Abstract

Reading is crucial for learning, in general. Starting-out right with reading in primary grades is therefore vital for school achievement. The present study investigates student and school factors most likely involved in 4118 fourth-grade students' reading performance using PIRLS 2016. Two questionnaires were used to collect data: a school principals' questionnaire and a student questionnaire. 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.

Keywords: reading achievement; reading predictors; fourth-graders; PIRLS; hierarchical modeling.

realización en lectura; predictores de lectura; cuarto grado; PIRLS; modelado jerárquico.

Word count: 6860
School and Student Determinants of Reading Performance: A Multilevel Analysis with Portuguese Students

In the last decades, large-scale international surveys such as PIRLS (Progress in International Reading Literacy Study) or PISA (Programme for International Student Assessment) provided invaluable information about the reading literacy skills of children and youth (Mullis, Martin, Foy, & Arora, 2012). 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 central point of the PIRLS scale (500 points), there was a significant 13 points decrease from 2011 to 2016. Portugal was one of the 11 countries that performed significantly worse in 2016 than 2011 (21 countries performed significantly better), going down from the nineteenth to the thirty-first place. 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 countries' progress is now well documented in international studies, the debate about the factors that most likely influence reading achievement about reading 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 (Hemmerechts, Agirdag, & Kavadias, 2017). The SES (socioeconomic status) of families, for example, is one of the most important predictors of reading performance and school performance (e.g., Diuk, Barreyro, Ferroni, Mena, & Serrano, 2019; Liu, Chung, & McBride, 2016). However, the literature refers to some mediators or moderators that explain the relationship between SES and student's reading performance. For instance, children's temperament (Wang et al., 2017), vocabulary and morphological knowledge (Cheng & Wu, 2017), academic language (particularly challenging for students from low SES-families), or peers (Chesters & Daly, 2017).

Since Bourdieu and Passeron (1977) introduced the notion of families' cultural capital 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). In turn, Criado and Bueno (2017) found that parents’ expectations of the lower social strata students significantly decrease from youth 12 to 16 years because of their children's expressive school failure. Therefore, the authors suggest, parents' expectations depend on school performance, not the contrary.

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.** Students' attitudes toward reading have been conceptualized and measured in different ways. The literature about the impact of students' attitudes toward reading in reading performance is multifaceted, 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 applied to attitudes toward reading concepts most usually found in the area of motivation. For example, reading efficacy, reading challenge, reading curiosity, the value of reading, reading goals, compliance (reading to fulfil academic obligations), or reader grades (reading to get grades). Petscher (2010) conducted a meta-analysis about the relationship between attitudes towards reading and achievement in reading, concluding that the relationship is moderate ($Z_r = .32$) but stronger for elementary students ($Z_r = .44$) than for middle school students ($Z_r = .24$). Nootens et al. (2019) also found their participants' attitudes toward reading to be less favorable in middle school than in the last two elementary school years. The effect was identical in reading for pleasure and academic reading for boys and girls. 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.
PIRLS study (2016) considers three aspects of students' attitude towards reading: students' reading engagement, students' like reading, and students' confidence in reading.

*School Determinants of Reading Performance*

The school effectiveness literature has explored many school factors related to student achievement (Martínez-Abad, 2019). For instance, achievement pressure for basic subjects, high expectations from principals and teachers, educational leadership, school climate, school's average socioeconomic level, or opportunity to learn (Biesta, 2019; Creemers & Kyriakides, 2015). Marzano (2003) assert 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 (McGuigan & Hoy, 2006). The construct's variability generates differences in measurement and makes comparisons across studies difficult (Nilsen and Gustafsson, 2014). Also, the concept of academic success has long been controversial. For instance, Garbarino (1976) considers that academic excellence is not a good measure of school success because it does not relate to life success's essential features outside school. Social status at school is not a good measure either since it focuses too much on non-academic factors. According to Garbarino (1976), the best index of academic success might be educational attainment, the number of years of schooling
completed. 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, Lynam, Tartwijk, & Stock, 2018). In this perspective, a school that promotes students’ grades in academic content should get better readers, on average.

**Previous literacy skills.** 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 (Kjeldsen, Educ, Saarento-Zaprudin, & Niemi, 2019; Pfost, Blatter, Artelt, Stanat, & Schneider, 2019). Although the literature is clear about the advantages of previous literacy skills for reading, there might be some caveats. For example, Pinto and Lopes (2016) 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, 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. 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.

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.

