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# Examining the associations between high achievement in reading and school climate: evidence from five South American countries

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## Abstract

An emergent literature has shown that some students overcome adversities related to their low Socio-Economic Status (SES) by attaining high academic achievement. One of the aims of this literature is to identify the factors that explain the capacity of students from low SES backgrounds to attain high academic achievement. However, upon reviewing this literature, I observed that few studies have comparatively investigated the associations between the capacity of students from low SES backgrounds to attain high achievement in reading and school climate characteristics. Additionally, I found that not many studies have researched whether student SES moderates these associations. This paper contributes to fill these two gaps by estimating associations between high achievement in reading and school climate characteristics. Moreover, it examines whether student SES moderates these associations. To do this, this research estimated logit and heterogeneous choice models using representative samples of students from Argentina, Brazil, Chile, Colombia, and Uruguay who participated in the 2018 Programme for International Student Assessment (PISA). The results show that high achievement in reading is positively correlated to certain teaching practices, such as perceived teacher enthusiasm during the instruction and adapting instruction to students' needs. Conversely, it is negatively correlated to teacher feedback and teacher-directed instruction. Furthermore, the findings indicate that high achievement in reading is negatively correlated to the scarcity and low quality of educational material. Interestingly, the results show that student SES does not moderate these associations. In conclusion, these findings indicate that interventions targeting these areas of school climate may help to increase students' probability of attaining high achievement in reading, regardless of their SES. Likewise, these results suggest that if these interventions are focused in low SES schools, they may contribute to bridge the gap in reading skills between students from low and middle or high socioeconomic backgrounds.

**Keywords** High achievement, Reading, PISA, Teaching practices, Educational resources, Argentina, Brazil, Chile, Colombia, Uruguay

## Background

Student results in standardized tests are important educational indicators because they predict other educational, economic, and social outcomes. Previous research has found that these results positively predict the probability of graduating from high school (Bushnik et al., 2004; Knighton & Bussière, 2006); the selection of higher education programs by youth (Bertschy et al., 2009); labor wages (Blau & Kahn, 2005; Denny et al., 2003; Hanushek & Zhang, 2009); wages inequalities (Blau & Kahn, 2005), and economic growth rates (E. A. Hanushek & Woessmann, 2012). In other words, students' results in standardized tests are important because they predict several individual and collective outcomes.

Nevertheless, multiple studies worldwide have consistently shown that students from low Socio-Economic Status (SES) backgrounds on average achieve lower academic results compared to their peers from high SES backgrounds (OECD, 2019d; Sirin, 2005; Tan et al., 2023; UNESCO, 2021). This phenomenon is significant because it may reproduce vulnerability conditions among low SES students. These include higher probabilities of school dropout and reduced likelihood of pursuing a higher education program.

Given the importance of this phenomenon, a rising number of studies have examined the factors that explain the capacity of students from low SES backgrounds to attain high academic achievement, often referred to as academic resilience. In general, there are two conditions an individual or a system must meet to be classified as resilient: they must face one severe adversity, and they must overcome that adversity by achieving positive adaptation (Masten, 2014). Masten (2014) defined severe adversity or risk as a factor that is related to a problematic outcome and positive adaptation as the capacity of a system or individual to do well in a given task. In educational research, academic resilience is usually defined as the capacity of students from low SES to attain high academic achievement (Agasisti & Longobardi, 2014, 2017; Bayona-Rodríguez & López Vera, 2021; Dueñas Herrera et al., 2019; OECD, 2011; Sandoval-Hernández & Białowolski, 2016). This definition is grounded in scientific evidence that has shown that improvements in student SES are positively related to academic results (OECD, 2019d; Sirin, 2005; Tan et al., 2023; UNESCO, 2021). Additionally, it considers cultural and scientific criteria that determine what constitutes high academic achievement.

Among all the factors related to academic resilience, this research centers on school climate. School climate is defined as: "the quality and character of school life. School climate is based on patterns of students', parents', and school personnel's experience of school life and reflects norms, goals, values, interpersonal relationships, teaching and learning practices, and organizational structures" (National School Climate Center, 2022). This research focused on school climate characteristics because they are related to the availability, frequency, and complexity of the interaction between students and their peers, teachers, and educational materials; and these interactions are recognized as important determinants of youth development (Bronfenbrenner & Morris, 2007).

## State of the art

Upon reviewing the literature on factors related to academic resilience, I identified 10 published studies that examine the associations between academic resilience and school climate. Table 1 shows the different school climate dimensions and their correlations to academic resilience that previous studies have explored. These dimensions include

**Table 1** Summary of the associations between academic resilience and school climate characteristics identified in the literature

School climate's dimensions	School climate's measure	Studies									
		1	2	3	4	5	6	7	8	9	10
School resources	Educational material resources availability and quality	X	X	X	X	X		X			
	Staff availability and quality	X	X	X	X						
Interpersonal relationships	Student-teacher relationships	X	X	X	X				X	X	
	Student relationships										
	Adult relationships										
Teaching practices	Assessment practices	X		X							
	Teacher feedback		X	X							
	Teaching and learning time		X	X				X			
	Adaptative instruction			X							
School safety	Physical safety										
	Emotional safety										
	Bullying			X						X	
	Selling and using illegal drugs and alcohol										
Sense of belonging	School belonging			X		X	X				X
	Students engaged in lessons							X			
Organizational structures	School discipline		X			X				X	
	School norms										

Notes 1=Agasisti and Longobardi (2014); 2=Agasisti and Longobardi (2017); 3=Bayona-Rodríguez & López Vera, (2021); 4=Cordero Ferrera et al., (2015); 5= García-Crespo, et al. (2019b); 6= García-Crespo, Fernandez-Alonso, et al. (2019a); 7=OECD (2011); 8=Padrón et al. (2012); 9=Vera et al. (2015); 10=Yavuz and Kutlu (2016)

school resources, interpersonal relationships, teaching and learning practices, school safety, sense of belonging, and organizational structure (Agasisti & Longobardi, 2014, 2017; Bayona-Rodríguez & López Vera, 2021; Cordero Ferrera et al., 2015; García-Crespo, Fernández-Alonso et al., 2019; García-Crespo et al., 2019; OECD, 2011; Padrón et al., 2012; Vera et al., 2015; Yavuz & Kutlu, 2016).

Literature on factors related to academic resilience has the potential to guide the design and implementation of interventions aimed at increasing the probability of students from low SES reaching high achievement in reading and reducing the gap in reading skills between students from low and middle or high SES backgrounds. However, upon reviewing this literature, I have observed two gaps that have constrained the potential of this literature in South American countries. Firstly, there is no comparative evidence from South American countries regarding the associations between high achievement in reading among low SES students (academic resilience) and school climate characteristics, such as teaching practices, school discipline, teacher support, and educational resources. Secondly, there is no evidence about the role of student SES as a moderator factor in the relationships between academic resilience and school climate characteristics.

At this point, it is worth noting that there is a parallel body of literature that has examined the factors related to high academic achievement. This body of literature has found that high academic achievement in mathematics is associated with school climate characteristics, such as school discipline, school safety, and positive teacher expectations (Sandoval-Hernández & Białowolski, 2016). Likewise, this literature has shown that high academic achievements in mathematics and science are correlated to student and school SES (Gilleece et al., 2010; Pitsia, 2022; Sandoval-Hernández & Białowolski, 2016).

