



Original

## School and student determinants of reading performance: A multilevel analysis with Portuguese students<sup>☆</sup>


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### ABSTRACT

Reading is crucial for learning, in general. Starting right with reading in primary grades is, therefore, vital for school achievement. The present study aims to test whether students' factors best predict reading performance than school factors and determine what student and school factors predict reading performance. The study sample includes 4,118 fourth-grade students participating in IEA PIRLS 2016. Three questionnaires were used to collect data: one for school principals, one for students, and one for parents. Hierarchical linear modeling was used to study the relation of school and student-level variables to students' reading performance. Students' confidence in reading and home resources for learning are the best predictors of reading performance at the student level. At the school level, school emphasis on academic success is the best predictor of reading performance. The results provide clues as to what schools might do to improve reading results.

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## Determinantes escolares y de los estudiantes en el rendimiento lector: Un análisis multinivel con estudiantes portugueses

### RESUMEN

La lectura es fundamental para el aprendizaje en general. Empezar con la lectura en educación primaria es, por tanto, vital para el rendimiento académico. El presente estudio tiene como objetivo probar si los factores de los estudiantes predicen mejor el rendimiento en lectura que los factores escolares y determinar qué factores del alumnado y de la escuela predicen el rendimiento en lectura. La muestra del estudio incluye 4.118 estudiantes de cuarto curso de educación primaria que participan en el Progress in International Reading Literacy Study (PIRLS), 2016. Han sido utilizados tres cuestionarios para recopilar datos: un cuestionario para directores de escuela, un cuestionario para estudiantes y un cuestionario para padres. Se ha utilizado un modelo lineal jerárquico para estudiar la relación de las variables al nivel de la escuela y del alumnado con el rendimiento de los estudiantes en lectura. La confianza de los estudiantes en la lectura y los recursos del hogar para el aprendizaje son los mejores predictores del rendimiento lector. Al nivel escolar, el mejor indicador del rendimiento lector es el énfasis de la escuela en el éxito académico. Los resultados proporcionan pistas sobre lo que podrán hacer las escuelas para mejorar los resultados de lectura.

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#### Palabras clave:

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## Introduction

In the last decades, large-scale international surveys such as the Progress in International Reading Literacy Study (PIRLS) or the Programme for International Student Assessment (PISA) provided invaluable information about the reading literacy skills of children and youth. In Portugal's case, the results of the several cycles of PISA (OECD, 2009, 2012, 2016) generically show that the country made significant progress on the skills and knowledge of 15-year-old students. The PIRLS (Martin & Mullis, 2013; Mullis & Martin, 2017), an extensive international scale survey that evaluates children's reading performance after four years of schooling, shows a different pattern. Although the Portuguese students (528 points) in 2016 are significantly above the PIRLS scale's central point (500 points), there was a significant 13 points decrease from 2011 to 2016. Portugal was one of the eleven countries that performed significantly worse in 2016 than in 2011 (21 countries performed significantly better), going down from the nineteenth to the thirty-first. Fifty percent of the Portuguese students scored higher than 530 points, and 5% got 633 points or more (percentile 95), but 5% got less than 500 points.

Although country' progress is now well documented in international studies, the debate about the factors that most likely influence reading achievement remains lively among researchers. It is still difficult for policymakers to decide what policies to adopt and at what level these policies should operate (e.g., curriculum level, teacher development, classroom instruction, student engagement with reading). The purpose of the present study is to identify individual and school factors involved in Portuguese fourth-graders reading achievement, using large-scale multilevel data from PIRLS 2016. PIRLS adds to previous studies the robustness of samples and the methodological sophistication that allows the testing of multilevel models in a trustable way.

## Individual determinants of reading performance

### Home resources

A significant number of factors influence students' reading performance. Some of these factors relate to the home environment (Gutiérrez-Fresneda, 2019; Hemmereichs et al., 2017). The socioeconomic status (SES) of families, for example, is one of the most important predictors of reading performance and school performance (e.g., Diuk et al., 2019). However, the literature refers to some mediators or moderators that explain the relationship between SES and student's reading performance. For instance, Wang et al. (2017, p. 1) found that "low negative affect, high effortful control, and low surgency mitigated the negative associations between SES risks and both reading and math development in this developmental period." Cheng and Wu (2017) verified that SES exerted an indirect effect on sentence reading comprehension through the mediating effect of morphological awareness and vocabulary knowledge. Also, (Chesters & Daly, 2017) found that the school attended moderates the relation between SES and literacy achievement.