**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 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., Cattaneo, Oggenfuss, & Wolter, 2017; Locher & Pfost, 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, untrustable. The authors studied the influence of instruction time on fourth-graders academic achievement from 24 countries, using data from TALIS and TIMMS 2011, and concluded that instruction "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, Gärtner, and Brunner (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 data from 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, France. Sciffer, Perry, and
McConney (2020) defend that critiques of socioeconomic compositional (SEC) effects are due to methods unlikely to detect SES effects.

**The Present Study**

The present study investigates student and school factors involved in Portuguese students' reading achievement using PIRLS 2016. PIRLS data are particularly suited to modeling individual and organizational factors and testing models that explain students' reading achievement. Specifically, our goals are (1) to test whether students' factors best predict reading performance than school factors, and (2) determine what student and school factors are significant predictors of reading performance. The most parsimonious multilevel model of reading performance will be retained.

**Method**

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. 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).

**Participants**

The Portuguese participants were recruited through a stratified multi-stage probability sampling design (Martin et al., 2017) (OECD, 2014). 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. In a third stage, a random sample of one or two 4th grade classes was extracted, 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). The IEA IDB Analyzer was used to deal with the sophisticated design of PIRLS 2016\(^1\).

**Variables and Measures**

**Student Variables**

**Reading achievement.** Reading achievement is the outcome of this study. 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 variables and measurements used from PIRLS 2016 were constructed by the International Association for the Evaluation of Educational Achievement (IEA) using 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, Mullis, & Hooper, 2017, Eds, p. 14). Moreover, for most scales, a scaling procedure transformed the original ordinal data into an interval scale with a centerpoint of 10.

---

\(^1\) 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, Dumais, LaRoche, & Mirazchiyski, 2013, p. 28) Moreover, it is straightforward in the analysis of combined data (e.g., school data and students’ data).
Students Confident in Reading (SCR). SCR 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). SER 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). SLR 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**

Four school-related predictors were used in this study:

**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 skills².

**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 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

---

² 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)
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.

**Model Building**

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), the calculation of the deviance statistic (-2LL), and the calculation of 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, Bryk, & Congdon, 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 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 1st 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**

\[ \text{SRA}_{ij} = \beta_{0ij} + r_{ij} \]

**Level-2 Model**

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

SRA$_{ij}$ corresponds to the test score in reading for student i in school j.

\( \beta_{0ij} \) represents the level 1 intercept term, which is a function of an intercept term at level 2 (\( \gamma_{00} \)) and of a level 1 residual term (\( r_{ij} \)). The level 1 intercept term (\( \beta_{0ij} \)) is a function of the grand mean (\( \gamma_{00} \)) of schools, plus a random term (\( u_{0j} \)), which means that the intercept is modeled as a random effect.

The null or unconditional model (Table 2) shows an average of 526.93 for SRA, almost 27 points above the scale's mid-point. Within-school variance for perceived classroom discipline is \( \sigma^2 = 3543.50 \), and between-school variance is \( \tau = 625.50 \), \( p < 0.001 \). 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 ($\chi^2 = 872.23$, $p < .001$)
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
(Design Effect = $1 + [n_c - 1] ICC$) is 3.98 ($n_c$ 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),
confidence in reading (SCR), and home resources for learning (HRL). The variables
were grand-centered.

Level-1 Model

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

Level-2 Model

$$\beta_1 = \gamma_{10} + u_0$$
$$\beta_2 = \gamma_{10}$$
$$\beta_3 = \gamma_{20}$$

---

3 “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)
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. Confidence in reading is by far the best predictor of reading achievement. A one-point increase in confidence 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 Perceived Classroom Discipline**

Finally, we tested a third model that includes both student and school-related variables as predictors of perceived classroom discipline. 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

\[
SRA = \beta_0 + \beta_1 \times (SER) + \beta_2 \times (SLR) + \beta_3 \times (SCR) + \beta_4 \times (HRL) + r
\]

Level-2 Model
\[ \beta_0 = \gamma_{00} + \gamma_{01} \ast (\text{EmpSucc}) + \gamma_{02} \ast (\text{EntLiter}) + \gamma_{03} \ast (\text{InsTime}) + \gamma_{04} \ast (\text{SchComp}) + u_0 \]

\[ \beta_1 = \gamma_{10} \]
\[ \beta_2 = \gamma_{20} \]
\[ \beta_3 = \gamma_{30} \]
\[ \beta_4 = \gamma_{40} \]

**TABLE 4 ABOUT HERE**

The results show that in this model, student-level 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 confidence 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 resource for learning 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 the Portuguese schools add to students' home resources, apparently running for social equity, one of the most critical schooling goals (Dadon-Golan, BenDavid-Hadar, & Klein, 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 difference raises the crucial question, whether schooling and instruction can close the achievement gap and mitigate home resources' effects (Kim, Cho, & Kim, 2019; Zuilkowski, McCoy, Jonason, & Dowd, 2019).

