



Teacher and Student Practices Associated with Performance in the PISA Reading Literacy Evaluation

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This article aims at finding teacher's and student's practices that relate to performance in PISA reading literacy evaluations and that are feasible to intervene in order to assist the improvement of reading competency. To achieve this purpose, the study was developed with data collected from the population of Costa Rica that took the PISA evaluation in 2018 ($n = 4691$, 2340 men, and 2351 women). A linear regression of the reading score was performed utilizing plausible values and sampling weights. The predictors of the regression were contextual factors, teacher practices, and student habits. Time spent and interest in reading showed a positive and relevant association with student's performance in reading, controlling important background aspects like economic resources and parents' education. Moreover, 28.19% to the obtained variance explanation of the reading literacy (27%) was only due to the teacher's and student's practices. These results provide favorable information to design interventions for the improvement of reading competency.

Keywords: reading literacy, sampling weights, teacher practices, student habits, time reading, plausible values

INTRODUCTION

In 2018, ten Latin American countries participated in the Program for International Student Assessment (PISA) tests: Argentina, Brazil, Chile, Costa Rica, Dominican Republic, Mexico, Panama, Peru, and Uruguay. In all countries of the region, except for Chile, it was observed that more than 40% of the student body presented a level 1 in reading literacy; while the countries of the Organization for Economic Cooperation and Development (OECD), on average, reached 22% of students at this level (OECD, 2019b). According to this result, almost half of 15-year-old students in Latin America have very low levels of reading literacy, that is, they barely understand the explicit or literal information in short texts.

Based on the above situation, we concluded the need to implement strategies to improve reading literacy performance in the region, as proposed in the present study which seeks to determine which teacher's and student's practices can have an impact on the improvement of reading literacy. To meet this objective, we first presented a set of variables that may be associated with reading literacy according to the literature and then we analyzed the effect of these variables on PISA 2018 reading literacy scores in a country in the region: Costa Rica.

According to PISA's own definition, reading literacy is one of the many communicative components that involves "the capacity to understand, use and reflect on written texts in order to achieve goals, develop knowledge and potential, and participate in society" (OECD, 2019a: 34). This conceptualization requires not only the act per se of reading, but also the replication that this

reading may have in the person who exercises it from the generation of new meaning. It therefore includes cognitive skills beyond decoding, such as, mastery of grammatical and linguistic structures, as well as contextual knowledge. The tasks considered by PISA for the evaluation of reading comprehension also assess the applicability of the reading exercise, which translates into the establishment of purposes that serve as a stimulus for reading itself or with the development of writing.

The notion of reading literacy has been differentiated from that of reading competence (Jiménez, 2013), from the pragmatic position by emphasizing a particular use that motivates the act of reading (Solé 2012) or applies it when seeking to solve a particular problem or situation with reading (Diez and Egío, 2017). Hence, the purpose is fundamental for reading comprehension and meaning-making to achieve the expected results both in the assessment and even outside of it.

Academic achievement or student's performance, understood as the result in the measurement of a skill or knowledge that in turn implies the performance on an assessment (Edel, 2003; Lamas, 2015) is subjected to and influenced by several variables that could have a negative or positive impact on that student's performance (Bormuth, 1973; Wilkinson, 1998; Artelt, Schiefele, and Schneider, 2001; Shiel and Cosgrove, 2002; Rasmussen, 2003; Connor, Son, Hitman and Morrison, 2005; Morrison, Bachman, and Connor, 2005; Brozo et al., 2014). These variables could include the practices that teachers have selected to teach their subject, (OECD, 2005; Guo et al., 2012; Meroni et al., 2015; Duke, Cervetti and Wise, 2016), student's habits (Bormuth, 1973; Wilkinson, 1998; Artelt, Schiefele, and Schneider, 2001; Shiel and Cosgrove, 2002; Rasmussen, 2003; OECD, 2010; Brozo et al., 2014; Brenes, 2019), and the factors that come from family context, such as the level of education of both the father and the mother, and their socioeconomic status (Montero et al., 2012; Hernández-Padilla and Bazán-Ramírez, 2016; Alves et al., 2017; García et al., 2018; Brenes, 2019).

Research concerning teacher's practices finds that teachers with positive attitudes toward their subject matter or student's learning are associated with students with high academic achievement (OECD, 2005; Guo et al., 2012; Meroni et al., 2015; Duke et al., 2016). Thus, one of the teacher's practices associated with student's performance, particularly in reading, is that the language instructor expresses interest in their subject (Wray and Medwell, 2000; Guo et al., 2012). Furthermore, Wray and Medwell (2000) indicating that when investigating instructors' teachings in reading literacy, they demonstrated their own appreciation for writing and reading, which generated better results in their students' learning, and therefore, in their academic performance.

Another relevant teacher's practice is for the language teacher to take an interest in the students' learning, providing them with more opportunities for understanding the subject matter. Thus, Vidal-MoscOSO and Manriquez-López (2016) stated in their study that teachers should assume the commitment to teach reading adequately to guide and support in the formation of reading literacy, due to the fact that there is a significant influence on student's performance when teachers express interest in their students' learning.