In the late 70's Bourdieu and Passeron (1977) introduced the concept of families' cultural capital (the familiarity with the dominant cultural codes of society) to explain the differences in children's academic achievement. The cultural capital model was tested under varying circumstances. Huang and Liang (2016), for instance, found that parents' expectation (the embodied cultural capital) better predicts student performance than parent education (the institutionalized cultural capital) or book possession (the objectified cultural capital).

PIRLS 2016 considers many home factors (e.g., SES, parental activities, home resources) that can affect students' reading

achievement. Some of these factors are educational resources in nature. Still, PIRLS separates digital home resources (e.g., internet access) from general home educational resources (e.g., number of books). Other factors concern home conditions (e.g., study desk/table for own use) or parents' supervision of the child's schoolwork (e.g., "Approximately, how often does your child do homework?").

### Students' attitudes toward reading

Another individual factor that might be involved in reading performance is attitudes towards reading (ATR). ATR encompasses a broad spectrum of concepts and models and brings together different research traditions. More than two decades ago, Pressley (1998) noted that scholars commonly approached attitudes toward reading using concepts from the area of motivation. For example, reading efficacy, reading challenge, reading curiosity, the value of reading, reading goals, compliance (reading to fulfill academic obligations), or reader grades (reading to get grades). More recently, Petscher (2010) conducted a meta-analysis about the relationship between attitudes towards reading and achievement in reading, concluding that the relationship is moderate but stronger for elementary students than for middle school students.

PIRLS 2016 study does not conceptualize or define attitudes toward reading clearly. Still, PIRLS considers three aspects of students' attitude towards reading: students' reading engagement, students' like reading, and students' confidence in reading. Wantchekon and Kim (2019) found that reading engagement predicted 4% of the end-of-year reading comprehension of their third and fourth-grade participants and that the relation between reading engagement and reading comprehension was weaker for below-average readers. Other studies (e.g., Hamedí et al., 2020; Lin et al., 2021) with different participants found moderate to strong correlations between reading engagement and reading comprehension. Still, other studies (Bautista et al., 2018) suggest that the relationship is not straightforward and that reading mastery might mediate the relation.

PIRLS 2016 "students like reading" is usually described in the literature as reading for pleasure (RfP). Several studies (Sullivan & Brown, 2015; Whitten et al., 2016) found positive relations between RfP and high-level reading outcomes, benefits in math or vocabulary, and positive social and emotional development. Still, Reedy and De Carvalho (2021) consider . . . "the possibility that a desire to read for pleasure could be the result of existing stronger reading fluency and consequent self-confidence in said reading fluency, rather than the other way around" (p. 135). Reedy & De Carvalho (2021) further note that several terms are used interchangeably with RfP (like reading, for instance) and that the child's motivation is the key to understanding RfP.

Self-confidence in reading has also been referred to as a good predictor of reading achievement. For instance, Melero et al. (2020) studied the relation of several motivational variables to word reading, and reading comprehension and found that perceived competence was the only motivational significant predictor. Also, Cho et al. (2018) found a positive relation of reading self-confidence to reading comprehension in second graders stating that it is critical to foster the involvement of families in children's reading acquisition to maintain the learners' self-confidence.

## School determinants of reading performance

The school effectiveness literature has explored many school factors related to student achievement. For instance, achievement pressure for basic subjects, high expectations from principals and teachers, educational leadership, school climate, school's aver-

age socioeconomic level, or opportunity to learn (Biesta, 2019). Marzano (2003) asserts that the opportunity to learn, learning time, monitoring, and pressure to achieve are the most relevant factors related to school performance. The PIRLS 2016 specifically evaluates school emphasis on academic success, students' previous literacy skills, and instruction time as school factors related to reading performance.

