Applied Economic Analysis

The influence of relative socioeconomic gap on Spanish children's performance: evidence from Spain

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Received 5 February 2025
Revised 19 June 2025
Accepted 15 September 2025

Abstract

Purpose – School and out-of-school social environments influence students' learning process. This research paper aims to study school compositional effects by documenting the influence of students' relative ranking within the school, in terms of their socioeconomic level and academic performance, on later educational outcomes.

Design/methodology/approach – To empirically assess these two influences, this study follows the universe of students attending the third grade in 2015–2016, until the sixth grade, in the Canary Islands. This study exploits changes in students' relative position in terms of their academic performance and socioeconomic level during primary education. Two different approaches are used to measure students' relative position: ordinal rank and distance to the average of the class. The identification strategy relies on student fixed effects to go beyond simple correlation.

Findings – The results show that being among the students with higher socioeconomic status in school is negatively associated with educational progression, which may be driven by peer effects. The opposite holds true for relative academic rank: being at the top of the school in reading and math positively influences absolute academic performance, which accounts for big-fish-little-pond effects. Additionally, heterogeneous peer effects are identified by school funding.

Originality/value – In light of the detrimental impact of social comparisons that often occur in school settings, teachers should actively promote student autonomy in setting personal goals and foster individualised growth, thereby mitigating the influence of social comparisons.

Keywords Human capital, Relative socioeconomic status, Relative academic performance, Big-fish-little-pond effects

Paper type Research paper

1. Introduction

Current research supports the significance of peer relationships in shaping the development of social, emotional and academic skills. Early exposure to diverse viewpoints and social interactions, usually occurring within the school environment, plays a pivotal role in the

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Funding: Junta de Andalucía, SEJ-645; Fundación BBVA – Programa Prismas y Problemas 2023 – ("La inequidad socioeconómica derivada de la ineficiencia de los sistemas educativos (INESOCEF)"; Fundación Ramón Areces.

Applied Economic Analysis
Emerald Publishing Limited
2632-7627
DOI 10.1108/AEA-02-2025-0042

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formation of skills and social attachments (Carter and Nutbrown, 2016). Nevertheless, the influence of these interactions on students' academic outcomes remains a subject of ongoing debate.

Different theories attempt to explain this association. On the one hand, *peer effects* explain that having high-income peers can positively influence students' educational achievements (van Ewijk and Sleegers, 2010; Vardardottir, 2015). Specifically, schools in higher socioeconomic and cultural contexts tend to possess more educational resources, which can shape the overall school environment and promote educational advancement. Importantly, due to the strong correlation between socioeconomic status and academic performance, students attending schools in such affluent settings may benefit from the improved educational outcomes of their peers (Correa *et al.*, 2019; Perry and McConney, 2010).

On the other hand, social comparisons which are drawn from within schools can be a handicap for more disadvantaged students. This influence is widely known as *big-fish-little-pond* (BFLP) *effect* (Marsh and Parker, 1984). According to this phenomenon, being surrounded by peers who excel academically can diminish students' self-beliefs regarding their own academic abilities. Consequently, their academic self-concept may suffer and ultimately have a negative impact on their educational attainment. Moreover, the extent of this negative influence varies depending on the student's perceived cost, in terms of effort of studying, as well as their proximity in the academic rankings relative to their peers (Tincani, 2017). In essence, when students find themselves closely ranked alongside their peers, they tend to strive to improve their position.

This paper aims to empirically investigate these two mechanisms. To formalise the potentially contradictory effects of school composition on academic performance, our research employs two strategies. First, we assess students' rankings within schools based on their socioeconomic status and academic performance. Second, we consider their proximity to the school mean concerning both socioeconomic status and academic performance. In this context, socioeconomic status captures *peer effects*, while academic performance captures the BFLP *effect*.

The influence of ordinal rank is a very recent topic explored in empirical research in education (Murphy and Weinhardt, 2020; Jerrim *et al.*, 2020). These studies identified that academic ordinal rank is positively associated with higher educational attainment and the relative socioeconomic level at school is also associated with educational attainment, independently of the absolute socioeconomic level. We depart from this literature which is based on relative position and include alternative estimations which control for the distance between students in the academic and socioeconomic distribution to the school mean.

We use administrative data for the Spanish region of the Canary Islands. It is a large and up-to-date data set, encompassing the entire population of primary school students who were in the third grade during the 2015–2016 academic year. Furthermore, we track the progress of these students into the sixth grade (corresponding to the 2018–2019 academic year), providing valuable longitudinal insights. In the context of this study, the availability of a measure of test scores at the third grade is crucial, enabling us to employ a value-added model and students' fixed-effects strategy, thereby enhancing the accuracy of our estimations and mitigating potential omitted variable bias.

