

Bullying as determinant of academic performance.

A case study for the Community of Madrid using administrative data

Abstract

Bullying is a problem that affects children and teenagers around the world and its repercussions can endure throughout adult life. The main objective of this research is to study the incidence of bullying on the academic performance of students in schools in the Madrid Region. The databases used are those of Competency Tests, a census evaluation carried out on all 10th grade students in Madrid during the year 2017 (almost 32.000 students). To analyse 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 school. The results indicate that bullying has a negative correlation with all the competencies evaluated and that bullying can affect students with low or high academic achievement in different ways, depending on what competency is evaluated.

Keywords

Bullying, Academic Performance, Case Study, Multilevel Analysis

JEL Classification: I121; I129

Introduction

Bullying is a naturalised 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 particular 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, at least from the perspective of consequences, 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 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 gender, age and the sociometric or relational dimension (Martínez & Monjas Casares, 2005; del Barco et al., 2012; Saiz et al., 2019). 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 (Cerezo, 2009; García Continente et al., 2010), but very few articles analyse the effects that these emotional disorders can have on academic performance (Fajardo Bullón et al., 2017).

The contribution of our article is the study of the prevalence of cases using census data from a region and the quantitative estimation of the linear association between bullying and students' academic performance. In addition, the probability of seeing reduced performance in environments where the problem is more prevalent has been estimated. In Spain, although prevalence studies exist, there was also an almost total ignorance of the magnitude of the phenomenon and our work tries to solve this lack of data with a solid quantitative study regarding the bullying-academic performance relationship, also as a way to make visible the consequences of the problem. The results of our study indicate that the problem of bullying is more prevalent in state and subsidised 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 (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.

Causes and consequences of bullying

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). 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).

To understand the causes that promote bullying, we must look at the asymmetry of the perpetrator/victim relationship and the profiles 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 tends to be introverted, insecure, sensitive, sad and also has low self-esteem, high levels of anxiety, suffers from depression and is increasingly susceptible to suicidal ideas. The bully is characterised by a combination of very specific characteristics, such as concentration problems, difficulty

reading and writing, behaviour that causes irritation or tension, impulsiveness and irritability, lack of empathy, low tolerance to frustration, emotional lability.

In addition to the victim and the bully, there is a third actor: the “witnesses, spectators or *bystanders*” (Trautmann, 2008). This represents the audience, who can favour or reduce the harassment. Coyle et al. (2021) indicate that 5 groups or roles emerged from their study: not involved, traditional victim-only, traditional bully-victim, verbal bully-victim, and cyber bully-victim. A bully-victim is a student who is victim and perpetrator at the same time.

Empirical evidence suggests that there are 3 interrelated motives behind the bullying: 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; and 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 (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.

The consequences derived from peer harassment are multiple: 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; Guerra Escoda, 2016, Halliday et al., 2021).

So far, we have reviewed both the concepts and the characteristics of the phenomenon and have found multiple studies in the literature review that observe and analyse the association between bullying and cyberbullying with relevant variables. This study, however, focuses on one particular consequence of this phenomenon: the decline in academic performance. In the next section, our study starts by reviewing the pre-existing literature on this relationship.

Literature review: bullying and academic performance

Our work focuses mainly on approximating the association between bullying and achievement. In this section we review how, through different statistical methodologies, this relationship has been previously studied. The aim is to find out which methodology is the most widely used and the most suitable for our research objectives.

One of the first research studies linking bullying and academic performance is by Gronna & Chin-Chance (1999) who study the impact of bullying on 2nd year (Grade 8) students in secondary education in western Canada. They use a multilevel model that includes student characteristics and school conditions and find a significant negative effect on performance as the number of disciplinary infractions increases.

Konishi et al. (2010), Juvonen et al. (2011), Strøm et al. (2013) and Gutiérrez et al. (2012), like Gronna & Chin-Chance (1999), use the multilevel approach to adjust the association between bullying and academic performance. The result indicates that the level of school bullying is significantly and negatively related to poorer performance (Strøm et al., 2013), and, more specifically, affects mathematical performance (Konishi et al., 2010; Gutiérrez et al., 2012) and reading comprehension (Konishi et al., 2010). It also shows that victimisation has a negative relationship with performance, although the drop in marks is greater in the case of self-perceived victimisation (Juvonen et al., 2011).