#### *School emphasis on academic success (SEAS)*

SEAS has to do with a focus on students' achievement and academics content. It might also characterize students' desire to do well, homework completion, teachers' expectations of student success, and even school safety (Badri, 2019). The construct's variability generates differences in measurement and makes comparisons across studies complex (Nilsen & Gustafsson, 2014). Also, the concept of academic success has long been controversial. According to Garbarino (1976), educational attainment, i.e., the number of years of schooling completed, might be a better index of than academic success (not much related to life outside school) or social status at school (too much non-academic). Hattie (2009), synthesizing over 800 meta-analyses relating to academic achievement, found that schooling years relate to positive mental health outcomes in adult life. Despite these arguments, most authors, and the public, seem to conceive school grades as the best indicator of academic success (Cachia et al., 2018). In this perspective, a school that promotes students' grades in academic content should get better readers, on average. Pirls 2016 conceives school emphasis on school success as a set of teachers, administrations, students, and parents behaviors favorable to a positive, healthy, and productive school climate.

#### *Literacy skills at the elementary school entrance*

Upon entrance to primary school, literacy skills seem to be a significant contributor to reading acquisition and performance. Phonological and phonemic awareness, awareness of print, or vocabulary are some of those skills (Gutiérrez-Fresneda, 2018; Kjeldsen et al., 2019; Pfof et al., 2019). Even though participants are fourth-graders, PIRLS 2016 measures only early literacy skills (e.g., "About how many students recognize most of the letters of the alphabet?" upon entering first grade), and does it in a school, not in an individual, perspective. The PIRLS 2016 explores the possibility that schools and classrooms with more students who entered first grade with literacy skills hold better reading results in fourth grade, not just in beginning reading.

Although the literature is clear about the advantages of early literacy skills for reading, there might be some caveats. For example, Pinto and Lopes (2017) compared three groups in reading and literacy skills at the beginning and the end of the first and second grades. One group could already read at the school entrance, another group received a one-year systematic phonological training, and the third group received no special training. The authors found no superiority of the phonological training group in reading at the end of first grade. Previous readers performed significantly better in reading in the four moments and phonological training (in this case, only in the first moment). This finding suggests that reading promotes phonological skills more than phonological skills promotes reading and that reading is the best predictor of reading. If this finding holds, reading in fourth grade will likely depend more on reading training during elementary school than on early literacy skills (Hirsch, 2003).

#### *Instructional time*

Instructional time is a concept related to the opportunity to learn (OTL). Elliott (2015) defines OTL as "...the degree to which a teacher dedicates instructional time and content coverage to the intended curriculum objectives..." (p. 58). Elliott (2015) also stresses that researchers have long examined several OTL indices, such as time, content, and instruction quality. Although the effect of instructional time is widely recognized as relevant to academic performance (e.g., Locher & Pfof, 2020), the effect on students' performance is complex, primarily because of the quality of time (Mullis & Martin, 2017). Still, some authors challenge the belief that the more time students spend in the classroom, the more they learn. Lopez-Agudo and Marcenaro-Gutierrez (2020) contend that most studies are correlational, therefore, not trustable. The authors studied the influence of instruction time on fourth-graders academic achievement from 24 countries, using data from the Teaching and Learning International Survey (TALIS) and the Trends in International Mathematics and Science Study (TIMSS), 2011. The conclusion was that instruction time "does not seem to be positively associated with students' academic performance for any of the countries under analysis, even when students remain engaged with the lesson during this instruction time" (p. 1).

#### *School composition by student background*

The studies about the relation between school composition and achievement are not conclusive. For instance, Boonen et al. (2014) found no direct school composition effects on prior achievement, SES, ethnicity, and sex on second graders' math achievement in Flanders. The authors concluded that overall school composition in the early years of primary education hardly matters. Wenger et al. (2020) found that the relation between school composition characteristics and most school quality components was close to zero in a study in Berlin primary schools. Conversely, Costa and Araújo (2018), using PIRLS 2011, report student/home universals (e.g., school literacy skills and practices, school climate, and school composition) and school particulars that explain variation in reading achievement in Denmark, Sweden, and France. Sciffer et al. (2020) defend that critiques of socioeconomic compositional (SEC) effects are due to methods unlikely to detect SES effects.

#### **The present study**

There is an ongoing debate, in Portugal and elsewhere, about the best strategies and contexts to promote childrens' reading or to remediate reading problems. Some scholars, governments or entities, defend that curriculum, schools or families, are critical contexts to intervene (e.g., Verdasca, 2018). Others (e.g., Hattie, 2009) consider that action over those contexts is an illusion and that efforts and resources must focus on classrooms. In Portugal (and maybe in other countries), the debate is seldom supported by large-scale data. Our study tries to fill this critical gap, investigating student and school factors involved in Portuguese students' reading achievement using PIRLS 2016 data.