The Canary Islands is an outermost region of Spain which exhibits a comparatively lower level of academic performance, significantly falling below both the Spanish and OECD averages. According to data from the latest progress in international reading literacy study (PIRLS) [1] wave, there is a discrepancy of 10 points below the Spanish average and 24 points below the OECD countries. In contrast to the progress seen in other regions of

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Spain like Andalusia, the Canary Islands have experienced a stagnation in academic performance over the past decade.

This study aims to contribute to the current body of research in the following ways. First, we integrate two different mechanisms of school composition into a single model. Most of the literature has investigated peer effects and BFLP effects separately, providing a limited view of school compositional effects. Second, the empirical strategy captures school compositional effects using a novel approach that analyses how students' rank and proximity to other peers in their school in the third grade condition their academic progression in the sixth grade. Third, we analyse school compositional effects in primary education, while most studies exploring peer effects exploited the transition between primary and secondary school (Gibbons and Telhaj, 2016). Fourth, Spanish evidence on peer effects is limited. The variation of size effects across countries emphasises the need for an analysis of the Spanish case (Raitano and Vona, 2013, related to peer effects; Marsh and Hau, 2003, related to self-concept).

2. Literature review

2.1 Peer effects

The literature has widely studied the influence of school socioeconomic composition on students' educational attainment (Martins and Veiga, 2010; Perry and McConney, 2010). Overall, the studies conclude that having peers from a socioeconomically advantaged background has a positive influence on students' test scores.

The influence of school socioeconomic composition on educational attainment potentially operates through different channels. First, there is a well-established positive correlation between socioeconomic status and academic achievement (Martins and Veiga, 2010; Hanushek and Woessmann, 2011). Essentially, having schoolmates of a higher socioeconomic status tends to translate into high-performing peers, and group interactions benefit academic performance. Another possible mechanism which could explain the positive association between socioeconomic school composition and academic performance is students' behaviour (Carrell and Hoekstra, 2010; Lavy and Schlosser, 2011). In particular, students from a low socioeconomic background may develop more behavioural problems. Consequently, being surrounded by peers from higher socioeconomic backgrounds, who are typically better behaved, can facilitate teachers' instruction and favour academic progress. Furthermore, peer effects can also manifest through adjustments in teachers' instruction based on classroom characteristics (Feld and Zölitz, 2017). However, they found that the improvement of group interaction is more important than teachers' adjustments.

The response of students to peer effects is usually conditioned by individual characteristics such as gender, socioeconomic status, race, etc. (Patacchini *et al.*, 2017). In this sense, some studies suggest that the socioeconomic composition of a group affects students in a similar way, regardless of their own socioeconomic status (Perry and McConney, 2010; Vardardottir, 2015). However, other research indicates that the returns of school socioeconomic composition are greater for poor students (Robertson and Symons, 2003). Consequently, the progress of economically disadvantaged students may outweigh any potential decline in academic performance that students from a high socioeconomic status might experience.

The variation in peer effects according to the type of school is a result of differing socioeconomic compositions. Zimmer and Toma (2000) found that increasing the socioeconomic status of classmates has a higher influence in public schools than in private schools. Accordingly, this research aims to examine if there are heterogeneous peer effects based on the type of school funding. In Spain, the literature indicates that private schools tend to be more homogenous, with a significant concentration of students from high

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socioeconomic status backgrounds (Prieto-Latorre and Marcenaro-Gutiérrez, 2021), while the socioeconomic make-up of public schools is more diverse. Given that in private schools, students interact with peers who share similar backgrounds, we hypothesise that peer effects may be less pronounced in such a setting.

Most studies exploring peer effects have exploited the transition between primary and secondary education (Gibbons and Telhaj, 2016; Jerrim *et al.*, 2020), while fewer studies have analysed peer effects in secondary education (Lavy *et al.*, 2012; Vardardottir, 2013), primary education (Ammermueller and Pischke, 2009) or at the university level (Feld and Zölitz, 2017).

In particular, the present paper departs from Jerrim *et al.* (2020), which is also based on relative position and include alternative estimations controlling for the distance between students in the academic and social economic distribution to the school mean, in many aspects:

- First, although both papers employ census data, the focus of Jerrim *et al.* (2020) was the region of Andalusia, whereas the present paper focuses in Canary Islands.
- Jerrim *et al.* (2020) followed fifth-grade students in the eighth grade, which supposes a change between primary and secondary education, making more likely that the student changes school and, thus, school characteristics may not be fixed between years. In the present study, third-grade students are followed in the sixth grade, both grades being in primary education and the potential of school change being low.
- Furthermore, related to the previous point, grade retention is much higher in secondary education compared to primary education, leading to a lower loss of students to grade retention in the present study.
- The data employed by Jerrim *et al.* (2020) was older, i.e. fifth-grade students in the academic year 2008/2009 who were followed in the eighth grade in the academic year 2011/2012, while the present study focussed on third-grade students in the academic year 2015/2016 who were followed in the sixth grade in the academic year 2018/2019.
- Jerrim *et al.* (2020) employed only a value-added model, hence controlling by a lower amount of both observable and unobservable variables compared to our paper. Our work also employs also student fixed effects, controlling by all observables and unobservables that are fixed within-students and between-academic years.
- The present study analysed the relative position at school and, as stated in the Supplementary Material tables, class levels.