Van Rijsewijk et al. (2018) also use the multilevel approach to examine how classroom peer relations can be described in terms of a network of support among students and how the individual position is associated with several factors, such as academic achievement. The results suggest that lower achievement is seen in classrooms where the support network is weaker or unequal.

Glew et al. (2005) and Wang et al. (2012) study the prevalence of bullying and its association with individual, family and school factors with a logistic multilevel analysis. The

results show lower achievement in victims (Glew et al., 2005 and Wang et al., 2012) and bully-victims (Glew et al., 2005). It also shows that a student with a 10% higher achievement score had 20% lower probability of being a victim or a bully-victim (Glew et al., 2005).

Finally, Varela et al. (2022) studied the influence of victim/perpetrator behaviour on student participation in the classroom, using multilevel models, in a sample of Chilean students in primary and secondary school. The results indicate a negative effect on participation, whether the behaviour is victim or perpetrator, as well as with emotional or cognitive engagement. Victims have lower emotional engagement and perpetrators have lower cognitive engagement.

As can be seen, multilevel models are a common methodology for studying the relationship between these variables, but it is not the only methodology used. Indeed, authors such as Bustamante et al. (2004), Lacey & Cornell (2013), Gálvez-Sobral et al. (2014), Al-Raqqad et al. (2017), Okafor (2021) and Abdelaziz & Abu-Snieneh (2021) use less complex methodologies, such as the independence test and simple or multiple linear regressions, in order to study the effects of bullying on performance. All authors find negative correlations between the variables. They show that individual victimisation reduces performance in Biology (Lacey & Cornell, 2013) and Reading results (Gálvez-Sobral et al., 2014), but the prevalence of bullying can negatively affect all subjects. Okafor (2021) finds that bullying can moderately predict performance, and Abdelaziz & Abu-Snieneh (2021) indicate that a lower point in average performance emerges as a significant predictor of victimisation behaviour.

Woods & Wolke (2004) use an ANOVA analysis to assess the relationship between direct and relational bullying and academic achievement in primary schools and find that relational victimisation predicts low academic performance for year 2 children. Ruiz & Ramírez (2011) use an ANOVA analysis to look into the differences between roles in the dynamics of bullying (victim, harasser, neutral, bully-victim) and academic performance. The analyses reveal differences between the four roles and that the bully-victims show a lower academic

performance. Rueger et al. (2011) also use an ANOVA descriptive and reliability analysis to investigate the impact of timing and duration of victimisation on academic outcomes. The study shows mixed results for timing and duration, with the second variable having the worst effect. Ottem (2018) studies the impact of traditional bullying on academic performance and self-esteem using bivariate regression models. The results indicate that a female student who suffers bullying presents a reduction in self-esteem and performance, and that this reduction worsens for older students and in line with an increase in the frequency of bullying. Sánchez-García et al. (2018) use a multivariate analysis of covariance and address the negative impact over average points in students from Grade 5 and 8 from La Rioja, Spain.

Along the same lines, Hammig & Jozkowski (2013) study the academic performance of adolescents who experienced victimisation using a multinomial logistic regression, and 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. Demuru et al. (2020) use a logistic regression model and find a negative effect between performance in Maths and victimisation. Torres et al. (2020) estimate a cumulative ordered logit model using different types of bullying to show the effects on academic performance. Results indicate that the overall effect is negative, but this relationship is especially significant when bullying is of a social nature.

Xiong et al. (2020) explore the link between bullying and academic achievement in China using the Moderating Moderation Model, which offers social support to students (from another student and teachers) and, through a stepwise regression, they prove that bullying intervention could be enhanced by addressing the relationships between academic achievement, social support, age cohort, and bullying. Li et al. (2020) analyse how bullying impacts on adolescents' academic achievement through the serial mediation of school belonging and

academic engagement in rural China. The results indicate that boys reported significantly higher bullying victimisation and lower school belonging and academic engagement than girls.