However, I only identified one study that examines both: the associations between high achievement in reading and school climate characteristics; and whether student SES moderates the associations between high achievement in reading and few school characteristics of school climate. In this research, Rodríguez De Luque (2024) found that high achievement in reading is correlated to physical safety, alcohol and drug consumption and commercialization, interpersonal relationships, school norms, and school participation. His results also showed that student SES does not moderate these relationships. To determine the generalizability of these results across South American countries, there is a need for comparative studies that assess whether student SES moderates the association between high achievement in reading and school climate in this region.

### **The current study**

These gaps in the academic resilience and high academic achievement literature are problematic because they constrain the potential of these bodies of work to guide the design and development of school climate interventions aimed at increasing the probability of students from low SES reaching high academic achievement and reducing the gap in reading skills between students from low and middle or high SES backgrounds. The current study seeks to fill these gaps.

Specifically, the current study has two analytical purposes. Firstly, it researches associations between high achievement in reading and several characteristics of school climate (i.e., teaching practices, school discipline, teacher support, and educational resources) using statistical information of students from Argentina, Brazil, Chile, Colombia, and Uruguay, who participated in the Programme for International Student Assessment (PISA) of 2018. Secondly, it investigates whether student SES moderates these associations.

### **Reference framework**

To achieve these analytical objectives, the data analysis and results discussion are framed using the bio-ecological model of human development (Bronfenbrenner & Morris, 2007). The bio-ecological model posits that human development is a function of proximal processes (i.e., interactions between one person and other people, objects, and symbols in their environment), individual characteristics, contextual factors, and the historical period when the proximal processes take place. Likewise, this theory suggests that proximal processes are the main determinants of human development and that the strength and shape of the impact of these proximal processes on human development depend on individual characteristics, contextual factors, and the historical period when proximal processes take place.

At this point, it is important to highlight that high achievement in reading, school climate, and student SES can be conceptualized as indicators of human development, proximal processes, and contextual factors, respectively. Firstly, the capacity to attain high achievement in reading can be seen as an indicator of human development because it reflects the cognitive skills required for information processing and meaning development from written texts. Secondly, school climate variables represent school proximal processes because they are related to the availability, frequency, and complexity of the interaction between students and their peers, teachers, and educational materials. Thirdly, students' cultural, social, and economic status serve as a measure of contextual

characteristics because they shape the framework of interactions between students and their mothers, fathers, siblings, and other people within their homes.

Given the above, I hypothesize that teaching practices, school discipline, teacher support, and educational resources are correlated to the probability of attaining high achievement in reading. These associations are put forward because these factors are related to the frequency and complexity of the interactions between students and their peers, teachers, and educational materials. Moreover, according to the bio-ecological model (Bronfenbrenner & Morris, 2007), these interactions allow youth to develop their knowledge and skills.

Additionally, I hypothesize that the shape and strength of these relationships are moderated by students' cultural, economic, and social status. This moderator role is put forward because students' SES is an environmental characteristic that affects child development. Likewise, according to Proposition II of this model, the form and power of proximal processes affecting development vary as a joint function of the characteristics of the environment, the developing person, and other factors (Bronfenbrenner & Morris, 2007).

## **Materials and methods**

### **Data**

This research used PISA 2018 databases to achieve its analytical objectives. PISA is a large-scale skills and knowledge assessment project conducted by the Organization for Economic Co-operation and Development (OECD) every three years. PISA assesses 15-year-old students' knowledge and skills in reading, mathematics, and science, along with their ability to face real life challenges. Since the OECD gathers information from statistically representative samples, PISA information is useful to compare academic achievement between participating societies and to determine what skills are achievable for 15-year-old students (OECD, 2019d). Additionally, students, parents, teachers, and school principals fill out questionnaires about student experiences, attitudes and dispositions, family characteristics, and school factors, which may explain student skills. Likewise, this information helps to identify factors that can be manipulated to improve student academic performance and thus offers insights into designing educational interventions aimed at improving student skills (OECD, 2011, OECD, 2019d).

### **Sample**

PISA 2018 used a two-stage sampling design to select students from 15 years and 3 months to 16 years and 2 months at the start of the assessments (OECD, 2009). However, there were two main differences in the sampling procedures among the analyzed countries. Firstly, there were variations in the definition of a "school" among the analyzed countries. Brazil and Chile used an administrative definition of a school that could encompass multiple buildings, which could be located far away from each other (OECD, 2019a). In contrast, Argentina and Colombia defined schools based on the location of their buildings (OECD, 2019a). Additionally, Uruguay considered night school as a separate school. Secondly, each country selected different stratification variables (OECD, 2019a). For example, on the one hand, Argentina used two explicit stratification variables (region and sector), and six implicit ones (subregion, department, location, academic performance, education level, and school size). On the other hand, Colombia

used two explicit stratification variables (region and urbanicity/school type) and four implicit ones (regional entities, main shift, school gender composition, and school size).

This study only removed the student information of those who did not possess the required data for estimating the statistical models employed to achieve the research's analytical goals. Given the above, the final student sample sizes used to estimate the statistical models for Argentina, Brazil, Chile, Colombia, and Uruguay were 9816, 8341, 6302, 6733, and 4132, respectively. These student sample sizes represented 82%, 78%, 83%, 90%, and 79% of the original samples for Argentina, Brazil, Chile, Colombia, and Uruguay, respectively.

### Measures

This research used as dependent variables some indicators of high achievement in reading (i.e., positive adaptation). PISA defined reading literacy as “students’ capacity to understand, use, evaluate, reflect on and engage with texts to achieve one’s goals, develop one’s knowledge and potential, and participate in society” (OECD, 2019b, p. 27). Furthermore, PISA’s reading literacy framework classifies student results into nine performance levels: below level 1c, level 1c, 1b, 1a, 2, 3, 4, 5, and 6 (OECD, 2019b). Given the distribution of student reading results in the analyzed countries, this study defined the variable “high achievement in reading” as a dichotomous indicator that took the value of one if students attained a performance level of four or higher, otherwise, it took a value of zero.

This decision was made because students who achieve a performance level of four or higher in the PISA reading test demonstrate the skills needed to understand lengthy texts, interpret texts, make inferences based on their reading, and reflect on argumentative strategies used by authors in their texts (OECD, 2019b). It is important to highlight that this research did not opt for a higher threshold to define high achievement because the number of students who achieved a level of performance of five and six was too low in the analyzed countries. Therefore, if this study had chosen a higher threshold to define high achievement, standard errors would have been too high.

Furthermore, this study used indicators of severe adversity related to having a Low Economic, Social, and Cultural Status (Low ESCS). The variable “Low ESCS” was constructed based on students’ Economic, Social, and Cultural Status (ESCS) index (OECD, 2019d), available in PISA 2018 databases. Specifically, a student was classified as having Low ESCS if their ESCS index was equal to or less than the 20th percentile of ESCS index in their home country; otherwise, it took a value of zero.

Likewise, given the multidimensional nature of school climate (Berkowitz et al., 2017; Thapa et al., 2013; Wang & Degol, 2016), this study used nine indicators of school climate which are related to teaching practices, educational resources, school discipline, and school support. Table 2 presents the indices used, examples of the items used to construct these indices, their interpretation, and their estimated Cronbach’s Alpha.