2.2 Social comparison

Being surrounded by better peers (in terms of academic performance) may also have a potential negative influence. Marsh and Parker (1984) established the theoretical grounds of the BFLP effect. According to this model, having high-achieving peers is detrimental for students' self-concept of their academic abilities, which consequently has a negative influence on their educational performance. Students have imperfect information about their abilities, but they have a precise perception of their rank within a group (Anderson *et al.*, 2006; Zafar, 2011). In this regard, equally able students may have different beliefs about their own abilities. If the student is surrounded by low-performers, they will see themselves as more capable and will progress faster. Conversely, if the school-average ability is higher than that of the student, students' beliefs about their ability may decrease.

The strength of the links between self-concept in ability and academic achievement changes with age (Huang, 2011). In primary education, this influence tends to be somewhat

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smaller than in secondary education (Marsh *et al.*, 2015; Fang *et al.*, 2018). Part of this influence is due to the higher ability stratification of students across schools in secondary education, but it is also the result of further comparison among students when they get older.

Studies related to the influence of relative academic performance are scarce in the field of education. Murphy and Weinhardt (2020) stated that they were the first to address this issue. They found that students at the top of performance in their primary school class had better performance in secondary school, irrespective of their underlying ability. In the context of experimental studies, Azmat and Iriberri (2010) analysed how high school students react to information related to their rank, finding that receiving feedback about the relative academic position and the distance to the mean in high school improved standardised test results.

Our research contributes to this strand of literature by analysing not only students' ranking, but also the distance of students' position compared to that of their schoolmates in terms of their academic performance and socioeconomic level.

3. Data and institutional background

The Spanish education system has progressively included the assessment of students' competences using standardised tests. In primary school (between 6 and 12 years old), students' competences are assessed in the third and sixth grades (LOMCE, art. 20.3 and 21; BOE, 2013). Our study uses information gathered on the basis of competence tests for the region of the Canary Islands, which were collected by the Canarian Agency of University Quality and Educational Assessment. In particular, the information used in this research is based on the cohort of students attending the third grade of the 2015–2016 academic year, who are followed again in the sixth grade (2018–2019 academic year).

3.1 Test scores

These surveys aim to evaluate students' skills in different domains. Our study exploits academic performance in reading and mathematics since both are available in the third and sixth grades. The reading test evaluates students' proficiency in understanding and generating written texts, along with their listening comprehension in Spanish language. Meanwhile, the mathematics test focuses on dimensions related to geometry, algebra and skills with numbers. To ensure comparability across subjects and academic years, these variables are standardised to a mean of 0 and a standard deviation of 1.

3.2 Index of economic, social and cultural status

Each student and their parents also answered questionnaires about their background. Parents' questionnaires collected information related to parental level of education, occupation and household possessions. These variables were used by the governmental agency to create a composite indicator of economic, social and cultural status (ESCS index henceforth) [2] following the procedure used in other international tests (ACCUEE, 2016). This creation process involved factor analysis of the following variables:

- highest level of parental education;
- highest level of parental occupation;
- number of digital devices at home; and
- number of books at home.

For a detailed list of items and the distribution in public and private schools, please refer to Table S1 in the Supplementary Material.

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3.3 Sample

The complete census of students enrolled in schools in the Canary Islands completed these tests: 75% of students were from public schools and 25% from private schools. Public schools are fully financed by the state, while private schools received part or none of their funding from the state.

From the census of third-grade primary school students in 2015–2016 in the Canary Islands (19,871 students), 18,332 students completed both tests in reading and mathematics. However, background questionnaires are not available for 3,639 families who did not answer them. Additionally, 773 students could not be tracked from the third to the sixth grade, with the most likely explanation being that they repeated a year. Moreover, 666 of them did not take some of the tests in the sixth grade. The sample is restricted to schools with 10 or more students (740 observations are dropped) given that the relative position is measured using deciles, requiring at least 10 students in each school. This leaves us with 12,514 students who attend 455 schools. To check for potential bias, a test of mean differences between the initial census and the employed sample has been included in Table S2 in the Supplementary Material, showing non-significant differences between both. Descriptive statistics for the variables employed in the analysis are presented in Table S3 in the Supplementary Material.

4. Methodology

Our purpose is to analyse the influence of students' rank ordering within the school in terms of their socioeconomic background and test scores on their academic performance. The baseline education production function takes the following form:

$$TS_{ij}^{6} = \alpha + \beta_1 Rel\_ESCS_{ij}^{3} + \beta_2 ESCS_{ij}^{3} + \gamma_1 Rel\_TS_{ij}^{3} + \gamma_2 TS_{ij}^{3} + \delta X_{ij} + \theta Z_j^{3} + \varepsilon_{ij} \quad (1)$$

where:

$i = 1, \ldots, 12$, identifies the student.