Okumu et al. (2020) and Tekel & Karadag (2020) use Structural Equation Modelling (SEM) to address the association between bullying and academic performance. Riffle et al. (2021) use the same methodology to study the association between bullying behaviour and performance. All studies find negative effects on all competences (Okumu et al., 2020; Tekel & Karadag, 2020) or on the Grade Point Average (Riffle et al., 2021). Tekel & Karadag (2020) also find a negative impact on academic mindfulness, a variable that has a negative effect on performance. Rizzotto & Franca (2020) use Propensity Score Matching in a PISA sample from Brazil and find that bullying negatively affects academic performance.

Finally, Shao et al. (2014) use the Latent Class Analysis (LCA) in a sample from eight public schools in China to identify and classify aggressive behaviours and analyse differences in loneliness, depression, anxiety and academic achievement between groups with the Wald Test. The results suggest that achievement is lower in aggressive victims, victims, and bullies than in children in general.

As can be seen, regardless of the methodology used - which is mostly multilevel - the results tend to coincide and verify the negative association between academic results and individual victimisation or the prevalence of bullying in the school environment. Multilevel approach seems to us, moreover, correct and robust for isolating the association between the variables because it allows us to control for a number of variables at various levels and to estimate with greater confidence the relationship between bullying and performance. A summary of the Literature Review can be found in Table A1 in the Annex.

Methods

Database: School Competency tests 2017 (4 ESO)

For this study, we use the Improvement of Educational Quality (LOMCE) database of the test carried out in the 2016-2017 academic year for 4th year ESO students from the Community of Madrid (Spain). 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. The database consists of two types of information; the results of the assessments and the context questionnaires.

In the 2016-2017 academic year, 56,172 students from 785 schools participated in the evaluation of the 4th year of ESO. 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).

Descriptive analysis

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, 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 descriptive in response variables*

Competency	Number of observations	Mean	Standard deviation	Minimum	Maximum
Spanish language	32,156	510.45	83.65	68.42	775.86
English language	32,152	510.08	93.38	240.71	734.80
Mathematics	31,817	505.08	98.72	159.87	1182.01
Social and Civic	31,779	507.42	96.35	158.35	1015.61

Source: compiled by the authors from Competency tests, 4th year ESO, 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.

Variable Treatment: Bullying

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 variable treatment comes from two¹ divergent sources of information. 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

¹ The survey does not directly ask students about bullying, but through indirect questions attempts to obtain information on associated variables such as feelings of safety. Given that the feeling of safety at school may be associated with factors other than bullying, we have decided not to include information from students since we cannot be sure that the effect obtained is solely due to the effect of bullying.

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

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). This question does not directly measure bullying, which is usually measured in terms of frequency. However, the perception of teachers and head teachers of the severity of the problem is in reference to the school climate and, as suggested by studies such as Kartal & Bilgin (2009), Giovazolias et al. (2010) and Han et al. (2017), there is a direct correlation between school climate and bullying. Moreover, the perception of teachers and head teachers is crucial in detecting peer bullying. Studies such as those by Boulton (1997) and Lee (2006) mention that teachers and principals share a solid understanding of what bullying is, even if there is sometimes no consensus on how to manage the problem. Indeed, Boulton (1997) proposes that school psychologists should consider teachers' views on the characteristics of the problem. Based on these studies, it is feasible to assume that the responses from teachers and head teachers may be a correct approximation of the variable bullying.

When coding our variables we use three criteria to create three different variables. The first defines the answer "Not a problem" as "0" and the others as "1". A binary bullying variable is produced for each data source. The second criterion continues categorising as zero the response "Not a problem", but coding as "1" intermediate responses and as "2" for "A serious problem". The third criterion uses the variables with their ordinal survey response from 0 to 3,

where zero represents schools where there are no bullying problems, and numbers 1-3 representing a greater presence of bullying. To summarise, we analyse bullying from 2 different perspectives and use 3 criteria to establish some exploratory relationships.

The information from the first criterion used, which is presented in Table 2, shows that approximately 72% of head teachers and teachers assess that this proxy for bullying is at least a minor problem.

Table 2. *Binary Bullying*

	Teachers*	Head teachers*
Bullying = 1 (Mean)	71.7	71.7
Standard deviation	0.450	0.451
Observations	6,103	1,415

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

*Proxy for bullying

When we use the second and the third criterion to analyse bullying, we see that teachers and head teachers consider that 33.4% and 19.5% of schools have serious or very serious bullying problems, respectively.