Additionally, this research used three control variables that measured individual and school characteristics that could explain students’ probability of attaining high achievement in reading. The control variables used in this analysis were: Female (female=1 and male=0); Grade (students’ grade compared to modal grade in country); and Public which is a categorical variable that took the value of one for students who attended a

**Table 2** Description of school climate variables

Dimension	Indices (variables)	Item examples	Response options	Interpretation	Cronbach's alpha
Teaching practices	Adaptive instruction	1. The teacher adapts the lesson to my class's needs and knowledge. 2. The teacher changes the structure of the lesson on a topic that most students find difficult to understand.	a. Never or almost never. b. Some lessons. c. Many lessons. d. Every lesson or almost every lesson	This variable was centered using the mean perception of OECD students. A value greater (lower) than zero indicates that a student perceives a higher (lower) frequency of adaptive practices implemented by their teachers than the average OCDE student.	0.72
Teaching practices	Directed instruction	1. The teacher sets clear goals for our learning. 2. The teacher asks questions to check whether we have understood what was taught.	a. Never or almost never. b. Some lessons. c. Many lessons. d. Every lesson or almost every lesson	This variable was centered using the mean perception of OECD students. A value greater (lower) than zero indicates that a student perceives a higher (lower) frequency of teacher-directed practices than the average OCDE student.	0.73
Teaching practices	Teacher feedback	1. The teacher tells me in which areas I can still improve. 2. The teacher tells me how I can improve my performance.	a. Never or hardly ever. b. Some lessons c. Most lessons. d. Every lesson.	This variable was centered using the mean perception of OECD students. A value greater (lower) than zero indicates that a student perceives a higher (lower) frequency of teacher feedback than the average OCDE student.	0.83
Teaching practices	Teacher's stimulation of reading engagement	1. The teacher encourages students to express their opinion about a text. 2. The teacher helps students relate the stories they read to their lives.	a. Never or hardly ever. b. Some lessons c. Most lessons. d. Every lesson.	This variable was centered using the mean perception of OECD students. A value greater (lower) than zero indicates that a student perceives a higher (lower) level of teacher stimulation of students in relation to reading engagement than the average OCDE student.	0.84
Teaching practices	Teacher enthusiasm	1. It was clear to me that the teacher liked teaching us. 2. The enthusiasm of the teacher inspired me.	a. Strongly agree. b. Agree. c. Disagree. d. Strongly disagree.	This variable was centered using the mean perception of OECD students. A value greater (lower) than zero indicates that a student perceives a higher (lower) level of teacher enthusiasm than the average OCDE student.	0.88
Educational resources	Educational material shortage	1. A lack of educational material (e.g. textbooks, IT equipment, library or laboratory material). 2. Inadequate or poor quality educational material (e.g. textbooks, IT equipment, library or laboratory material)	a. Not at all. b. Very little. c. To some extent. d. A lot.	This variable was centered using the mean perception of OECD principals. A value greater (lower) than zero indicates that a principal perceives a higher (lower) level of educational material shortage than the average OCDE principal.	0.86



**Table 2** (continued)

Dimension	Indices (variables)	Item examples	Response options	Interpretation	Cronbach's alpha
Educational resources	Staff shortage	1. A lack of teaching staff. 2. Inadequate or poorly qualified teaching staff.	a. Not at all. b. Very little. c. To some extent. d. A lot.	This variable was centered using the mean perception of OECD principals. A value greater (lower) than zero indicates that a principal perceives a higher (lower) level of staff shortage than the average OCDE principal.	0.77
School discipline	Disciplinary climate	1. Students don't listen to what the teacher says. 2. There is noise and disorder	a. Every lesson. b. Most lessons. c. Some lessons. d. Never or hardly ever.	This variable was centered using the mean perception of OECD students. A value greater (lower) than zero indicates that a student perceives better (worse) disciplinary climate than the average OCDE student.	0.82
School support	Teacher support	1. The teacher gives extra help when students need it. 2. The teacher helps students with their learning”;	a. Every lesson. b. Most lessons. c. Some lessons. d. Never or hardly ever.	This variable was centered using the mean perception of OECD students. A value greater (lower) than zero indicates that a student perceives that their teacher provides more (less) support than the average OCDE student.	0.85

*Note* Items examples and response options were taken from OECD (2019d) and OECD (2019c)

public school and zero for those attended a private school. For detailed descriptions of the indices used in this research, please consult OECD (2019d, 2019c).

### Data analysis procedures

To fulfill the analytical purposes of this research, a correlational research design was used. Due to the correlational nature of the research design, the results should be interpreted as correlations or associations and not causal effects. Likewise, this research estimated logit models (Wooldridge, 2010) and heterogeneous choice models with a logit link function (Williams, 2009, 2010).

Firstly, this study estimated logit models to examine the associations between the probability of attaining high achievement in reading and school climate variables. These models included as explanatory variables the Low ESCS, the school climate indices, and the control variables. Secondly, this research estimated heterogeneous choice models with a logit link function to examine whether Low ESCS moderates the associations between the probability of attaining high achievement in reading and the school climate variables. The estimated heterogeneous choice models included as explanatory variables the Low ESCS, school climate indices, interaction terms of Low ESCS and school climate variables, and control variables. It is worth noting that the estimated coefficients of the interaction terms of Low ESCS and school climate variables quantify differences in the associations between the probability of attaining high achievement in reading and school climate variables attributed to having a Low ESCS.

During this research, it was decided to conduct heterogeneous choice models to achieve the second analytical goal of the study because it implies comparing how the effects of school climate variables differ across Low SES and Middle or high SES groups. On this point, it is worth noting that in logit models, real coefficients ( $\alpha$ ) are



confounded with residual variation ( $\sigma$ ) (Williams, 2009, 2010). In other words, we cannot estimate  $\alpha$  and  $\sigma$  separately, we only can estimate their ratio ( $\beta = \alpha / \sigma$ ) (Johnston & DiNardo, 1997; Williams, 2009, 2010). Williams (2009) highlighted the issues related to the above:

*Two groups could have identical values on the  $\alpha$ , but if their residual variances differ, their  $\beta$  will differ as well. Similarly, the  $\alpha$  values could be larger in one group, but if the residual variance is also greater for that group, the  $\beta$  values for the two groups could be equal. (p. 534)*

Since it is plausible that residual variation differs among students from Low SES and Middle or high SES, it was decided to conduct heterogeneous choice models to achieve the second analytical goal. The heterogeneous choice models deal with the aforementioned issues by estimating two equations, one for the determinants of the outcome variable, and another for the determinants of the residual variance (Williams, 2010). According to Williams (2009), for a binary case, the model can be written as:

$$Pr(y_i = 1) = g\left(\frac{X_i\beta}{e^{(Z_i)}}\right) = g\left(\frac{X_i\beta}{\sigma_i}\right)$$

Where  $g$  stands for the logit function;  $X_i$  is a vector of explanatory variables; in this case the school climate variables;  $\beta$  and  $\gamma$  are vectors of coefficients;  $Z_i$  is the group variable with different error variance, in this case, this group variable refers to students from Low SES and Middle or high SES. Finally,  $X_i\beta$  is the equation of the determinants of the odds of attaining high achievement in reading, or choice equation, and  $e^{(Z_i)}$  is the variance equation.

This study assesses whether residual variation differs among students from Low SES and Middle or high SES. Note that if there are no differences in residual variation among SES groups, the second analytical goal of this study may also be achieved using logit models.