$j = 1, \ldots, 455$ identifies the school.

TS_{ij}^{6} are the standardised [3] test scores in the sixth grade in reading or mathematics, alternatively.

$Rel\_ESCS_{ij}^{3}$ is a series of dummies indicating the decile rank of the student within the school in terms of the socioeconomic status in the third grade, where the 10th decile identifies the students at the top of the distribution (relatively higher ESCS), and the 1st decile, the students at the bottom (relatively lower ESCS is the reference category).

$ESCS_{ij}^{3}$ is the absolute [4] value of the index of socioeconomic status of the student in the third grade.

$Rel\_TS_{ij}^{3}$ is a series of dummies indicating the decile rank within the school of the student test scores in the third grade, where the 10th decile identifies the students at the top of the distribution (relatively higher test scores) and the 1st decile, the students at the bottom (relatively lower test scores is the reference category).

TS_{ij}^{3} are the standardised test scores in the third grade in reading and mathematics.

X_{ij} are students' characteristics (sex and immigrant status).

Z_j are the characteristics of the school (public or private) and the location (Tenerife, Gran Canaria or another island).

The parameters of interest are β_1 and γ_1, which capture the influence of the relative position within the school in terms of the socioeconomic status and academic performance in the third grade on students' academic performance in the sixth grade.

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To the extent that students tend to compare themselves with the average of the school, the second specification accounts for the distance of students' socioeconomic level and academic performance with the average school characteristics:

$$TS_{ij}^{6} = \alpha + \beta_1\left(ESCS_{ij}^{3} - \overline{ESCS}_{j}^{3}\right) + \beta_2 ESCS_{ij}^{3} + \ \gamma_1\left(TS_{ij}^{3} - -TS_{j}^{3}\right) + \ \gamma_2 TS_{ij}^{3} + \delta X_{ij} \ + \theta Z_{j}^{3} + \varepsilon_{ij} \qquad (2)$$

where:

$\overline{ESCS}_{ij}^{3}$ is the average socioeconomic level of the school in the third grade.

$(ESCS_{ij}^{3} - \overline{ESCS}_{j}^{t})$ measures the distance of student's socioeconomic status to the average school level in the third grade.

$-TS_{j}^{3}$ is the average academic performance of the school in the third grade in reading and mathematics.

$(TS_{ij}^{3} - -TS_{j}^{3})$ measures the distance of student's test scores to the average school level in the third grade in each subject.

The parameters β_1 and γ_1 thus reflect how the distance between students' characteristics (i.e. their socioeconomic status and test scores) and the school average influences academic progression.

The two previous specifications [equations (1) and (2)] measure the gains in students' scores in the sixth relative to the third grade, defining a value-added model, hence test scores in the sixth grade are conditioned by test scores in the third grade. To go further from simple correlations, we apply time-variant student fixed effects, which control for time-invariant characteristics:

$$TS_{ij}^{t} = \alpha + \beta_1 Rel\_ESCS_{ij}^{t} + \beta_2 ESCS_{ij}^{t} + \ \gamma_1 \ Rel\_TS_{ij}^{t} + \ \theta Z_{j}^{t} + \varepsilon_{ij}^{t} \qquad (3)$$

$$TS_{ij}^{t} = \alpha + \beta_1\left(ESCS_{ij}^{t} - \overline{ESCS}_{j}^{t}\right) + \beta_2 ESCS_{ij}^{t} + \ \gamma_1\left(TS_{ij}^{t} - -TS_{j}^{t}\right) + \theta Z_{j}^{t} + \varepsilon_{ij}^{t} \qquad (4)$$

where t are the two time periods referring to the third and sixth grades.

In this case, parameters β_1 and γ_1 capture how changes in the relative position in the school explain academic performance. Students' characteristics (X) are time-invariant, so they are not included in the fixed-effects specification. Regarding school characteristics (Z_j^t), we identify if the student changed school and island during this period [5].

However, although the latter model controls for a series of relevant covariates, previous academic performance (as a proxy of e.g. student ability) and a range of potential confounding factors (e.g., relative socio-economic status), we remain cautious and indicate that these models capture association and not causal relations, because such estimations might still leave out relevant variables.

To assess the influence of students' relative positions within schools on their academic performance, it is essential that students were not grouped into classes based on their socioeconomic characteristics or ability levels. This holds true in the context of Spain, as indicated by data from school principals (INECSE, 2004). The data shows that 47% of schools employ alphabetical order for student classroom assignments, while 41% aim to form socially heterogeneous classrooms.