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 gender, the nationality of the student, as well as that of the father and mother, and absenteeism in the previous quarter are chosen as a dichotomous variable. Repetition 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 the family level, the variables included are the use of books, computer, ICT devices available, number of people living at home, education level of mother and father, work situation of mother and father.

At teacher level, the variables chosen are the gender, 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, subsidised or private), number of teachers, pedagogical, administrative and managerial support staff at the school, number of students, and job satisfaction. The complete table of Control Variables is in the Annex (Table A2).

Study of the prevalence of bullying with respect to some of the characteristics of 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 instance, most of the variables show dependence on the treatment variable, except for the student's gender and the mother's nationality.

As we are interested in studying the prevalence of the phenomenon with greater specificity according to characteristics of the school, we undertake a more significant exploration between bullying and some variables answered by 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, which we can see in Table 3, is more prevalent in state education schools and subsidised schools than in private ones. Teachers and head teachers show similar trends, although it is remarkable that, in the survey, only 43% of head teachers of private school's 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, while head teachers of subsidized schools reporter that in the 70% of the cases is a problem and the other 30% say it is not.

Table 3. *Bullying by type of school*

School/Bullying	Teacher (%Yes)*	Head teacher (%Yes)*
State	75.53%	83.02%
Subsidised	69.99%	65.11%
Private	62.06%	43.07%

Source: compiled by the authors from Competency tests, 2017. *Proxy for bullying

Lastly, comparing whether or not size could be a variable for consideration, we carry out a frequency table and an independence test, which reveal the existence of a relationship between the variable. Although the effect 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.

Methodological approach

Multilevel Methodology

Multilevel models are an extension of linear regression models that enable estimation of submodels which 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 which enables us to isolate the association of bullying with 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 from the 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, Subsidised and Private) and the variable Size of school, which divides 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 (Snijder & 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 association of the variable with 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 is also estimated, using Bullying 4-level Students as a treatment variable, to identify differences in the effect according to the type and

size of schools. A random slope model allows an 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 (Snijder & Bosker, 2011). In our research, Y_{ij} corresponds to the scores of one of the competences assessed.

In order to be able to perform the multilevel estimation, a hierarchical grouping variable is created, taking into account the types of schools (public, subsidised and private) as well as their size (4 levels). Therefore, 12 different groups are created for which the association between bullying and achievement will subsequently be measured to see if this is different for each of them in order to identify whether school type and size have a differential effect on the relationship of both variables when grouped together.

For our research, we estimate four models, one for each assessed competence (Spanish Language, English Language, Mathematics and Civic-Social Education), considering them independently. In each regression, one of the aforementioned bullying information criteria is incorporated in order to quantify the association between the variables. Thus, for each competency assessed, 6 different models are estimated in order to identify differences in the association according to the informant of the severity of the problem.

In addition to the treatment variable, variables at 3 different levels are incorporated as control variables to isolate this relationship. At level 1 we find variables specific to the student and his or her family, at level 2 we incorporate the teacher or class variables and at level 3 those related to the school. The variables incorporated are limited to the available database, but also to those usually incorporated as controls in the previously reviewed literature. A similar model, in terms of explanatory and control variables, is also used for the estimation of the ordered logistic multilevel model, although with the response variable by categories.

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

$$Y_i = X_i \beta_0 + \mu_{qi} \text{Quant}_q(y_i/x_i): X_i \beta_0 \text{ donde } q \in (0,1)$$

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 $\text{Quant}_q(\mu_{qi}/x_i) = 0$. The command for the estimation of this model will be *qreg* and it is estimated with STATA 14 software.

Results

Results of multilevel regression with fixed effects and random slope.

Table 4 shows a summary of the results obtained for all the treatment variables created, explaining the coefficient that accompanies the variables of interest. The results indicate that the response variables have a negative association with bullying, which would verify the general hypothesis of researchers. In addition, it would correspond with 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 Social and Civic score reduced by between 5.32 and 13.09 points, depending on the criterion with which the bullying variable is defined.