Given the clustered nature of student information, it may seem necessary to estimate multilevel models. However, this study did not estimate multilevel models for conceptual and technological reasons. As mentioned before, there were variations in the definition of a school among the analyzed countries. These conceptual differences affect the comparability of the unit of analysis, and they may affect both the estimation of between-school variance and within-school variance and the interpretation of regression coefficients. Secondly, multilevel heterogeneous choice models were not estimated because, to the best of my knowledge, there is no statistical software to conduct this type of regression analysis.

Instead of estimating multilevel models, this research estimated unbiased population parameters and standard errors by considering the complexity of the PISA reading test (i.e., PISA used 10 plausible values to report students' performance), the PISA two-stage sampling design, and the fact that PISA employed the Balanced Repeated Replication with Fay's modification (OECD, 2009). Given these characteristics, the OECD (2009) states a six-step procedure for estimating unbiased parameters and standard errors, incorporating final students' weights, 80 replicate weights, and 10 plausible values available in PISA databases. To do this, this study used the "repest" Stata module (Avvatsati & Keslair, 2014), which was developed by OECD researchers to analyze data from

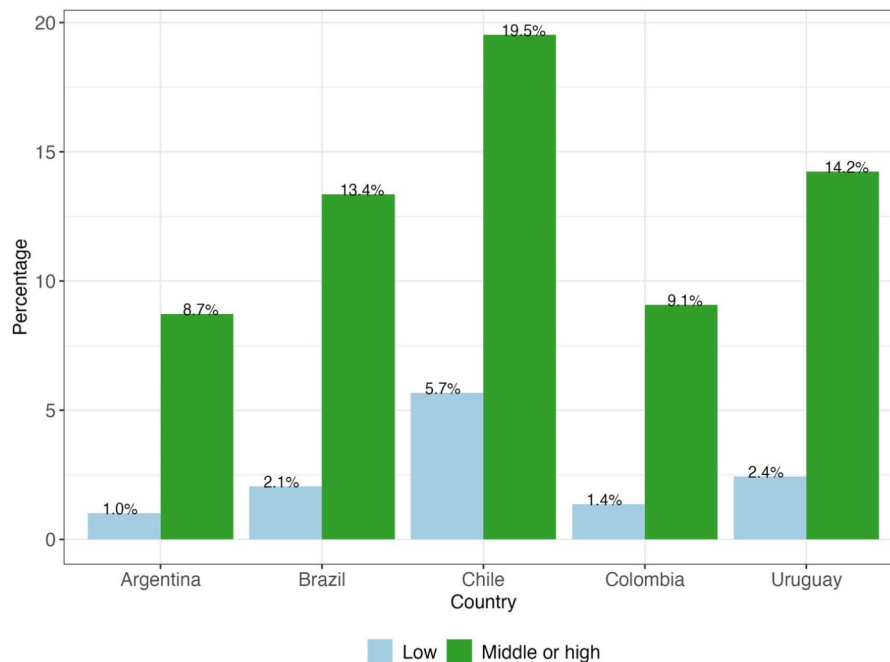
large-scale assessment projects. In other words, this research estimated logit models and heterogeneous choice models using the “glm” (StataCorp, 2021) and the “oglm” (Williams, 2010) Stata commands in conjunction with the “repest”. Likewise, this study used the “intsvy” R package (Caro & Biecek, 2017) to account for the PISA sample design and complexity in estimating descriptive statistics.

## Results

This section is divided into three parts. Firstly, it presents descriptive statistics to examine differences in the percentage of students who attain high achievement in reading and the perceived school climate between countries and among students from different ESCS backgrounds. Secondly, it reports the estimated associations between the log odds of attaining high achievement in reading and perceived school climate variables. Finally, it analyzes whether Low ESCS moderates these associations.

### Descriptive statistics

Figure 1 presents the percentage of students who attain high achievement in reading by country and socioeconomic status. This figure shows that there are differences in that percentage between analyzed countries and socioeconomic groups. Specifically, the results show that within each country, the percentage of students who attain high achievement in reading was higher for those with middle or high ESCS compared to their low ESCS peers. Likewise, results show that, on the one hand, Chile had the highest percentage of high achiever students for both low ESCS (5.7%) and middle or high ESCS (19.5%) groups; on the other hand, Argentina and Colombia had the lowest percentage of high achiever students for low ESCS (1.0% and 1.4%, respectively) and middle or high ESCS (8.7% and 9.1%, respectively) groups.



**Fig. 1** Percentage of students who attain high achievement in reading by country and student ESCS. *Note* R intsvy package (Caro & Biecek, 2017) was used to calculate the descriptive statistics and R ggplot2 package (Wickham, 2009) was used to make this plot

Given these differences in the percentage of students who attain high achievement in reading, Table 3 presents school climate descriptive statistics by Low ESCS and country. The objective is to identify possible differences in school climate that may explain the aforementioned differences in the percentage of students who attain high achievement

**Table 3** Descriptive statistics of school climate variables by country and student ESCS

Variable	Country	M	M	DiM	SD	SD
		Low ESCS=0	Low ESCS=1		Low ESCS=0	Low ESCS=1
Disciplinary climate	Argentina	-0.43	-0.39	-0.04	0.91	0.88
	Brazil	-0.34	-0.39	0.06+	0.98	0.97
	Chile	-0.10	-0.13	0.03	0.97	0.99
	Colombia	0.12	0.10	0.02	0.87	0.87
	Uruguay	-0.05	-0.13	0.08+	0.95	0.96
Teacher support	Argentina	0.38	0.47	-0.09*	0.91	0.87
	Brazil	0.42	0.47	-0.05*	0.91	0.88
	Chile	0.43	0.49	-0.06	0.89	0.88
	Colombia	0.35	0.32	0.03	0.89	0.86
	Uruguay	0.25	0.35	-0.10**	0.94	0.88
Directed instruction	Argentina	0.25	0.47	-0.23**	0.94	0.91
	Brazil	0.31	0.49	-0.17**	1.00	0.99
	Chile	0.48	0.57	-0.10**	0.96	0.95
	Colombia	0.28	0.33	-0.04	0.96	0.97
	Uruguay	0.11	0.31	-0.20**	0.94	0.95
Teacher feedback	Argentina	-0.19	-0.12	-0.07+	0.97	0.92
	Brazil	-0.15	-0.15	0.00	0.97	0.91
	Chile	0.16	0.28	-0.12**	1.10	1.06
	Colombia	0.24	0.30	-0.05	0.99	0.93
	Uruguay	-0.26	-0.20	-0.06	0.92	0.88
Teacher's stimulation of reading engagement	Argentina	-0.11	-0.05	-0.06	0.99	0.97
	Brazil	-0.01	0.05	-0.06*	1.03	1.02
	Chile	0.28	0.30	-0.02	1.05	1.00
	Colombia	0.23	0.14	0.09*	0.97	0.93
	Uruguay	-0.03	-0.07	0.04	0.97	0.92
Adaptive instruction	Argentina	-0.06	-0.12	0.07+	0.93	0.90
	Brazil	-0.04	-0.07	0.03	1.02	0.97
	Chile	0.29	0.28	0.01	1.03	0.97
	Colombia	0.03	-0.07	0.10**	0.96	0.91
	Uruguay	-0.02	-0.04	0.02	0.97	0.96
Teacher enthusiasm	Argentina	0.23	0.25	-0.02	1.00	0.93
	Brazil	0.22	0.25	-0.03	0.94	0.89
	Chile	0.34	0.32	0.02	1.05	0.97
	Colombia	0.36	0.35	0.01	0.94	0.86
	Uruguay	0.15	0.04	0.10*	0.95	0.86
Educational material shortage	Argentina	0.29	0.72	-0.43**	1.18	1.12
	Brazil	-0.15	0.37	-0.52**	1.13	1.06
	Chile	-0.24	0.00	-0.25**	0.87	0.90
	Colombia	0.58	1.23	-0.65**	1.18	0.91
	Uruguay	0.03	0.37	-0.34**	1.15	1.14
Staff shortage	Argentina	-0.12	0.22	-0.33**	0.98	0.88
	Brazil	-0.25	-0.05	-0.20**	1.10	1.00
	Chile	-0.25	-0.11	-0.14	0.99	1.05
	Colombia	0.26	0.68	-0.42**	1.15	1.03
	Uruguay	0.34	0.72	-0.38**	1.19	1.00