Finally, we conduct robustness checks where we investigate the extent to which the sorting of students between public and private schools can lead to different results and whether school composition has a differential influence by sex. Analogous models to the one described in equations (3) and (4) are then estimated, splitting the sample by school funding

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and sex. In addition, we considered students' relative position within the classroom (instead of within the school).

5. Results

This section presents the empirical evidence obtained using value-added modelling and student time-variant fixed effects following the two approaches, that of relative position within the school and the distance to the school average.

5.1 Value-added models

5.1.1 Relative position within the school. The estimates presented in Table 1 (columns 1 and 2), which refer to equation (1), show the influence of students' relative position within the school on academic attainment three years later. In the first column, the dependent variable is standardised test scores in reading and, in the second one, standardised test scores in mathematics.

The first variable of interest is the student's relative socioeconomic position within the school, which is measured with a series of nine dummies – each referring to a decile rank. Considering that the reference category is the 1st decile (10% of the poorest students in the school), negative coefficients indicate that being among the more affluent students within the school is negatively associated with educational progress. For instance, the 10% of richest students within the school (10th decile) reduce their academic performance by 0.13 standard deviations (SDs) in reading. In mathematics, the relative socioeconomic position is more important to predict later educational attainment. In particular, 10% of the highest socioeconomic status students obtained 0.27 SD lower scores compared to the reference category. Hence, the opposite association holds, as students seem to benefit from being among the poorest in their school. As previously argued, this result may be the consequence of peer effects.

The question that arises now is to what extent the relative socioeconomic position in the school is important compared to the absolute socioeconomic level. Results show that the advantage of students from a high socioeconomic level does not disappear when controlling by the absolute socioeconomic level in the school, so both variables might be measuring different influences.

The second variable of interest is the school academic rank in the third grade. The series of dummies which control for relative position in reading and mathematics are positive and significant for both subjects; that is, being among the best in reading (in the third grade) positively influences students' academic performance in reading and mathematics in the sixth grade, and vice versa. Logically, this influence is stronger for the relative position in the same subject under analysis. For instance, the 10% most advantaged students within the school in reading obtained 0.31 SD more in reading and 0.13 SD more in mathematics three years later. It is worth to highlight that the model controls for absolute academic performance. Thus, two students with initially the same test scores in the third grade may progress differently according to their relative ranking within the school. Specifically, a higher school ranking in the third grade seems to stimulate academic performance in the sixth grade. This result may be driven by the increase of self-concept, which positively influences educational attainment (BFLP effect).

Parameters of relative academic position within school are large in comparison to other students' characteristics. For instance, girls performed 0.08 SD lower in mathematics than boys. In the case of a girl ranked at the 4th decile in her school in mathematics (in the third grade), this gender gap would be compensated.

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Table 1. The influence of relative socioeconomic level and relative academic performance within the school on academic performance

	OLS		FE	
Variables	Reading	Mathematics	Reading	Mathematics
Relative socioeconomic level within the school in the third grade (ref: 1st decile, bottom)				
10th decile (top)	−0.127* (0.065)	−0.265*** (0.060)	−0.308*** (0.067)	−0.315*** (0.066)
9th decile	−0.088 (0.054)	−0.168*** (0.050)	−0.288*** (0.057)	−0.294*** (0.057)
8th decile	−0.058 (0.049)	−0.191*** (0.045)	−0.262*** (0.051)	−0.245*** (0.050)
7th decile	−0.083* (0.046)	−0.130*** (0.042)	−0.215*** (0.046)	−0.241*** (0.044)
6th decile	−0.031 (0.043)	−0.071* (0.039)	−0.206*** (0.042)	−0.205*** (0.040)
5th decile	−0.044 (0.042)	−0.149*** (0.037)	−0.177*** (0.038)	−0.173*** (0.036)
4th decile	−0.010 (0.039)	−0.110*** (0.036)	−0.128*** (0.035)	−0.143*** (0.033)
3rd decile	−0.030 (0.037)	−0.097*** (0.034)	−0.102*** (0.031)	−0.105*** (0.030)
2nd decile	−0.012 (0.037)	−0.035 (0.033)	−0.077*** (0.029)	−0.079*** (0.026)
ESCS index in the third grade	0.120*** (0.019)	0.172*** (0.017)	0.130*** (0.023)	0.107*** (0.023)
Relative academic performance in reading within the school in the third grade (ref: 1st decile, bottom)				
10th decile (top)	0.310*** (0.070)	0.125* (0.065)	2.629*** (0.029)	−0.050* (0.027)
9th decile	0.333*** (0.062)	0.087 (0.057)	2.278*** (0.027)	−0.034 (0.025)
8th decile	0.295*** (0.057)	0.074 (0.053)	1.963*** (0.027)	−0.001 (0.025)
7th decile	0.237*** (0.053)	0.037 (0.049)	1.739*** (0.027)	0.008 (0.025)
6th decile	0.265*** (0.049)	0.072 (0.045)	1.474*** (0.026)	−0.013 (0.023)
5th decile	0.190*** (0.047)	0.035 (0.043)	1.300*** (0.027)	0.015 (0.024)
4th decile	0.185*** (0.043)	0.081** (0.040)	1.026*** (0.026)	−0.031 (0.024)
third decile	0.159*** (0.041)	0.036 (0.037)	0.795*** (0.026)	−0.001 (0.023)
2nd decile	0.105*** (0.037)	0.031 (0.035)	0.491*** (0.025)	−0.022 (0.023)
Relative academic performance in mathematics within the school in the third grade (ref: 1st decile, bottom)				
10th decile (top)	0.299*** (0.059)	0.456*** (0.056)	−0.060* (0.031)	2.524*** (0.030)
9th decile	0.232*** (0.052)	0.421*** (0.049)	−0.030 (0.028)	2.068*** (0.027)
8th decile	0.182*** (0.049)	0.273*** (0.045)	−0.031 (0.028)	1.751*** (0.025)
7th decile	0.145*** (0.045)	0.214*** (0.042)	−0.011 (0.027)	1.518*** (0.025)