On the other hand, relevant teacher practices include the classroom environment where disciplinary control is crucial for teaching, learning and, therefore, for student academic performance. From this perspective in a number of studies (Omoteso and Semudara, 2011; Akiri, 2013; Duke et al., 2016), it is stated that the environment generated by the instructors during class influences significantly the students' academic achievement in public high schools. In addition, a teacher's ability to effectively manage a classroom also depends on the mode of training and the work experience they have; generally, more experienced teachers tend to have better disciplinary control in their classrooms (Omoteso and Semudara, 2011).

Regarding the variables associated to the students' habits, studies show that absenteeism, daily dedicated time to read for pleasure (reading time), and the interest the student has for reading are factors associated with students' academic performance. From this perspective, in a number of studies (Romer, 1993; Chen and Lin, 2008; Schmulian and Coetzee, 2011; López-Bonilla and López-Bonilla, 2013; Teixeira, 2016) it is affirmed that there is a negative association between students' absenteeism and academic performance. Moreover, researches have hypothesized that class attendance should be positively correlated with academic achievement, consequently being beneficial in the development of reading literacy. For example, Schmulian and Coetzee (2011), utilizing simple correlation techniques and a sampling characterized by low levels of class absenteeism (less than 10%), observed that there is a positive and significant correlation between class attendance and academic performance. Nonetheless, Schmulian and Coetzee (2011) affirmed that such correlation is low.

On the other hand, López-Bonilla and López-Bonilla (2013) determined that absenteeism is a complex and multifactorial phenomenon. Their study showed that efficiency, teaching style, academic interest, content, teaching format, peer influence, and peer fears are determinant on absenteeism; however, absenteeism had an association with student's performance. In another line of research, Teixeira (2016) substantiates that class absenteeism weakens student's academic performance, substantially influenced by contextual factors such as attendance rules, perceived difficulty of the class, teacher's characteristics and access to online reading material. In addition, Teixeira (2016) affirmed that it is true that factors of individual difference such as motivation, conscience, and intelligence increase the probability of a student attending class.

Some other studies indicate that there is an impact on student's academic performance when subjects are absent from class. To illustrate, Romer (1993), Devadoss and Foltz (1996), Chen and Lin (2008) found a positive and significant relation between class attendance and the grades obtained by students in their tests. Thus, Chen and Lin (2008) in their study determined that 114 students who attended classes for an entire semester had a better grade and a positive impact on test scores. According to Chen and Lin (2008), the effect of attending class correlated with an improvement between the 9.4 and 18% in performance on the exams on those students who chose to attend every class. Meanwhile, Devadoss and Foltz (1996) found that a student

who attended every class had chances of achieving, on average, a grade 0.45 points higher than a student who only attended half of the classes, this on a sampling of 400 students.

In relation to the variable interest in reading, different studies (OECD, 2011; Schiefele et al., 2012; Brozo et al., 2014; Dezcallar et al., 2014) indicate that those students who read for pleasure have a better performance in the PISA evaluation, and they are more efficient in their learning, as well as in their scholarly achievements in general. For example, Shiel and Cosgrove (2002) conducted a study about the association between reading literacy and the variables: positive attitude towards reading, frequency of reading during free time, and the socioeconomic status of the student. These researchers determined that the students with higher achievement were those who kept a positive attitude toward reading, participated in a moderate amount of reading during leisure time, and read a vast range of texts. Similarly, in the studies of Montero et al. (2012), Dezcallar et al. (2014), Valdés (2013), and Castro (2014) it is stated that interest in reading contributes to student achievement. For example, Castro (2014) points out that students who show interest in reading, and who read to satisfy their curiosity and enjoyment, obtained 439 points in their performance level in the PISA 2009 reading literacy test, while those students who indicated disinterest in reading had a performance of 413 points, generating a difference of 26 points between both groups.

In this regard, it should be noted that the pleasure of reading is also associated with academic performance in general and not only with reading comprehension. In the study by Dezcallar et al. (2014), it is indicated that reading not only implies access to information, but also a mechanism for critical thinking and socialization. There is a relationship between knowing how to read and enjoying reading that positively favors the perception of learning. Today, however, reading rivals other forms of entertainment such as video games, television and digital media, the use of which diminishes the time spent on academic homework.

Despite the advantages of reading for pleasure, according to the OECD, the percentages of students who read daily for pleasure declined in most OECD countries between 2000 and 2009, and it is women and students with higher socioeconomic status who are more likely to read for pleasure.

Regarding time spent reading, Shiel and Cosgrove (2002) found that the frequency of reading during leisure time was one of the factors explaining reading literacy performance. Similarly, Yubero and Larrañaga (2015) through a logistic regression analysis, in a sample of 2,745 students, found that part of the time devoted to leisure reading is defined by including reading in the student's lifestyle which allows a greater appropriation of vocabularies and an improvement in reading comprehension. Likewise, Guerra and Guevara's (2017) study reports that students who spend little time reading obtain lower scores in reading comprehension tests while those who invest more time obtain higher scores; however, Guerra and Guevara (2017) argue that the high scores were largely due to the use of metacognitive strategies and motivation towards reading. However, these variables: metacognitive strategies, motivation

towards reading, and time spent reading, presented a high positive association. Moreover, Valdés (2013) in his correlational study found that reading is an activity seldom performed in the spare time of pre-adolescents and adolescents whose positive disposition towards reading decreases as age increases; this is because said population reads due to the demands imposed by the school which prevents the development of skills that forge the competent reader.