Note Significance codes: + 0,1 \* 0,05 \*\* 0,01. Mean (M), differences in means (DiM), and standard deviation (SD)

in reading by student ESCS backgrounds. This table shows that students from Low ESCS perceived higher levels of directed instruction practices by their teachers, both educational material and staff shortage and teacher support than their peers from Middle or high ESCS backgrounds.

**What are the associations between high achievement in reading and teaching practices, school discipline, teacher support, and educational resources, regardless of student SES?**

Table 4 presents the results of logit models for high achievement in reading. The results showed several empirical regularities in the associations between high achievement in reading and teaching practices, school discipline, teacher support, and educational resources. Firstly, it was found that teacher enthusiasm was positively correlated to high achievement in reading across all analyzed countries, while adaptive instruction was positively correlated to high achievement in reading in three countries. Furthermore, the results showed that directed instruction practices were negatively correlated to high achievement in reading across all analyzed countries, while teacher feedback and

**Table 4** Results of logit models for high achievement in reading

	High achievement in reading				
	(1)	(2)	(3)	(4)	(5)
	Argentina	Brazil	Chile	Colombia	Uruguay
	b/se	b/se	b/se	b/se	b/se
Low ESCS	-1.50** (0.43)	-1.11** (0.26)	-1.11** (0.15)	-1.19** (0.31)	-1.33** (0.28)
Disciplinary climate	0.15+ (0.09)	0.14* (0.06)	0.07 (0.05)	-0.07 (0.10)	0.07 (0.07)
Teacher support	0.09 (0.08)	0.12 (0.08)	-0.00 (0.07)	-0.09 (0.09)	-0.06 (0.09)
Directed instruction	-0.42** (0.07)	-0.43** (0.08)	-0.29** (0.07)	-0.34** (0.10)	-0.34** (0.09)
Teacher feedback	-0.25** (0.09)	-0.25** (0.07)	-0.29** (0.05)	-0.05 (0.08)	-0.21* (0.09)
Teacher's stimulation of reading engagement	0.12 (0.10)	0.11 (0.08)	0.14* (0.06)	0.21* (0.10)	0.14+ (0.08)
Adaptive instruction	0.10 (0.09)	0.23** (0.07)	0.21** (0.05)	0.06 (0.09)	0.20* (0.08)
Teacher enthusiasm	0.21* (0.09)	0.19* (0.08)	0.18** (0.06)	0.18* (0.09)	0.25** (0.08)
Educational material shortage	-0.25* (0.10)	-0.27** (0.09)	-0.22* (0.11)	-0.34** (0.11)	0.04 (0.09)
Staff shortage	0.04 (0.11)	0.01 (0.09)	-0.04 (0.07)	0.18 (0.11)	-0.12 (0.09)
Grade	1.09** (0.20)	0.74** (0.08)	0.76** (0.07)	0.85** (0.11)	1.38** (0.19)
Female	-0.03 (0.15)	0.18+ (0.11)	0.09 (0.10)	-0.11 (0.14)	0.01 (0.13)
Public	-1.01** (0.25)	-1.36** (0.21)	-0.61** (0.15)	-1.28** (0.24)	-0.49* (0.21)
Intercept	-1.82** (0.17)	-0.87** (0.20)	-1.36** (0.10)	-1.49** (0.19)	-1.33** (0.21)
Observations	9814	8341	6302	6733	4132

Note Standard errors (se) are presented in parentheses. Significance codes: + 0,1 \* 0,05 \*\* 0,01

educational material shortage were both negatively correlated to high achievement in reading in four countries.

Regarding the role of analyzed teaching practices on the probability of attaining high achievement in reading, the results showed that adaptive instruction practices were correlated to high achievement in reading in Brazil (estimated parameter  $(b)=0.23$  and Odd Ratio<sup>1</sup> (OR)=1.26), Chile ( $b=0.21$  and OR=1.23) and Uruguay ( $b=0.20$  and OR=1.22). In other words, for each one-unit increase in adaptive instruction, the odds of attaining high achievement in reading are 1.26, 1.23, and 1.22 times higher in Brazil, Chile, and Uruguay, respectively, while holding all other predictor variables constant.

Additionally, the findings showed that teacher enthusiasm was positively correlated to high achievement in reading in Argentina ( $b=0.21$  and OR=1.23), Brazil ( $b=0.19$  and OR=1.21), Chile ( $b=0.18$  and OR=1.20), Colombia ( $b=0.18$  and OR=1.20), and Uruguay ( $b=0.25$  and OR=1.28). What this means is that for each one-unit increase in teacher enthusiasm, the models predicted a 23%, 21%, 20%, 20%, and 28% increase in the odds of attaining high achievement in reading in Argentina, Brazil, Chile, Colombia, and Uruguay, respectively, while holding the other predictor variables constant.

Likewise, the results showed that high achievement in reading was correlated to teachers' stimulation of reading engagement practices in Chile ( $b=0.14$ , and OR=1.15), Colombia ( $b=0.21$  and OR=1.23), and Uruguay ( $b=0.14$  and OR=1.15). In other words, for each one-unit increase in teacher's stimulation of reading engagement practices, the odds of attaining high achievement in reading are 1.15, 1.23, and 1.15 times higher in Chile, Colombia, and Uruguay, respectively, while holding the other predictor variables constant.

Furthermore, the findings indicated that teacher feedback was negatively correlated to high achievement in reading in Argentina ( $b=-0.25$  and OR=0.78), Brazil ( $b=-0.25$  and OR=0.78), Chile ( $b=-0.29$  and OR=0.75) and Uruguay ( $b=-0.21$  and OR=0.81). What this means is that for each unit of increase in the variable teacher feedback, there was an associated decrease in the odds of attaining high achievement in reading by a factor of 0.78, 0.78, 0.75, and 0.81 in Argentina, Brazil, Chile, and Uruguay, respectively, while keeping all other variables included in the model constant.

The results showed that directed instruction practices were correlated to high achievement in reading in Argentina ( $b=-0.42$  and OR=0.66), Brazil ( $b=-0.43$  and OR=0.65), Chile ( $b=-0.29$  and OR=0.75), Colombia ( $b=-0.34$  and OR=0.71) and Uruguay ( $b=-0.34$  and OR=0.71). In other words, for each unit of increase in the variable directed instruction, there was an associated decrease in the odds of attaining high achievement in reading by a factor of 0.66, 0.65, 0.75, 0.71, and 0.71 in Argentina, Brazil, Chile, Colombia, and Uruguay, respectively, while keeping all other variables included in the model constant.