The PIRLS is a large-scale survey conducted by the International Association for the Evaluation of Educational Achievement (IEA). The main goal of the survey is to study international trends in reading in fourth-grade students. Overall, 50 countries and 11 benchmarking entities participated in PIRLS 2016. PIRLS data are particularly suited to modeling individual and organizational factors and testing models that explain students' reading achievement. Specifically, the goals of our study are (1) to test whether students' factors best predict reading performance than school factors and (2) determine what student and school factors are significant pre-

ditors of reading performance. The most parsimonious multilevel model of reading performance will be retained.

## Method

### Participants

The Portuguese participants were recruited through a stratified multi-stage probability sampling design (Martin et al., 2017). According to the “Nomenclature of Territorial Units for Statistical Purposes” (NUTS III), the country was stratified into regions in the first stage. In the second stage, 220 schools were selected through a systematic sample procedure. A random sample of one or two 4th grade classes was extracted in a third stage, taking into account the classes’ number and size. After accounting for missing data, the Portuguese sample includes 203 schools and 4118 students (49% female, 51% male,  $M_{age} = 9.8$ ,  $SE = 0.01$ ;  $min. = 8.3$ ;  $max. = 14.5$ ), representing the 25 Nacional territorial units for statistical purposes (NUTS III). Around 9% ( $n = 19$ ) of the schools are private and 91% ( $n = 199$ ) are public. However, the former represent 31.3% of the students and the latter 68.5%. The IEA IDB Analyzer was used to deal with the sophisticated design of PIRLS 2016<sup>1</sup>.

### Instruments

Three questionnaires from PIRLS 2016 were used in our study. One questionnaire for school principals (to collect data about school), a questionnaire for students (to collect data about students’ home and school lives, including demographic information, home resources for learning, and attitudes toward reading), and a questionnaire for parents (to collect data about students’ early literacy skills and parents educational level and occupations). In Portugal, the Institute for Educational Evaluation (IAVE) developed all the assessment tools that follow.

### Student variables

**Reading achievement.** Reading achievement is the outcome of this study. According to Martin et al. (2017), “Consistent with the goal of a comprehensive view of reading comprehension, the entire PIRLS assessment consists of twelve reading passages and accompanying questions (known as items)... “In each assessment, six passages assess reading for literary experience and six assess reading to acquire and use information. In order to keep the assessment burden on any one student to a minimum, each student is presented with just two passages according to a systematic booklet assembly and rotation procedure...” (p. 56). The texts, response items, and coding of students’ answers can be found at [https://iave.pt/wpcontent/uploads/2019/08/Unidades\\_Avaliacao\\_PIRLS\\_ePIRLS\\_2016.pdf](https://iave.pt/wpcontent/uploads/2019/08/Unidades_Avaliacao_PIRLS_ePIRLS_2016.pdf). The percentage of variance explained by the PIRLS 2016 achievement scales in Portugal is 81%.

According to the PIRLS metric, the international mean for this variable is 500, and the standard deviation is 100. Four scales that measure different concepts were used in the models. The International Association for the Evaluation of Educational Achievement (IEA) constructed the variables and measurements of PIRLS 2016 through a composite method. According to the Rasch model of item response theory, most items were combined “. . . into scales measuring a single underlying latent construct” (Martin et al., 2017, p. 14). Moreover, for most scales, a scaling procedure transformed the original ordinal data into an interval scale with a centerpoint of 10.

**Students Confident in Reading (SCR).** This scale is based on students’ degree of agreement (from “agree a lot” to “disagree a lot”) with six statements (e.g., I usually do well in reading; Reading is easy for me). A result below 8.2 in SCR indicates that the student is not confident in reading; results between 8.2 and 10.3 suggest that the student is somewhat confident in reading; a result above 10.3 indicates that the student is very confident in reading.

**Students Engaged in Reading Lessons Scale (SER).** This questionnaire represents students’ degree of agreement (from “agree a lot” to “disagree a lot”) with nine statements (e.g., I like what I read about in school; My teacher gives me interesting things to read). A result below 7.1 in SER suggests that the student is less engaged in reading; results between 7.1 and 9.5 indicate that the student is somewhat engaged in reading; a result above 9.5 indicates that the student is very engaged in reading.