Table 4. Results of the multilevel estimation

<i>Variables</i>	<i>Spanish language</i>	<i>English language</i>	<i>Mathematics</i>	<i>Social and Civic</i>
<i>Binary bullying teacher</i>	-7.44**	-8.71**	-5.47**	-12.09**
<i>Binary bullying head teacher</i>	-5.57**	-8.80**	-6.16**	-13.09**
<i>Bullying 3 levels teacher</i>	-2.22**	-1.39	-2.17	-8.03**
<i>Bullying 3 levels head teacher</i>	-3.06**	-10.05**	-5.41**	-9.39**
<i>Bullying 4 levels teacher</i>	-1.33**	-0.31	-2.66**	-5.32**
<i>Bullying 4 levels head teacher</i>	-2.71**	-6.29**	-8.30**	-6.35**
<i>Control Variables</i>	Yes	Yes	Yes	Yes
<i>N</i>	9,022	9,001	8,985	8,985

Note: A different multilevel estimation has been made for each coefficient shown in table 4 and the complete results are available upon request. **: $p < 0,05$

It is also worth noting the way in which the two perspectives (teacher, head teacher) can diverge. If we observe, for example, the correlation of bullying with the Spanish language competency, we see that, when considering the variable as binary, the coefficient corresponding to the teacher shows greater value. However, when treating the variable as frequencies of 3 or 4 categories, the head teachers and teachers change positions. It cannot be inferred with

certainty which one of the two perspectives is more accurate, but it is clear that there are differences when it comes to perceiving the phenomenon and the negative correlation with academic performance.

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 teachers, the percentages vary between 0.26% and 2.36%, while in the case of head teachers the value vary between to 0.53% and 2.58%. 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.

Respect to the control variables included in the estimates, it is worth noting that gender, student and mother's nationality, repetition and absenteeism are some of the significant variables with respect to academic performance in most cases. It is complex to draw a general conclusion about the behaviour of each control variable included because several estimates have been made, one for each competence assessed according to each treatment variable included. However, we will try to draw some general conclusions based on the most recurrent results.

First, gender is mostly positively associated with language skills (Spanish and English) and negatively associated with Mathematics and Science. Nationalities varies negatively with performance in all skills, as do repetition and absenteeism, a result that is consistent with intuition about these variables. Other variables at the family level, such as the use of internet at home, the number of books or ICT devices available at home have a positive relationship with performance in most of the cases analysed, although they are not always significant variables. Teacher-related variables such as gender or teacher experience (inside and outside the school) also varied positively with achievement, but were not always significant either. As for the

school variables, the way they associated with the response variable is more diffuse and depends on the estimation carried out, so we do not think it prudent to express a concrete conclusion. These variables, however, are not the main interest of our research, but serve to better isolate the effect of bullying on students' performance. All these results are available upon request.

Results of Ordinal Multilevel Regression

We now present Table 5 with the coefficients and the ODDS associated with the multilevel estimates with the response variable in categories, including control variables.

Table 5. Coefficients and ODDS associated with the Ordered Multilevel Estimation

Variables	Spanish language	English language	Mathematics	Social and Civic
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	8.785	9.860	9.045	9.395

Note: The complete results are available upon request. **: $p < 0,05$

The results show negative coefficients. This confirms the inverse relationship between the variables. In this analysis, we focus on the ODDS values that give the probability that a student will reduce his/her performance due to the negative association 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 20.85% more likely to reduce their performance in Spanish, according to the teachers, and by a percentage greater than 24.95% according to head teachers. In the case of English language, the probability of reducing marks is 19.03% and the percentages of reduction in marks for Mathematics is 16.84%, according to head teachers. Finally, for the score in Social and Civic studies, the percentages are 22.66% (teachers) and 21.51% (head teachers).

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 are taken as reference with all the observations used in the two previous estimates. As a variable of interest, we take Binary bullying teachers and include control variables. Table 6 shows the main results.