Regarding the associations between high achievement in reading and educational material shortage, the findings showed that they were negatively correlated in Argentina ( $b=-0.25$  and OR=0.78), Brazil ( $b=-0.27$  and OR=0.76), Chile ( $b=-0.22$  and OR=0.80) and Colombia ( $b=-0.34$  and OR=0.71). What this means is that for each unit of increase in the variable educational material shortage, there was an associated decrease in the odds of attaining high achievement in reading by a factor of 0.78, 0.76, 0.80, and 0.71

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<sup>1</sup> Odd Ratio= $\exp(b)$ .

in Argentina, Brazil, Chile, and Colombia, respectively, while keeping all other variables included in the model constant.

### Does student ESCS moderate the associations between high achievement in reading and teaching practices, school discipline, teacher support, and educational resources?

Table 5 presents the results of heterogeneous choice models for high achievement in reading. The results indicated that none of the 45 estimated parameters for interaction terms were statistically significant. In other words, findings indicated that student ESCS did not moderate the relationships between high achievement in reading and the analyzed school climate characteristics.

It is worth noting that Table 5 findings indicated that the standard deviation of the residuals was generally lower for students from Low ESCS than for students from middle or high ESCS. Nevertheless, these differences were not statistically significant. This evidence indicates that, in this case, it is valid to compare differences in estimated parameters for students from Low SES and middle or high SES using logit models. Therefore, this research assessed the robustness of these results using logit models. The logit model results from this research are presented in Table 6. These findings confirmed heterogeneous choice model results; in other words, logit model results indicated that none of the 45 estimated parameters for interaction terms were statistically significant.

**Table 5** Results of estimated interactions between perceived school climate variables and low ESCS using heterogeneous choice models

	High achievement in reading				
	(1)	(2)	(3)	(4)	(5)
	Argentina	Brazil	Chile	Colombia	Uruguay
	b/se	b/se	b/se	b/se	b/se
Disciplinary climate x Low ESCS	-0.25 (0.66)	-0.02 (0.27)	0.24 (0.22)	-0.23 (0.34)	0.23 (0.42)
Teacher support x Low ESCS	0.04 (0.96)	0.07 (0.31)	-0.14 (0.24)	0.52 (0.47)	0.15 (0.48)
Directed instruction x Low ESCS	-0.40 (1.21)	-0.14 (0.34)	0.17 (0.22)	-0.26 (0.54)	0.03 (0.71)
Teacher feedback x Low ESCS	0.00 (0.80)	-0.08 (0.43)	-0.11 (0.21)	-0.01 (0.38)	-0.28 (0.85)
Teacher's stimulation of reading engagement x Low ESCS	-0.28 (0.83)	-0.39 (0.33)	0.01 (0.20)	0.07 (0.52)	-0.32 (0.58)
Adaptive instruction x Low ESCS	0.52 (0.76)	0.24 (0.31)	0.02 (0.23)	-0.00 (0.29)	0.23 (0.80)
Teacher enthusiasm x Low ESCS	-0.26 (0.53)	0.09 (0.37)	-0.11 (0.23)	0.30 (0.45)	-0.18 (0.48)
Educational material shortage x Low ESCS	0.01 (0.54)	-0.31 (0.32)	-0.14 (0.21)	0.14 (0.43)	-0.11 (0.36)
Staff shortage x Low ESCS	-0.33 (0.57)	-0.26 (0.28)	0.25 (0.16)	0.09 (0.24)	0.11 (0.39)
School climate variables	Yes	Yes	Yes	Yes	Yes
Low ESCS	Yes	Yes	Yes	Yes	Yes
Control variables	Yes	Yes	Yes	Yes	Yes
Ln sigma Low ESCS	0.07 (0.57)	-0.10 (0.36)	0.02 (0.25)	-0.10 (0.31)	-0.14 (0.66)
Observations	9814	8341	6302	6733	4132

Note Standard errors (se) are presented in parentheses. Significance codes: + 0,1 \* 0,05 \*\* 0,01

**Table 6** Results of estimated interactions between perceived school climate variables and low ESCS using logit models

	High achievement in reading				
	(1)	(2)	(3)	(4)	(5)
	Argentina	Brazil	Chile	Colombia	Uruguay
	b/se	b/se	b/se	b/se	b/se
Disciplinary climate x Low ESCS	-0.28 (0.47)	-0.03 (0.25)	0.24 (0.19)	-0.25 (0.33)	0.29 (0.31)
Teacher support x Low ESCS	-0.01 (0.43)	0.10 (0.33)	-0.13 (0.23)	0.56 (0.44)	0.18 (0.45)
Directed instruction x Low ESCS	-0.30 (0.46)	-0.21 (0.39)	0.18 (0.21)	-0.31 (0.43)	0.03 (0.35)
Teacher feedback x Low ESCS	0.09 (0.46)	-0.14 (0.43)	-0.10 (0.19)	-0.02 (0.39)	-0.28 (0.44)
Teacher's stimulation of reading engagement x Low ESCS	-0.27 (0.61)	-0.40 (0.33)	0.01 (0.19)	0.07 (0.50)	-0.33 (0.47)
Adaptive instruction x Low ESCS	0.44 (0.50)	0.29 (0.32)	0.01 (0.22)	-0.01 (0.30)	0.20 (0.36)
Teacher enthusiasm x Low ESCS	-0.28 (0.44)	0.13 (0.36)	-0.12 (0.22)	0.34 (0.40)	-0.18 (0.36)
Educational material shortage x Low ESCS	0.01 (0.47)	-0.35 (0.28)	-0.14 (0.18)	0.11 (0.43)	-0.14 (0.31)
Staff shortage x Low ESCS	-0.28 (0.39)	-0.27 (0.26)	0.25 (0.16)	0.10 (0.24)	0.12 (0.30)
School climate variables	Yes	Yes	Yes	Yes	Yes
Low ESCS	Yes	Yes	Yes	Yes	Yes
Control variables	Yes	Yes	Yes	Yes	Yes
Observations	9814	8341	6302	6733	4132

Note Standard errors (se) are presented in parentheses. Significance codes: + 0,1 \* 0,05 \*\* 0,01

## Discussion

This research found several empirical regularities in the associations between the odds of attaining high achievement in reading and several characteristics of school climate in Argentina, Brazil, Chile, Colombia, and Uruguay. The findings showed that teacher feedback, directed instruction practices, teacher enthusiasm, adaptive instruction practices, and educational material shortage were correlated to high achievement in reading in at least three of the analyzed countries. Likewise, the results showed that student SES did not moderate the association between high achievement in reading and the perceived school climate characteristics.

The results showed that high achievement in reading was negatively correlated to the perceived frequency of teacher feedback in four out of the five analyzed countries. Eskreis-Winkler and Fishbach (2019) findings offer some insights to understand these associations. According to their results, failure feedback negatively affects people's learning because it causes individuals to disconnect from the activity and hinders their capacity to learn from their mistakes (Eskreis-Winkler & Fishbach, 2019). It is important to highlight that two of the three items used to build the teacher feedback scale measure the frequency of comments related to the areas students need to improve and how they can improve their performance in these areas, essentially feedback on mistakes. Likewise, the teacher feedback scale has a higher level of internal consistency (Cronbach's Alpha=0.83); in other words, the items used to build this scale are highly correlated among themselves. Given the above, the negative associations between high



achievement in reading and teacher feedback make sense because an increase in feedback on students' mistakes can affect their egos. Therefore, it will increase the probability that they disconnect from academic activities, and it will reduce the likelihood that they learn from their mistakes.