(*continued*)

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Table 1. Continued

	OLS		FE	
Variables	Reading	Mathematics	Reading	Mathematics
6th decile	0.134*** (0.042)	0.170*** (0.039)	−0.035 (0.026)	1.299*** (0.024)
5th decile	0.129*** (0.041)	0.071* (0.038)	0.008 (0.026)	1.140*** (0.025)
4th decile	0.075* (0.040)	0.070** (0.036)	0.003 (0.025)	0.918*** (0.024)
3rd decile	0.001 (0.037)	0.005 (0.034)	−0.029 (0.025)	0.683*** (0.023)
2nd decile	0.064* (0.037)	0.020 (0.033)	−0.024 (0.025)	0.419*** (0.023)
Standardised test scores in reading in the third grade	0.144*** (0.020)	0.139*** (0.019)		
Standardised test scores in mathematics in the third grade	0.103*** (0.016)	0.261*** (0.016)		
Female students (ref: male)	0.238*** (0.017)	−0.082*** (0.015)		
Immigrant status (ref: native)				
First immigrant generation	0.058 (0.044)	0.105** (0.043)		
Second immigrant generation	0.022 (0.030)	0.067** (0.028)		
School funding in the third grade: private school (ref: public school)	−0.013 (0.024)	−0.007 (0.022)	0.194*** (0.054)	0.068 (0.057)
Island (ref: other islands)				
Gran Canaria	0.193*** (0.027)	−0.052** (0.023)	−0.093 (0.156)	0.197* (0.108)
Tenerife	0.029 (0.027)	0.021 (0.023)	0.022 (0.176)	0.258* (0.138)
Constant	−0.487*** (0.055)	−0.054 (0.050)	−1.144*** (0.135)	−1.207*** (0.102)
Observations	12,514	12,514	12,514	12,514
R-squared	0.182	0.302	0.589	0.537

Note(s): Robust and clustered at school-level standard errors in parentheses; dependent variable: students' standardised scores (reading or mathematics) using the mean and standard deviations of the sixth grade for each subject; estimation method: ordinary least squares (OLS), Columns 1 and 2; fixed effects (FE), Columns 3 and 4. Student FE estimations measure changes between the third and sixth grade; coefficient: ***significant at 1%, **significant at 5%, *significant at 10%
Source(s): Authors' own calculations

Compared to absolute academic performance, the parameters of academic rank are also substantially large. For example, it seems that being over the school median in mathematics in the third grade (between the 6th and 10th deciles) has an influence of more than 0.1 SD on academic performance. Therefore, it seems that students tend to compare with the average academic level.

5.1.2 Distance to the school average level. Table 2 (columns 1 and 2), corresponding to equation (2), examines the influence of the distance of students' characteristics to the school average. The first outcome of interest is the distance of the student's ESCS to the average ESCS. The findings suggest that having a socioeconomic level higher than the school average could potentially hinder educational progress, while having a socioeconomic level lower than the school average might be beneficial for educational attainment. This association is more pronounced in mathematics than in reading, as previously found in Table 1 using deciles. This implies that students with a relatively high ESCS in the school (indicating a positive value in the "distance" variable) tend to show a more significant drop in academic performance in mathematics compared to reading.

The second variable of interest is the distance of students' test scores to the school average. A performance above the school average in the third grade is related to better performance in the sixth grade, while falling below the school average in the third grade has a detrimental influence on academic performance in the sixth grade.

5.2 Students' fixed-effects models

Columns 3 and 4 (Tables 1 and 2) replicate the estimates presented in Columns 1 and 2 using student fixed effects. As previously argued, these estimations control for variables which might be omitted from the specifications (e.g., students' ability), hence providing more precise results. Thus, these are our preferred estimations.