**Students Like Reading Scale (SLR).** This scale represents students’ degree of agreement (from “agree a lot” to “disagree a lot”) with eight statements (e.g., I enjoy reading; I learn a lot from reading). A result below 8.1 in SLR suggests that the student does not like reading; results between 8.1 and 10.5 indicate that the student somehow likes reading; a result above 10.5 shows that the student very much likes reading.

**Home Resources for Learning (HRL).** This scale was created based on responses of parents and students about the availability of five resources: number of books in the home, number of children’s books in the home, number of home study supports, the highest level of education of either parent, highest level of occupation of either parent. A result below 7.5 denotes few resources; results between 7.5 and 11.8 denote some resources; results above 11.8 indicate many resources.

### School-related variables

**School emphasis on academic success.** This scale comes from principals’ responses about how the school emphasizes academic success (e.g., teachers’ expectations for school success; students’ desire to do well in school). A result below 9.2 denotes medium emphasis; results between 9.2 and 12.9 denote high emphasis; results above 12.9 denote very high emphasis.

**Students enter the primary grades with early literacy skills scale.** This scale refers to the percentage of children who come to the school with literacy skills (e.g., read some words; write letters of the alphabet). A result below 9.2 indicates that less than 25% of the children entered with the skills; results between 9.2 and 12.9 mean that 25–75% entered with the skills; results above 12.9 indicate that more than 75% enter with the skills.<sup>2</sup>

**Instructional Time.** According to the school principal, the total number of hours per year spent on language and reading instruction.

**School composition by student background.** (1) the percentage of students that came from economically disadvantaged homes and (2) the percentage of students who came from affluent homes, according to the school principal. Answers were collected on a four-level scale (from 0 to 10% to more than 50%) for (1) and (2). The results were transformed in a classification with three levels: more affluent ( $n = 606$ , 13.2%); neither more affluent nor more disadvantaged ( $n = 2006$ , 43.7%); more disadvantaged ( $n = 1982$ , 43.1%). Since there were three levels, we dummy coded this variable.

The PIRLS 2016 provides the median Cronbach’s alpha coefficients reliability across all PIRLS 2016 assessment booklets. For Portugal, the test coefficient is .87. Also, in Portugal, the percentage of variance explained by the PIRLS 2016 achievement scales is 81%.

<sup>1</sup> The IDB Analyzer “. . . is a stand-alone software originally developed by the IEA Data Processing and Research Center (IEA DPC) for the use in IEA’s large-scale surveys. . .” (Becker et al., 2013, p. 28) Moreover, it is straightforward in the analysis of combined data (e.g., school data and students’ data).

<sup>2</sup> Informations about scales and values for SCR, SER, SLR, HRL, School Emphasis on Academic Success, Students enter the primary grades with early literacy skills scale can be found in Martin et al. (2017)



**Table 1**  
Descriptive statistics for students (n = 4118; 49% female, 51% male)

	M	SD	Min	Max
Students engaged in reading	11.19	1.79	2.54	13.13
Students like reading	11.47	2.00	2.55	14.58
Students confident in reading	9.62	1.79	2.96	13.47
Home resources for learning	10.05	1.60	4.03	14.80
Descriptive statistics for schools (n = 203)				
	M	SD	Min	Max
School emphasis on school success	9.04	1.74	5.58	15.36
Students enter with literacy skill	9.26	1.89	7.11	14.77
School Composition	2.31	0.69	1.00	3.00
Instructional Time	894.62	188.13	673.75	2000

**Table 2**  
Unconditional hierarchical linear model

Estimated fixed effects					
Parameter	Coefficient	SE	DF	t	p
Intercept	525.22	2.02	202	149.20	0.000
Estimated random effects					
Parameter	SD	VC	DF	χ <sup>2</sup>	p
u <sub>0</sub> (variation among schools)	25.02	625.50	202	872.23	0.000
r (variation within schools)	59.53	3543.50			

Note. SE – Standard error; DF – Degrees of freedom; VC – variance component.

**Procedure**

As a national goal, the implementation of PIRLS 2016 in Portugal was conducted by a national education agency, the Institute of Educational Evaluation (IAVE). IAVE was responsible for sampling schools, obtaining their cooperation (including informed consent (from schools, students, and parents), contacting schools and sampling classes for the data collection, and managing the PIRLS 2016 assessment administration. Each sampled class was assigned a test administrator(s) that provided students with the achievement booklets. The students should answer the two sections of the booklets in 80 minutes (40 minutes each with a 30 minutes interval). The students should also answer a demographic and personal questionnaire.