Table 6. Quantile Regression Results

	Spanish language	English language	Mathematics	Social and Civic
0.25	-7.23**	-10.07**	-4.37**	-7.61**
0.50	-7.94**	-8.55**	-4.83**	-9.12**
0.75	-7.29**	-8.01**	-7.92**	-12.85**
Control Variables	Yes	Yes	Yes	Yes
N	8.785	9.860	9.045	9.395

Note: The complete results are available upon request. **: $p < 0,05$

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

In the case of Spanish language, the negative correlation seems greater in students who are at the centre of the distribution, although the effect is quite homogeneous across quartiles. In English language the impact is greater in the lower part of the distribution, i.e. in the students with lower scores. In Mathematics and Social and Civic competencies, we can see how the negative effect increases in the upper quartiles. Therefore, the effect of bullying on achievement is greater for those students who have higher test scores in these two competencies. In conclusion, although the association is always negative, the marginal effect of bullying, taking quartiles as a reference varies depending on the competency analysed.

Conclusions

This article analyses the association that bullying has with academic performance. 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.

Association between Bullying and Type and Size of Schools

Our study also shows that the problem of harassment is more prevalent in state and subsidised schools than in private schools. Thus, regardless of the informant, in more than 75% of state schools there is bullying, the same happens in more than 65% of subsidised schools, compared to only 45% 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 (teacher or head teacher).

Association between Bullying and Academic Performance

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 (Gwen et al., 2005; Konishi et al., 2010; Juvonen et al., 2011; Okumu et al., 2020; Okafor, 2021), 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 association with academic performance, our study verifies the significant existence of a negative relationship 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 20-25%, in the English language competency between 19%, in the Mathematics competency the probability is 17% and, finally, in the Social and Civic competency, it varies between 11-13%. In addition, differences are seen on the level of negative correlation 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 Social and Civic or Mathematics, the association could be greater among the best-performing students, while English language has a greater negative association on lower quartiles and Spanish language is the competency that show the least divergences between analysed quartiles with a slightly higher effect in the centre of distribution.

Strengths and Limitations

One of the strengths of this article is the quantitative approach to an association between the variables harassment and performance that has not been explored in depth for Spain or its regions. The methodology used allows us to test the negative relationship between the variables and even to approximate the probability that a student will have difficulties in his or her results due to the prevalence of bullying in his or her school.

Another strength is the use of administrative census data that has allowed us to have a large amount of data with which to better characterise the prevalence of the phenomenon in the community of Madrid, as well as the particular characteristics of the schools involved. At the same time, the database has made it possible to control for several individual, class and school

variables, and thus to adjust with more certainty the association between bullying and academic results.

With regard to limitations, we must first consider some limitations that arise from the design of the questionnaires. Students are not asked directly about the frequency with which they experience bullying situations, so it has to be approached by means of other questions. In our case we have decided not to use this indirect approach to bullying since it is not possible to ensure that the effect observed by the proxy obtained is, in fact, a measure of bullying itself. For this reason, we only resort to heteroinformed bullying as reported by teachers and principals. The absence of the student's own perception is an important limitation.

Another limitation of the database is that bullying is not disaggregated by type (verbal, social, physical or virtual, for example), which limits the analysis and the possibility of creating profiles among students or schools that could generate more concrete implications for educational policy. In addition, it does not allow us to compare traditional bullying with cyberbullying, a phenomenon that has been increasing and which, due to its particular characteristics, we believe should be studied separately.

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Annex

Table A1: Summary of the Literature Review

Year	Authors	Country	Methodology	Conclusion
1999	Gronna & 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
2004	Woods & Wolke	UK	ANOVA	Relation victimisation can predict lower achievement
2005	Glew et al.	USA	Multi-level Logistic Regression	Lower Achievement in victims and bully-victims
2010	Konishi et al.	Various countries	Multi-level	Negative relationship seen in maths performance and reading comprehension
2011	Ruiz & Ramírez	Spain	ANOVA	Performance differences depending on the role played
2011	Rueger et al.	USA	ANOVA	Duration of victimisation has worst impact on performance than timing
2011	Juvonen et al.	USA	Multi-level	Negative relationship between victimisation and performance
2012	Gutiérrez et al.	Chile	Multi-level	Negative relationship seen in maths performance
2012	Wang et al.	China	Multi-level Logistic Regression	Being victim is correlated with below average academic achievement
2013	Strøm et al.	Norway	Multi-level	Relationship between schools with a high level of bullying and poorer performance
2013	Hammig & Jozkowski	USA	Multinomial Logistic Regression	Suspended students more likely to have been bullied in the previous year
2013	Lacey & Cornell	USA	Multiple Regression	Prevalence of bullying reduced grades in almost all subjects