Students' attitudes towards reading (students reading engagement, like reading, confident in reading) also predict SRA, but at very different levels. Confidence in reading (SCR) is, by far, the better 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. SER and like reading (SLR) have a much higher correlation, $r(4118) = .50, p < .001$, than SER with SCR, $r(4118) = .16, p < .001$, or SLR with SCR $r(4118) = .20, p < .001$. These results are relevant because they suggest that better achievers are confident in their reading skills, but they are not necessarily those who enjoy reading the most or are most engaged in reading.

Although we found that a one-point increase in like reading represents a 2.5 decrease in reading achievement, results should be interpreted cautiously. It is hardly conceivable that high achievers do not like reading more than others do, and it is still more challenging to understand how low achievers can like reading more than others do. Indeed, Vaknin-Nusbaum, Nevo, Brande, and Gambrell (2018) found that low achievers showed a decline in self-concept as readers and overall motivation during a school year, as opposed to high achievers. Also, Bou Malham & Saucier (2016) note that even young children's answers in self-reports may suffer from social desirability.
Schwanenflugel and Knapp (2016) also 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., can read, and is, therefore, more confident in his reading competence than a student who likes a student that is 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 (Lee & Kang, 2019; Paletta, 2019). The notion of school effectiveness based on academic results might be questionable or uncomfortable for many teachers and administrators (Keddie, 2016; Thingstrup, Schmidt, & Andersen, 2018), but schools can hardly avoid it (Goddard, Goddard, Bailes, & Nichols, 2019; Paletta, 2019; Tolo, Lillejord, Flórez Petour, & Hopfenbeck, 2020). 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.

**Conclusions**

Overall, PIRLS 2016, in Portugal, shows that confidence as a reader and home resources for learning are the best predictors of reading achievement at the student level, and school emphasis on academic success is the only significant predictor at the school
level. Reading engagement and enjoying reading are also significant predictors of reading achievement, but enjoying reading is negatively related to students' reading achievement. Since self-confidence in reading depends on perceived competence in reading, and that instructional factors influence reading proficiency and motivation (Bates, D'Agostino, Gambrell, & Xu, 2016), a school emphasizing academic success and focusing on reading learning will likely get better results in reading. Contrary to the claims of some educational theories, the results suggest that emphasizing reading skills is much more critical to reading achievement than emphasizing reading engagement or reading enjoyment. However, this might be true only for primary graders.

**Limitations**

Perhaps the main limitation of this study is the risk of social desirability in responses to the reading questionnaire. The literature has long referred that self-reports are subject to social desirability and questionnaires about reading even more. According to Oldfather and Wiglfield (1996), young children tend to give definite answers and use the scales' upper ends. Some PIRLS 2016 items may also not represent constructs accurately (e.g., the School Emphasis on Academic Success Scale). Still, the strong relations between self-reports, students' grades, parents' reporting, and teachers' evaluations show that many students answer honestly to the questionnaires.
References


Cognition and Development, 20(1), 75-95. doi: 10.1080/15248372.2018.1545656


Martin, M. O., Foy, P., Mullis, I. V. S., & O'Dwyer, L. M. (2013). Effective schools in reading, mathematics, and science at the fourth grade. In M.O. Martin & I. V. S.
Mullis (Eds.), *TIMSS and PIRLS 2011: Relationships among reading, mathematics, and science achievement at the fourth grade—Implications for early learning* (pp. 109-178). TIMSS & PIRLS International Study Center, Boston College.


Table 1

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

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students engaged in reading</td>
<td>11.19</td>
<td>1.79</td>
<td>2.54</td>
<td>13.13</td>
</tr>
<tr>
<td>Students like reading</td>
<td>11.47</td>
<td>2.00</td>
<td>2.55</td>
<td>14.58</td>
</tr>
<tr>
<td>Students confident in reading</td>
<td>9.62</td>
<td>1.79</td>
<td>2.96</td>
<td>13.47</td>
</tr>
<tr>
<td>Home resources for learning</td>
<td>10.05</td>
<td>1.60</td>
<td>4.03</td>
<td>14.80</td>
</tr>
</tbody>
</table>

Descriptive statistics for schools (n = 203)