**Data analysis**

Multilevel modeling was used considering two hierarchical levels: the first level is composed of student variables, and level 2 represents the school characteristics. The model building followed several steps. The first step was to create a null or unconditional model (one-way ANOVA random-effects model with no level 1 or level 2 predictors) to know whether there is between-school variation in overall reading achievement. This first step addresses the question, “how much of the variation in student reading performance is explained by the schools?”. It involves calculating the intraclass correlation coefficient (ICC), calculating the deviance statistic (-2LL), and calculating the design effect. In a second step, a random coefficient model was added to test for significant relationships between level 1 predictors and reading achievement and examine how the students' characteristics explain the differences in reading achievement. Finally, a third model, combining level 1 and level 2 variables, tested the relevance of variables at the two levels in predicting reading achievement. The model incorporates level 1 and level 2 predictors. The level 1 intercept and the level 1 slopes are predicted as random effects. Level 1 and level 2 predictors were grand-mean centered in the partially and fully conditional models. HLM 7 Hierarchical Linear and Nonlinear Modeling

(Raudenbush et al., 2013) were used to adjust the models. The analysis considers the five plausible values in reading and the student and school weights.

**Results**

Table 1 shows the descriptive statistics for students and school variables.

The descriptive statistics show that Portuguese students like reading and are engaged in reading but are only somehow confident in their reading skills. Students' home resources for learning are fair. Schools moderately emphasize academic success, and most children did not have much literacy skills when they entered 1<sup>st</sup> grade.

**Unconditional model**

Table 2 shows the unconditional or null model (no predictors are included in the model). This model aims to test whether there is between-school variation in overall students' reading achievement (SRA). The model is the following:

Level-1 Model

$$SRA_{ij} = \beta_{0ij} + r_{ij}$$

Level-2 Model

$$\beta_{0ij} = \gamma_{00} + u_{0j}$$

SRA<sub>ij</sub> corresponds to the test score in reading for student i in school j.

β<sub>0ij</sub> represents the level 1 intercept term, which is a function of an intercept term at level 2 (γ<sub>00</sub>) and of a level 1 residual term (r<sub>ij</sub>). The level 1 intercept term (β<sub>0ij</sub>) is a function of the grand mean (γ<sub>00</sub>) of schools, plus a random term (u<sub>0j</sub>), which means that the intercept is modeled as a random effect.

The null or unconditional model (Table 2) shows an average of 525.22 for SRA, almost 27 points above the scale's mid-point. Within-school variance for perceived students' reading achievement is σ<sup>2</sup> = 3543.50, and between-school variance is τ = 625.50, p < 0.001. The intraclass correlation is 0.15 (625.50/[3543.5+625.50]). Therefore, 15% of the variability in students' reading achievement is explained by differences between schools. Differences between individual students explain 85% of the variability in reading achievement. The significant between-schools variation (χ<sup>2</sup> = 872.23, p < .001) for reading achievement shows that there is still considerable residual variation yet to be explained and that a model with additional predictors is needed. The design effect<sup>3</sup> (Design Effect = 1 + [n<sub>c</sub> - 1]ICC) is 3.98 (n<sub>c</sub> is the number of students per school). According to some authors (e.g., Muthén & Satorra, 1995), a design effect greater than 2.0 indicates the need for hierarchical linear modeling.

**Hierarchical linear modeling considering student-related variables**

Once determined that there is a significant between-school variation in reading achievement, the second step was to test to what degree student-related variables explain variance in reading achievement (means as outcomes model) (see Table 3). Level-1 model includes students engaged in reading (SER), like reading (SLR), confident in reading (SCR), and home resources for learning (HRL). The variables were grand-centered.

<sup>3</sup> “The design effect quantifies the effect of independence violations on standard error estimates and is an estimate of the multiplier that needs to be applied to standard errors to correct for the negative bias that results from nested data.” (Peugh, 2010, p. 91)

**Table 3**  
Hierarchical linear model considering student-related variables without school-level predictors

Estimated fixed effects					
Parameter	Coefficient	SE	DF	t	p
Intercept	526.056	1.55	202	338.41	0.000
Students engaged in reading	2.67	0.64	3911	4.18	0.000
Students like reading	-3.26	0.59	3911	-5.56	0.000
Students confident in reading	12.18	0.654	3911	22.58	0.000
Home resources for learning	10.30	0.60	3911	17.12	0.000
Estimated random effects					
Parameter	SD	VC	DF	χ <sup>2</sup>	p
u <sub>0</sub> (variation among schools)	18.35	336.65	202	668.07	0.000
r (variation within schools)	52.69	2776.67			

Note. SE – Standard error; SD – Standard deviation; VC – Variance component; DF – Degrees of freedom.