Regarding both perceived teacher enthusiasm and adaptive instruction, the findings indicated that the former was positively correlated to the odds of attaining high achievement in reading in five countries, while the latter was positively correlated to the odds of attaining high achievement in reading in three countries. These results are aligned with the OECD (2019c), which indicated a significant association between teacher enthusiasm and the PISA reading test in OECD countries. Likewise, the findings in this study indicated that increases in perceived adaptive instruction are correlated to increases in the odds to attain high achievement in reading in Brazil, Chile, and Uruguay. However, the evidence did not indicate a significant association for the cases of Argentina and Colombia. In this regard, these results are aligned with Bayona-Rodríguez and López Vera (2021), who also did not find a significant relationship between PISA reading results and adaptive instruction in Colombia.

Findings indicated that the odds of attaining high achievement in reading were correlated to educational material shortage in four of the analyzed countries. These results are aligned with the postulates of the bio-ecological model of human development (Bronfenbrenner & Morris, 2007). As previously mentioned, this bio-ecological model suggests that human development is a function of proximal processes, individual characteristics, contextual factors, and the historical period when the proximal processes take place. Given this, the educational material shortage may affect the frequency of student reading activities and, thus, the development of their reading competencies. Moreover, these results are aligned with previous studies, which have found that academic resilience is correlated to educational material quality in European countries (Agasisti & Longobardi, 2014, 2017).

Regarding the second aim of this research, the results showed that student socioeconomic status did not moderate the relationships between the odds of attaining high achievement in reading and perceived school climate variables in any of the five analyzed South American countries. These results are aligned with previous studies conducted in both Bogotá D.C. and five South Asian countries. Rodríguez De Luque (2024) studied the associations between high achievement in reading and eight characteristics of school climate (i.e., emotional safety, physical safety, commercialization and consumption of illegal drugs inside the school, peer relationships, teacher-students' relationships, adult relationships, sense of belonging, and respect for school norms). He found that student socioeconomic background did not moderate these associations. Likewise, Sandoval-Hernández and Białowolski (2016) examined whether student socioeconomic background moderates the associations between academic success in mathematics and one school climate variable (student exposure to bullying). Through this research, Sandoval-Hernández and Białowolski (2016) concluded that student socioeconomic background moderates these relationships in only one out of the five analyzed educational systems.

It is important to highlight that this is the first research that has comparatively examined the associations between the odds of attaining high achievement in reading and teaching practices, school discipline, teacher support and educational and staff shortage in five South American countries. Likewise, this is the first study which has

comparatively examined whether student socioeconomic status moderates the relationships between the probability to attain high achievement in reading and these school climate characteristics. Therefore, these results offer insights into designing regional interventions aimed at increasing student probabilities to attain advanced competencies in reading, while helping to bridge the gap between students from low and middle or high socioeconomic status.

However, these results should be interpreted considering the limitations of this study. Firstly, given the correlational design and the cross-sectional database used in this research, its findings should be interpreted as correlations or associations and not causal effects. In this sense, future studies should use an experimental design or longitudinal databases to estimate the causal effects of programs aimed at increasing student probabilities to attain high achievement in reading through the intervention of school climate.

Finally, future studies should examine how to improve feedback practices. Eskreis-Winkler and Fishbach (2019) findings offer insights to improve teacher feedback practices. Eskreis-Winkler and Fishbach (2019) found that failure feedback negatively affects peoples' egos, and it causes people to disconnect from activities or ignore it and, thus, they do not learn from their mistakes. Conversely, people can learn as much as from success feedback received by others as from failure feedback received by others.

## Conclusion

The results of this study indicate that actions aimed at improving teaching practices and educational resources may serve as mechanisms to help 15-year-old students develop advanced reading competencies, regardless of their SES. Likewise, since there is no evidence of a heterogeneous relationship between the capacity to attain high achievement in reading and perceived school climate, these actions may help to bridge the gap between Low SES and middle or high SES students in attaining high achievement in reading. However, this bridging is only possible if efforts are focused on schools attended mainly by socioeconomically vulnerable students.

These efforts should be aimed at several areas of improvement. For instance, teaching competencies to match students' needs, knowledge, and skills; feedback competencies to avoid affecting students' ego and keeping them engaged in academic activities; teaching competencies to keep students engaged in their learning; and the quality and availability of educational resources. Additionally, these results emphasize the importance of strengthening educational information systems to obtain the required information to understand the socioeconomic characteristics of students. This information can facilitate the targeting of educational interventions aimed at improving the learning outcomes of students from low SES backgrounds.

### Abbreviations

SES	Socio-Economic Status
PISA	Programme for International Student Assessment
OECD	Organization for Economic Co-operation and Development
UNESCO	United Nations Educational, Scientific and Cultural Organization
Low ESCS	Low Economic, Social and Cultural Status
ESCS	Economic, Social and Cultural Status

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**Data availability**

The datasets analyzed during the current study are available in Harvard Dataverse, <https://doi.org/10.7910/DVN/NGSMW0>.

**Declarations****Ethics approval and consent to participate**

Not applicable.