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>School emphasis on school success</td>
<td>9.04</td>
<td>1.74</td>
<td>5.58</td>
<td>15.36</td>
</tr>
<tr>
<td>Students enter with literacy skill</td>
<td>9.26</td>
<td>1.89</td>
<td>7.11</td>
<td>14.77</td>
</tr>
<tr>
<td>School Composition</td>
<td>2.31</td>
<td>0.69</td>
<td>1.00</td>
<td>3.00</td>
</tr>
<tr>
<td>Instructional Time</td>
<td>894.62</td>
<td>188.13</td>
<td>673.75</td>
<td>2000</td>
</tr>
</tbody>
</table>
### Table 2

Unconditional hierarchical linear model

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Coefficient</th>
<th>SE</th>
<th>DF</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>525.22</td>
<td>2.02</td>
<td>202</td>
<td>149.20</td>
<td>0.000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter</th>
<th>SD</th>
<th>VC</th>
<th>DF</th>
<th>$\chi^2$</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\mu_0$ (variation among schools)</td>
<td>25.02</td>
<td>625.50</td>
<td>202</td>
<td>872.23</td>
<td>0.000</td>
</tr>
<tr>
<td>$r$ (variation within schools)</td>
<td>59.53</td>
<td>3543.50</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: SE – Standard error; DF – Degrees of freedom; VC – variance component
Table 3

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Coefficient</th>
<th>SE</th>
<th>DF</th>
<th>t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>526.056</td>
<td>1.55</td>
<td>202</td>
<td>338.41</td>
<td>0.000</td>
</tr>
<tr>
<td>Students engaged in reading</td>
<td>2.67</td>
<td>0.64</td>
<td>3911</td>
<td>4.18</td>
<td>0.000</td>
</tr>
<tr>
<td>Students like reading</td>
<td>-3.26</td>
<td>0.59</td>
<td>3911</td>
<td>-5.56</td>
<td>0.000</td>
</tr>
<tr>
<td>Students confident in reading</td>
<td>-3.26</td>
<td>0.59</td>
<td>3911</td>
<td>-5.56</td>
<td>0.000</td>
</tr>
<tr>
<td>Home resources for learning</td>
<td>12.18</td>
<td>0.654</td>
<td>3911</td>
<td>22.58</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>10.30</td>
<td>0.60</td>
<td>3911</td>
<td>17.12</td>
<td>0.000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter</th>
<th>SD</th>
<th>VC</th>
<th>DF</th>
<th>$\chi^2$</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>$u_0$ (variation among schools)</td>
<td>18.35</td>
<td>336.65</td>
<td>202</td>
<td>668.07</td>
<td>0.000</td>
</tr>
<tr>
<td>$r$ (variation within schools)</td>
<td>52.69</td>
<td>2776.67</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 perceived classroom discipline

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Coefficient</th>
<th>SE</th>
<th>DF</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>525.86</td>
<td>1.48</td>
<td>198</td>
<td>356.41</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>Student-level variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students engaged in reading</td>
<td>2.66</td>
<td>0.56</td>
<td>3911</td>
<td>4.76</td>
<td>0.000</td>
</tr>
<tr>
<td>Students like reading</td>
<td>-3.23</td>
<td>0.50</td>
<td>3911</td>
<td>-6.49</td>
<td>0.000</td>
</tr>
<tr>
<td>Students confident in reading</td>
<td>12.16</td>
<td>0.49</td>
<td>3911</td>
<td>24.70</td>
<td>0.000</td>
</tr>
<tr>
<td>Home resources for learning</td>
<td>10.00</td>
<td>0.58</td>
<td>3911</td>
<td>17.22</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>School-level variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School emphasis on academic success</td>
<td>4.38</td>
<td>1.47</td>
<td>198</td>
<td>4.64</td>
<td>0.000</td>
</tr>
<tr>
<td>Students enter with literacy skills</td>
<td>-0.88</td>
<td>0.94</td>
<td>198</td>
<td>-1.10</td>
<td>0.797</td>
</tr>
<tr>
<td>Instructional Time</td>
<td>-0.003</td>
<td>0.01</td>
<td>198</td>
<td>0.34</td>
<td>0.450</td>
</tr>
<tr>
<td>School composition by student background</td>
<td>-0.89</td>
<td>2.29</td>
<td>198</td>
<td>-0.39</td>
<td>0.970</td>
</tr>
</tbody>
</table>

**Estimated random effects**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>SD</th>
<th>VC</th>
<th>DF</th>
<th>( \chi^2 )</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>( u_0 ) (variation among schools)</td>
<td>16.87</td>
<td>284.76</td>
<td>198</td>
<td>587.72</td>
<td>0.000</td>
</tr>
<tr>
<td>( r ) (variation within schools)</td>
<td>52.69</td>
<td>2776.75</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>