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2014	Gálvez-Sobral et al.	Guatemala	Multiple Regression	As the aggression reported increases, reading results decrease
2014	Shao et al.	China	Latent Class Analysis	Academic achievement is lower in the bully-victim, victim and bully than in children in general
2017	Al-Raqqa et al.	Jordania	Descriptive Analysis	Significant negative impact on performance
2018	Ottem	USA	Bivariant Regression	Negative impact on marks and self-esteem in Mathematics
2018	Van Rijsewijk et al.	Netherlands	Multi-level	Achievement is lower in classrooms where help network is weaker
2018	Sánchez-García et al.	Spain	MANCOVA	Addresses negative impact over average points
2020	Xiong et al.	China	Moderating Moderation Model	Bullying intervention could be positive to reduce the relationship between bullying and lower academic achievement
2020	Li et al.	China	Serial mediation model	Boys reported higher bullying and lower academic achievement than girls
2020	Okumu et al.	USA	Structural Equation Modelling	Negative effect between both variables
2020	Demuru et al.	Italy	Logistic regression	Negative effect between performance in Maths and victimisation
2020	Tekel & Karadag	Turkey	Structural Equation Modelling	Found negative effects in all competences and in academic mindfulness
2020	Torres et al.	USA	Cumulative ordered logit model	The overall effect was negative, but this relationship was especially significant when bullying was of a social nature
2021	Abdelaziz & Abu-Sniench	Saudi Arabic	Multiple Regression	A lower point in average performance emerged as a significant predictor of victimisation behaviour
2021	Riffle et al.	USA	Structural Equation Modelling	Students who engage in bullying behaviour are more likely to have lower GPA
2021	Rizzotto & Franca	Brazil	Propensity Score Matching	Bullying negatively affects academic performance
2021	Okafor	Nigeria	Simple Regression	Bullying has negative influence on Academic Achievement and moderately predicts this
2022	Varela et al.	Chile	Multi-level	Bullying has negative association with engagement and differs between victims and perpetrators

Table A2: Control variables

Variable	Level / Who Responds	Type	Mean	Standard deviation	Min.	Max.
Gender	Students	Nominal	0.51	0.500	0	1
Nationality student	Students	Nominal	1.09	0.250	1	2
Nationality mother	Students	Nominal	1.2	0.402	1	2
Nationality father	Students	Nominal	1.19	0.395	1	2
Absenteeism	Students	Ordinal	0.28	0.451	0	1
Repetition	Students	Ordinal	0.18	0.485	0	2
Teacher Gender	Teacher	Nominal	0.61	0.488	0	1
Labour situation	Teacher	Ordinal	2.95	1.375	1	5
Years of experience	Teacher	Discrete	17.3	10.216	0	47
Years of experience in the school	Teacher	Discrete	10.465	9.522	0	43
Self-perception at work	Teacher	Ordinal	3.15	0.820	1	4
Type of school	Head teacher	Ordinal	1.60	0.650	1	3
Size of School	Head teacher	Discrete	2.50	1.117	1	4
Use of Books	Families	Ordinal	3,17	0.976	1	4
Use of Daily Press	Families	Ordinal	3,15	1.114	1	4
Use of Encyclopaedias or References Books	Families	Ordinal	2.76	1.042	1	4
Use of Computer or Tablet	Families	Ordinal	3.88	0.418	1	4
Use of Internet	Families	Ordinal	3.96	0.266	1	4
ICT devices	Families	Discrete	7.81	3.334	0	20
Number of people living at home	Families	Discrete	5.02	1.007	2	15
Books at home	Families	Ordinal				
Hours spent studying and doing homework	Families	Discrete	11.6633	7.905	0	50
Level of studies Mother	Families	Ordinal	5.25	1.821	1	10
Level of studies Father	Families	Ordinal	5.11	1.917	1	10
Work situation Mother	Families	Ordinal	2	1.510	1	6
Work situation Father	Families	Ordinal	1.62	1.386	1	6
Job Mother	Families	Ordinal	8.53	3.383	1	13
Job Father	Families	Ordinal	8.39	3.428	1	13