**Consent for publication**

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**Competing interests**

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**References**

- Agasisti, T., & Longobardi, S. (2014). Inequality in education: Can Italian disadvantaged students close the gap? *Journal of Behavioral and Experimental Economics*, 52, 8–20. <https://doi.org/10.1016/j.socec.2014.05.002>
- Agasisti, T., & Longobardi, S. (2017). Equality of Educational opportunities, schools' characteristics and resilient students: An empirical study of EU-15 countries using OECD-PISA 2009 data. *Social Indicators Research*, 134(3), 917–953. <https://doi.org/10.1007/s11205-016-1464-5>
- Avvisati, F., & Keslair, F. (2014). *REPEAT: Stata module to run estimations with weighted replicate samples and plausible values*. Statistical Software Components.
- Bayona-Rodríguez, H., & López Vera, D. C. (2021). Factores asociados a la resiliencia académica: evidencia para Colombia. *Documentos CEDE*. <https://hdl.handle.net/1992/48061>. Accessed 15 January 2023.
- Berkowitz, R., Moore, H., Astor, R. A., & Benbenishty, R. (2017). A Research synthesis of the associations between socioeconomic background, Inequality, School Climate, and academic achievement. *Review of Educational Research*, 87(2), 425–469. <https://doi.org/10.3102/0034654316669821>
- Bertschy, K., Cattaneo, M. A., & Wolter, S. C. (2009). PISA and the transition into the Labour Market. *LABOUR*, 23, 111–137. <https://doi.org/10.1111/j.1467-9914.2008.00432.x>
- Blau, F. D., & Kahn, L. M. (2005). Do cognitive test scores explain higher U.S wage inequality? *The Review of Economics and Statistics*, 87(1), 184–193.
- Bronfenbrenner, U., & Morris, P. A. (2007). The Bioecological Model of Human Development. In *Handbook of child psychology*. <https://doi.org/10.1002/9780470147658.chpsy0114>
- Bushnik, T., Barr-Telford, L., & Bussière, P. (2004). In and out of High School: First Results from the Second Cycle of the Youth in Transition Survey, 2002. *Education, skills and learning Research*.
- Caro, D. H., & Biecek, P. (2017). Intsvy: An R Package for analyzing International large-scale Assessment Data. *Journal of Statistical Software*, 1(7). <https://doi.org/10.18637/jss.v081.i07>
- Cordero Ferrera, J. M., Chaparro, P. F., & Simancas Rodríguez, R. (2015). Factores del éxito escolar en condiciones socioeconómicas desfavorables. *Revista De Educación*, 370, 172–198. <https://doi.org/10.4438/1988-592X-RE-2015-370-302>
- Denny, K., Harmon, C., & O'Sullivan, V. (2003). Education, earnings and skills: a multi-country comparison. *IFS Working Papers*.
- Dueñas Herrera, X., Mateus, G., Duarte, S., Rodríguez, J. L., & López Vera, D. C. (2019). La Resiliencia en El Logro Educativo De Los estudiantes colombianos. *Revista Colombiana De Educación*, 76, 69–90. <https://doi.org/10.17227/rce.num76-8037>
- Eskreis-Winkler, L., & Fishbach, A. (2019). Not learning from failure—the Greatest failure of all. *Psychological Science*, 30(12), 1733–1744. <https://doi.org/10.1177/0956797619881133>
- García-Crespo, F. J., Fernández-Alonso, R., & Muñiz, J. O. L. (2019a). Resilient and low performer students: Personal and family determinants in European countries. *Psicothema*, 31(4), 363–375. <https://doi.org/10.7334/psicothema2019.245>
- García-Crespo, F. J., Galián, B., Fernández-Alonso, R., & Muñiz, J. (2019b). Resiliencia Educativa en Comprensión Lectora: Factores determinantes en PIRLS-Europa. *Revista De Educación*, 384, 71–96. <https://doi.org/10.4438/1988-592X-RE-2019-384-413>
- Gilleece, L., Cosgrove, J., & Sofroniou, N. (2010). Equity in mathematics and science outcomes: Characteristics associated with high and low achievement on PISA 2006 in Ireland. *International Journal of Science and Mathematics Education*, 8(3), 475–496. <https://doi.org/10.1007/s10763-010-9199-2>
- Hanushek, E. A., & Woessmann, L. (2012). Do better schools lead to more growth? Cognitive skills, economic outcomes, and causation. *Journal of Economic Growth*, 17(4), 267–321. <https://doi.org/10.1007/s10887-012-9081-x>
- Hanushek, E., & Zhang, L. (2009). Quality-consistent estimates of International Schooling and Skill gradients. *Journal of Human Capital*, 3(2), 107–143. <https://doi.org/10.1086/644780>
- Johnston, D., & DiNardo, J. (1997). *Econometric methods*. McGraw-Hill.
- Knighton, T., & Bussière, P. (2006). Educational Outcomes at Age 19 Associated with Reading Ability at Age 15. *Culture, Tourism and the Centre for Education Statistics Research*.
- Masten, A. S. (2014). Global perspectives on Resilience in Children and Youth. *Child Development*, 85(1), 6–20. <https://doi.org/10.1111/cdev.12205>
- National School Climate Center (2022). What is School Climate and Why is it Important? <https://schoolclimate.org/school-climate/>. Accessed 6 December 2023.
- OECD (2019b). PISA 2018 results. What students know and can do? I. <https://doi.org/10.1787/5f07c754-en>

- OECD (2019d). PISA 2018 results where all students can succeed II. <https://doi.org/10.1787/b5fd1b8f-en>
- OECD (2009). PISA Data Analysis Manual: SAS, Second Edition. <https://doi.org/10.1787/9789264056251-en>
- OECD (2011). Against the Odds: Disadvantaged Students Who Succeed in School. <https://doi.org/10.1787/9789264090873-en>
- OECD (2019a). Chapter 4: Sample design. In PISA 2018 Technical Report.
- OECD (2019c). PISA 2018 Results (Volume III) What School Life Means for Students' Lives. <https://doi.org/10.1787/acd78851-en>
- Padrón, Y. N., Waxman, H. C., & Lee, Y. H. (2012). Classroom Learning Environment differences between resilient, average, and Nonresilient Middle School Students in Reading. *Education and Urban Society*, 46(2), 264–283. <https://doi.org/10.1177/0013124512446217>
- Pitsia, V. (2022). Examining high achievement in mathematics and science among post-primary students in Ireland: A multilevel binary logistic regression analysis of PISA data. *Large-Scale Assessments in Education*, 10(1), 14. <https://doi.org/10.1186/s40536-022-00131-x>
- Rodríguez De Luque, J. J. (2024). Asociaciones entre El alto desempeño académico y El Clima escolar en Bogotá: ¿hay diferencias debido Al Nivel socioeconómico Del estudiantado? *Magis Revista Internacional De Investigación En Educación*, 17, 1–24. <https://doi.org/10.11144/Javeriana.m17.aada>
- Sandoval-Hernández, A., & Białowolski, P. (2016). Factors and conditions promoting academic resilience: A TIMSS-based analysis of five Asian education systems. *Asia Pacific Education Review*, 17(3), 511–520. <https://doi.org/10.1007/s12564-016-9447-4>
- Sirin, S. R. (2005). Socioeconomic status and academic achievement: A Meta-Analytic Review of Research. *Review of Educational Research*, 75(3), 417–453. <https://doi.org/10.3102/00346543075003417>
- StataCorp. (2021). *Stata 17 base reference Manual*. Stata.
- Tan, C. Y., Hong, X., Gao, L., & Song, Q. (2023). Meta-analytical insights on school SES effects. *Educational Review*. <https://doi.org/10.1080/00131911.2023.2184329>
- Thapa, A., Cohen, J., Guffey, S., & Higgins-D'Alessandro, A. (2013). A review of School Climate Research. *Review of Educational Research*, 83(3), 357–385. <https://doi.org/10.3102/0034654313483907>
- UNESCO (2021). Los aprendizajes fundamentales en América Latina y el Caribe, Evaluación de logros de los estudiantes: Estudio Regional Comparativo y Explicativo (ERCE 2019); Resumen ejecutivo.
- Vera, G. G., Valenzuela, J. P., & Sotomayor, C. (2015). Against all odds: Outstanding reading performance among Chilean youth in vulnerable conditions. *Comparative Education Review*, 59(4), 693–716. <https://doi.org/10.1086/683108>
- Wang, M. T., & Degol, J. L. (2016). School Climate: A review of the Construct, Measurement, and impact on Student outcomes. *Educational Psychology Review*, 28(2), 315–352. <https://doi.org/10.1007/s10648-015-9319-1>
- Wickham, H. (2009). *ggplot2: Elegant graphics for data analysis*. Springer.
- Williams, R. (2009). Using Heterogeneous Choice models to compare Logit and Probit coefficients Across groups. *Sociological Methods & Research*, 37(4), 531–559. <https://doi.org/10.1177/0049124109335735>
- Williams, R. (2010). Fitting heterogeneous choice models with oglm. *The Stata Journal*, 10(4), 540–567.
- Wooldridge, J. M. (2010). *Introducción A La econometría: Un enfoque moderno*. Cengage Learning.
- Yavuz, H. Ç., & Kutlu, Ö. (2016). Investigation of the factors affecting the academic resilience of economically disadvantaged High School Students. *Egitim Ve Bilim*, 41(186). <https://doi.org/10.15390/EB.2016.5497>

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