5.2.1 Relative position within the school. In Columns 3 and 4 of Table 1 [equation (3)], we observe that the negative influence of relative socioeconomic position persists, but it becomes more pronounced, reaching approximately 0.1 SD more in the highest deciles.

When it comes to students' relative position in terms of academic performance, we find that the previously identified positive influence is increased by roughly 1 SD for the highest deciles. However, students' ranking in the other subject (e.g., mathematics in the reading estimation) does not seem to exert an influence. This suggests that the previously observed influence from the other subject may have been due to omitted variables in the ordinary least squares (OLS) estimations, which are now controlled for with student fixed effects.

5.2.2 Distance to the school average level. In Columns 3 and 4 of Table 2 [equation (4)], we once again observe that having a higher socioeconomic level than the school average may hinder educational progress. The influence of relative socioeconomic status is approximately 0.2 SDs greater than the equivalent value-added model presented in Columns 1 and 2.

Regarding the influence of the distance of the students' academic performance to the school average, our results indicate that performing above the school average is positively correlated to academic performance in the same subject. In this case, the influence is 0.7 SD higher than the base model (the value-added model).

In summary, the student fixed-effects estimates confirm that the relative socioeconomic status within the school influences educational attainment. They also clarify that it is specifically the academic rank within the same subject that holds significance for academic performance.

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Table 2. The influence of the distance between students' characteristics and that of their school

Variables	OLS		FE	
	Reading	Mathematics	Reading	Mathematics
Distance to the average ESCS of the school (third grade)	−0.099*** (0.025)	−0.128*** (0.023)	−0.297*** (0.036)	−0.360*** (0.039)
ESCS index in the third grade	0.174*** (0.022)	0.220*** (0.021)	0.297*** (0.036)	0.355*** (0.039)
Distance to the average reading performance of the school (third grade)	0.236*** (0.030)	0.030 (0.028)	0.991*** (0.006)	−0.005 (0.006)
Distance to the average mathematics performance of the school (third grade)	0.050** (0.024)	0.205*** (0.023)	−0.007 (0.007)	0.986*** (0.007)
Standardised test scores in reading in the third grade	0.026 (0.028)	0.135*** (0.026)		
Standardised test scores in mathematics in the third grade	0.144*** (0.020)	0.232*** (0.020)		
Female students (ref: male)	0.233*** (0.017)	−0.083*** (0.015)		
Immigrant status (ref: native)				
First immigrant generation	0.058 (0.044)	0.108** (0.043)		
Second immigrant generation	0.024 (0.030)	0.072*** (0.028)		
School funding in the third grade: private school (ref: public school)	−0.040 (0.025)	−0.038 (0.024)	0.147*** (0.046)	0.010 (0.052)
Island (ref: other islands)				
Gran Canaria	0.200*** (0.027)	−0.043* (0.024)	−0.025 (0.110)	0.216** (0.102)
Tenerife	0.025 (0.027)	0.026 (0.024)	0.070 (0.122)	0.264** (0.109)
Constant	−0.202*** (0.026)	0.046** (0.022)	−0.051 (0.088)	−0.205*** (0.078)
Observations	12,514	12,514	12,514	12,514
R-squared	0.183	0.298	0.716	0.688

Note(s): Robust and clustered at school-level standard errors in parentheses; dependent variable: students' standardised scores (reading or mathematics) using the mean and standard deviations of the sixth grade for each subject; estimation method: ordinary least squares (OLS), Columns 1 and 2; fixed effects (FE), Columns 3 and 4. Student FE estimations measure changes between the third and sixth grade; coefficient: ***significant at 1%, **significant at 5%, *significant at 10%
Source(s): Authors' own calculations

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5.3 Robustness checks

To check the robustness of our results, we use the student fixed-effects approach to assess whether school compositional effects vary between type of school funding (Tables S4 and S5 in the Supplementary Material). We observe that the previously identified influence of students' relative socioeconomic position persists across both public and private schools. Notably, the strength of this influence appears to be slightly attenuated in private schools. This difference may be attributed to lower levels of school segregation in the private school setting (Prieto-Latorre and Marcenaro-Gutiérrez, 2021). Private schools tend to have a more homogenous socioeconomic composition among students compared to public schools, which exhibit greater diversity in their student body. Regarding students' relative academic performance, we find a comparable influence in both public and private schools.

In addition, we have split the sample by students' sex (Tables S6 and S7 in the Supplementary Material). The comparison between the subsamples of boys and girls reveals that the relative socioeconomic composition in the school has slightly more pronounced influence for girls, with coefficients approximately 0.1 SD greater for them. It is important to highlight that both relative and absolute socioeconomic levels have a larger influence on girls' academic performance. On the other hand, boys and girls are similarly influenced by their academic rank within the school. In this case, the gender difference is just about 0.03 SD in favour of girls. This indicates that, for girls, it is marginally more advantageous to perform above the average level of the school than it is for boys. These results are consistent across subjects.