**Table 4**  
Hierarchical linear model considering student-related variables and school-level predictors as predictors of students' reading achievement

Estimated fixed effects					
Parameter	Coefficient	SE	DF	t	p
Intercept	525.86	1.48	198	356.41	0.000
<i>Student-level variables</i>					
Students engaged in reading	2.66	0.56	3911	4.76	0.000
Students like reading	-3.23	0.50	3911	-6.49	0.000
Students confident in reading	12.16	0.49	3911	24.70	0.000
Home resources for learning	10.00	0.58	3911	17.22	0.000
<i>School-level variables</i>					
School emphasis on academic success	4.38	1.47	198	4.64	0.000
Students enter with literacy skills	-0.88	0.94	198	-1.10	0.797
Instructional Time	-0.003	0.01	198	0.34	0.450
School composition by student background	-0.89	2.29	198	-0.39	0.970
Estimated random effects					
Parameter	SD	VC	DF	χ <sup>2</sup>	p
u <sub>0</sub> (variation among schools)	16.87	284.76	198	587.72	0.000
r (variation within schools)	52.69	2776.75			

Level-1 Model

$$SRA = \beta_0 + \beta_1*(SER) + \beta_2*(SLR) + \beta_3*(SCR) + \beta_4*(HRL) + r$$

Level-2 Model

$$\beta_1 = \gamma_{00} + u_0$$

$$\beta_2 = \gamma_{10}$$

$$\beta_3 = \gamma_{20}$$

$$\beta_4 = \gamma_{40}$$

The results show that all the *student-level predictors* seem to affect *reading achievement*. Notably, the relation between *like reading* and *reading achievement* is negative. *Confident in reading* is by far the best predictor of *reading achievement*. A one-point increase in *confident in reading* predicts an average 12 point increase in *reading achievement*. *Home resources for learning* are also a strong predictor of *reading achievement*. There was a significant increase in model fit from the unconditional model (deviance = 45632.63) to this second model (deviance = 44568.22), represented by a significant decrease in the deviance of the model (45545.55-44607.28 = 1064.41,  $p < .001$ ).

*Hierarchical linear modeling combining student and school-related variables as predictors of students' reading achievement*

Finally, we tested a third model that includes both *student and school-related variables* as predictors of *students' reading achievement*. At the school level, the model includes *school emphasis on academic success* (EmpSucc); *students enter with literacy skills* (EntLiter); *instructional time* (InsTime); and *school composition by student background* (SchComp) (see Table 4). Level-1 and level-2 variables were grand mean-centered. The model is as follows:

Level-1 Model

$$SRA = \beta_0 + \beta_1*(SER) + \beta_2*(SLR) + \beta_3*(SCR) + \beta_4*(HRL) + r$$

Level-2 Model

$$\beta_0 = \gamma_{00} + \gamma_{01}*(EmpSucc) + \gamma_{02}*(EntLiter) + \gamma_{03}*(InsTime) + \gamma_{04}*(SchComp) + u_0$$

$$\beta_1 = \gamma_{10}$$

$$\beta_2 = \gamma_{20}$$

$$\beta_3 = \gamma_{30}$$

$$\beta_4 = \gamma_{40}$$

In this model, the results show that *student-level variables* are good predictors of *reading achievement*, despite the introduction of *school-level variables* in the model. At the school level, the only variable that significantly accounts for the variance in *reading achievement* is *school emphasis on academic success*. There was a significant increase in model fit from the unconditional model (deviance = 45632.63) to the complete model (deviance = 44543.22), represented by a significant decrease in the deviance of the model (45632.63 - 44543.22 = 1089.41,  $p < .001$ ). Still, a significant portion of the variance remains unexplained.

