, P.; Glachant, M.; Tamokoué Kamga, P.-H.: "Energy performance certificates and investments in building energy efficiency: a theoretical analysis"

2018/12, van den Bergh, J. C.J.M.; Angelsen, A.; Baranzini, A.; Botzen, W.J. W.; Carattini, S.; Drews, S.; Dunlop, T.; Galbraith, E.; Gsottbauer, E.; Howarth, R. B.; Padilla, E.; Roca, J.; Schmidt, R.: "Parallel tracks towards a global treaty on carbon pricing"

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2018/21, Montolio, D.; Taberner, P. A.: "Gender differences under test pressure and their impact on academic performance: a quasi-experimental design"

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2018/23, Ramos, R.; Sanromá, E.; Simón, H.: "Wage differentials by bargaining regime in Spain (2002-2014). An analysis using matched employer-employee data"

2019

2019/1, Mediavilla, M.; Mancebón, M. J.; Gómez-Sancho, J. M.; Pires Jiménez, L.: "Bilingual education and school choice: a case study of public secondary schools in the Spanish region of Madrid"

2019/2, Brutti, Z.; Montolio, D.: "Preventing criminal minds: early education access and adult offending behavior"

2019/3, Montalvo, J. G.; Piolatto, A.; Raya, J.: "Transaction-tax evasion in the housing market"

2019/4, Durán-Cabré, J.M.; Esteller-Moré, A.; Mas-Montserrat, M.: "Behavioural responses to the re)introduction of wealth taxes. Evidence from Spain"

2019/5, Garcia-López, M.A.; Jofre-Monseny, J.; Martínez Mazza, R.; Segú, M.: "Do short-term rental platforms affect housing markets? Evidence from Airbnb in Barcelona"

2019/6, Domínguez, M.; Montolio, D.: "Bolstering community ties as a means of reducing crime"

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2019/8, Gómez-Fernández, N.; Mediavilla, M.: "What are the factors that influence the use of ICT in the classroom by teachers? Evidence from a census survey in Madrid"

2019/9, Arribas-Bel, D.; Garcia-López, M.A.; Viladecans-Marsal, E.: "The long-run redistributive power of the net wealth tax"

2019/10, Arribas-Bel, D.; Garcia-López, M.A.; Viladecans-Marsal, E.: "Building(s and) cities: delineating urban areas with a machine learning algorithm"

2019/11, Bordignon, M.; Gamalerio, M.; Slerca, E.; Turati, G.: "Stop invasion! The electoral tipping point in anti-immigrant voting"

2020

2020/01, Daniele, G.; Piolatto, A.; Sas, W.: "Does the winner take it all? Redistributive policies and political extremism"

2020/02, Sanz, C.; Solé-Ollé, A.; Sorribas-Navarro, P.: "Betrayed by the elites: how corruption amplifies the political effects of recessions"

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2020/04, Romarri, A.: "Does the internet change attitudes towards immigrants? Evidence from Spain"

2020/05, Magontier, P.: "Does media coverage affect governments'preparation for natural disasters?"

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2020/07, Veneri, P.; Comandon, A.; Garcia-López, M.A.; Daams, M.N.: "What do divided cities have in common? An international comparison of income segregation"

2020/08, Piolatto, A.: "'Information doesn't want to be free': informational shocks with anonymous online platforms"

2020/09, Marie, O.; Vall Castello, J.: "If sick-leave becomes more costly, will I go back to work? Could it be too soon?"

2020/10, Montolio, D.; Oliveira, C.: "Law incentives for juvenile recruiting by drug trafficking gangs: empirical evidence from Rio de Janeiro"

2020/11, Garcia-López, M.A.; Pasidis, I.; Viladecans-Marsal, E.: "Congestion in highways when tolls and railroads matter: evidence from European cities"

2020/12, Ferraresi, M.; Mazzanti, M.; Mazzarano, M.; Rizzo, L.; Secomandi, R.: "Political cycles and yardstick competition in the recycling of waste. evidence from Italian provinces"

2020/13, Beigelman, M.; Vall Castelló, J.: "COVID-19 and help-seeking behavior for intimate partner violence victims"

2020/14, Martínez-Mazza, R.: "Mom, Dad: I'm staying" initial labor market conditions, housing markets, and welfare"

2020/15, Agrawal, D.; Foremny, D.; Martínez-Toledano, C.: "*Paraísos fiscales*, wealth taxation, and mobility"

2020/16, Garcia-Pérez, J.I.; Serrano-Alarcón, M.; Vall Castelló, J.: "Long-term unemployment subsidies and middle-age disadvantaged workers' health"

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