Furthermore, Tables 1 and 2 have been re-estimated by obtaining the relative SES and the distances (respectively) at classroom level instead of school level which are found in Tables S8 and S9 (Supplementary Material), showing that results are robust to this criterion change. This approach allows controlling by classroom unobservables that are fixed within-students.

6. Discussion and conclusions

Our study provides empirical evidence of school compositional effects in primary education. Specifically, we examine how the students' relative position within the school, both in terms of their socioeconomic level and academic performance, influences later educational outcomes. To move beyond mere correlation, we exploit a longitudinal data set, allowing us to apply student time-variant fixed-effects estimations. Nevertheless, it is important to highlight that, in spite of these features, there are still unobservables that may not have been controlled, so we do not interpret our results as causal but as conditional associations. The findings indicate that a relatively high socioeconomic status may hinder educational attainment, while a high academic rank in a subject improves their performance. We also find consistent results when measuring the distance to the school average in terms of socioeconomic level and academic performance. We posit that the influence of relative socioeconomic status can be attributed to peer effects, while the influence of the academic rank is consistent with *BFLP effects*.

Our findings, combined with prior research on the influence of school ranking on academic performance, provide insights into the ongoing debate about whether being in a school with higher-achieving peers leads to improved academic outcomes (Elsner and Isphording, 2017; Hanushek and Woessmann, 2011; Murphy and Weinhardt, 2020; Vardardottir, 2015). When parents are selecting a school for their children, they should weigh the trade-off between choosing a high-quality school or prioritising a high relative rank. Our results also imply that having a high academic rank is a more important predictor of academic performance than being surrounded by peers with relatively higher socioeconomic status. Thus, the influence of school composition on students' self-concept outweighs any

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potential learning disadvantages associated with lower-income classmates. This highlights the substantial influence of social comparisons at an early age, which continues to be significant in later stages of life (Marsh *et al.*, 2015; Fang *et al.*, 2018).

Moreover, the influence of academic rank within school on educational attainment is subject specific. This is supported by previous literature which found that self-concept ability in mathematics and reading predicts later achievement in each respective domain (Möller *et al.*, 2011).

To reduce the influence of social comparisons and harness the benefits of peer effects, teachers may encourage students to set their own goals and promote individualised improvements, thereby avoiding social comparison processes that reduce their self-concept and, subsequently, hinder academic progression. Positive feedback from the teacher can improve the learner's self-concept and enable him/her to persevere. Parents can also refrain from comparing their child to peers of the same age, and instead, emphasise the child's personal growth and development.

Further, we observed heterogeneous influences based on the type of school funding. Specifically, the influence of school composition is more pronounced in public schools compared to private ones. This result holds significant relevance for socioeconomically disadvantaged students, who may benefit from attending socially diverse schools. In the context of the Canary Islands, where a considerable proportion of students face socioeconomic challenges,[6] advocating for lower levels of school segregation becomes crucial to narrow the attainment gap.

Additionally, we have explored whether school composition influences girls' and boys' educational performance differently. Results suggests that girls' educational performance is more susceptible to the school socioeconomic environment than boys' educational performance. This result is in line with Van Hek *et al.* (2018), who found that girls gained more than boys from a school's advantaged socioeconomic composition. Regarding the influence of academic rank, we do not find significant differences by gender.

While some information is missing, our findings suggest no significant differences between students who were included and those who were not. Nevertheless, our study does have certain limitations. First, despite using student fixed effects, there may still be some unobservable factors that may not be fixed within students (e.g., teachers, school facilities, etc.) and influence students' competences. In particular, there may be time-varying unobservables (e.g., changes in family circumstances, motivation, school climate) that could be correlated with changes in relative rank. Furthermore, changes in relative position might be influenced by sorting or differential progress that itself depends on unobservables (for instance, students might improve their academic rank not only due to effort, but because of family support or tutoring that may not be fully captured in the model). This leads us to interpret our results as conditional associations rather than causal effects. Second, this research study presents interval validity for the Spanish region of the Canary Islands, but external validity for the other regions of Spain or other countries is limited. The implications of school composition on individual educational improvements highlight the necessity for further research in this area.

Notes

[1.] PIRLS stands for "Progress in International Reading Literacy Study".

[2.] The ESCS index was created using the same methodology as PISA; this is, using the highest parental occupational status, the highest education of parents in years and home possessions (OECD, 2024).

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[3.] This standardisation has been performed using each grade's mean and standard deviations, for each subject. The objective is to report our results as effect sizes, for international comparisons.

[4.] Note that this refers to the absolute socioeconomic level in the context of the Canary Islands.

[5.] Only 2.77% of the sample moved school between the third and sixth grades, and 0.59% moved from one island to another.

[6.] In the Canary Islands, the proportion of students whose parents have attained at most compulsory secondary education (the lowest level of education) is 21% (MEPF, 2018).

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Supplementary material

The supplementary material for this article can be found online.

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