## Discussion

Overall, the results show that student variables predict reading achievement (SRA) better than school variables. Individually, home resources for learning (HRL) and confident in reading are by far the best single predictors of reading achievement. HLR has been measured in many different ways (including the socio-psychological environment and intellectual stimulation). Hattie (2009) found an average effect size of 0.57 of home resources on achievement, being maternal involvement, variety, and play materials the most consistent predictors. Noteworthy, Portuguese students are about the scale centerpoint HLR but significantly above the mean in reading achievement. This finding suggests that Portuguese schools add to students' home resources, apparently running for social equity, one of the most critical schooling goals (Dadon-Golan et al., 2019). Conversely, 18% of students with many home resources got an average of 568 points against only 487 points of the 6% of students with a few home resources. This seeming contradiction in results suggests that schooling and instruction actually promote the education level of the whole population but do not readily close the achievement gap or mitigate home resources' effects (Kim et al., 2019; Murillo & Hernández-Castilla, 2020).

Students' attitudes towards reading (students reading engagement, like reading, confident in reading) also predict SRA, but at very different levels. Confident in reading (SCR) is, by far, the best predictor of SRA. Reading engagement (SER) is a marginal predictor, and enjoying reading is a surprisingly negative SRA predictor. The data show that the three constructs are only partially related. These results are relevant because they oddly suggest that better achievers are confident in their reading skills, but they do not necessarily report more pleasure or engagement in reading. Also, the results show that lower readers tend to like reading more than higher achievers. This finding contrasts with the results of many other studies (e.g., Vaknin-Nusbaum et al., 2018) that show a decline in low achievers' self-concept as readers and overall motivation as opposed to high achievers.

The seemingly odd results in reading engagement and enjoying reading most likely stems from social desirability (SD), that is, "peoples' tendency to present themselves in a positive light by over-reporting culturally approved positive behaviors and under-reporting negative behaviors" (Miller et al., 2015, p. 85). Individuals with reading problems have been found to rate themselves more favorably than their parents or teachers in cognitive and academic skills and social acceptance by peers (Nelson & Liebel, 2018). Job and Klassen (2012) classify this mismatch as a miscalibration effect between perceived and actual academic competencies. Also, Bou Malham and Saucier (2016) note that even young children's self-reports about reading may suffer from social desirability (SD) and that SD is a robust phenomenon in which cultural normativity plays an important role. Schwanenflugel and Knapp (2016) likewise sustain that self-report measures, including those in the area of reading motivation, are "notoriously subject to social desirability bias" (p. 255). Overall, the results in attitudes towards reading indicate that a high achiever in PIRLS 2016 is a skilled reader, i.e., someone who

can read and is, therefore, more confident in his reading competence than a student who likes or a student engaged in reading. This finding can give some clues about reading instruction's focus, whether the goal is reading achievement.

Finally, contrary to our expectations, only school emphasis on academic success predicts reading achievement at the school level. Perhaps teachers and principals feel that they must emphasize academic success pressed by the societal trend to make schools accountable for students' progress (Paletta, 2019). The notion of school effectiveness based on academic results might be questionable or uncomfortable for many teachers and administrators (Keddie, 2016), but schools can hardly avoid it (Goddard et al., 2019). Although the school effectiveness movement might be perceived as if schools are companies, it may induce school engagement with students' progress, namely in reading (Valenzuela et al., 2016).

PIRLS 2016 suggests that an effective school is ultimately a school geared to academic success in reading achievement. PIRLS further suggests that schools' emphasis on academic success may mitigate the effect of school composition or literacy skills at the school entrance.

## Limitations

Two limitations are worth mentioning. One is that some PIRLS 2016 items may not represent constructs accurately (e.g., the School Emphasis on Academic Success Scale). The second and main limitation of this study is the likelihood of social desirability in students' responses to the reading questionnaire and their tendency to give definite answers and use the scales' upper ends.

## Conclusions and implications

Our study's most significant contribution is to envision the targets and organizational strategies that might produce significant effects on students' reading performance and those that will likely not, according to the results of PIRLS 2016. First, schools should emphasize reading proficiency over and before emphasizing reading engagement or reading enjoyment. Secondly, schools should assume academic success as an organizational goal. Thirdly, schools should not focus on students' home resources (a significant predictor of reading achievement) because it is an uncontrollable factor. Overall, our study suggests that schools, as organizations, should promote a school climate that values success in reading and encourage instruction focused on students' reading competency. When schools are requested to perform multiple functions and teach countless contents (risking dropping their focus), it is relevant to assume the primacy of reading and show the most likely ways to promote it.

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