Studies concerning contextual factors and their relationship with academic performance have shown that parental education, dependence on the school, and resources available for their performance in the school environment are determinants of student's performance (Hernández-Padilla and Bazán-Ramírez, 2016; García et al., 2018; Brenes, 2019). This way, research indicates students have more probabilities of staying in school and performing better if they have the support of their families, both in affective and economic terms (availability of economic resources). It has also been observed that students' academic achievement is lower if the household has a precarious socioeconomic state, due to youngsters having to find a job to support their households (Trejos, 2010; Montero et al., 2012; Brenes, 2019).

From another perspective, in several studies it is stated that the level of education of legal guardians, fathers, and mothers, as well as their socioeconomic status, represent a positive relation with student's performance (Trejos, 2010; Montero et al., 2012; Brenes, 2019). To illustrate, in the study conducted by Alves et al. (2017) on the latent variable family in which the association between the fathers' and mothers' levels of education, socioeconomic level, students' cognitive performance, and academic achievement were considered; it was found that the family variable has an important association with the students' cognitive and academic performance, the fathers and mothers with higher academic and socioeconomic levels are associated with higher academic achievement of their children.

This section has showed that teacher practices, student's habits and contextual factors are related to the reading literacy. These variables were selecting because they are showed a relevant relationship with reading literacy in several studies. The importance of this study lies in recognizing which of these variables are more related to the reading literacy in order to give information to researchers to create new strategies to improve this competency. The hypothesis is that the contextual variables will be the more relevant predictors, besides that the rest of variables will have relevant associations too.

MATERIALS AND METHODS

Participants

The participants of this study are a sampling of 15-year-old students enrolled in a Costa Rican educational institution at grade 7 or higher (Schleicher, 2019). The sampling was of a probabilistic type in two stages, whose objective was to obtain a representative sample. In the first one, the institutions of

education of 5 established strata (technical rural, technical urban, academic rural, academic urban, and private) were randomly selected. In the second stage, a number of students from these institutions were randomly selected too. The sampling collected by PISA was of 7,119 subjects.

The sample used in this study has a total of 4,691 people. We only considered people that completed every instrument used in this study (2,351 women and 2,340 men; 417, 701, 718, 2,222, and 633 from the strata technical rural, technical urban, academic rural, academic urban, and private, respectively).

Measures

Teacher Practices

In this study, three practices of Spanish teachers (the language of the PISA reading test considered) were taken into account who are also in charge of promoting reading comprehension in the secondary education setting in Costa Rica: interest in the subject matter, interest in student's learning (interest in learning) and disciplinary control of the group (disciplinary control).

The variables were measured from the students' perception regarding the practices of their Spanish teacher. For the measurement, four-point Likert scales were used. Every scale consisted of four items, except for the one regarding disciplinary control of the class which consisted of five. The Cronbach's alphas of the scales were 0.88, 0.86, and 0.79 for interest in the subject, interest in students' learning, and disciplinary control.

The measures of each variable of teacher practices were the average score of the items; therefore, the potential ranges of variation were of 1–4. In all three variables, the value 4 indicated the highest positive perception of the students regarding the practices of the Spanish teacher.

Student Habits

The three student's habits analyzed were the amount of lessons from which the student was absent in the last two weeks (absenteeism), daily dedicated time to reading for pleasure (reading time), and interest in reading. The data of the first two variables was collected via direct questions. For the first variable, 4 answer options were available (0 lessons, 1 or 2 lessons, 3 or 4 lessons, 5 or more lessons); for the second variable there were 5 answer options (I do not read for pleasure, 30 min or less per day, more than 30 min but less than 60 min per day, from 1 to 2 h per day, more than 2 h per day). The third variable, interest in reading, was collected through a Likert scale with 5 four-point items. The scale had 5 items about behaviors related to reading (e.g., I like to talk about books).

For the variables 'Absenteeism' and 'Reading time' an ordinal score was considered to which a series of consecutive numbers were assigned to the categories of the variables. In the first variable, a score from 0 to 3 was created (0 = no absenteeism; 3 = high absenteeism) and in the second, a score from 0 to 4 (0 = no reading time; 4 = high reading time). This means that the values of these variables represent levels. Lastly, the unit of measure of interest in reading was the average score of the scale, therefore, its potential range of variation was of 1 to 4.

Contextual Factors

The contextual factors considered were the mother's level of education, the father's level of education, and the household resources. As with the student's variables, in the levels of education of the mother and father ordinal measures were created. These measures varied from 0 to 4 (0 = incomplete primary education; 1 = complete primary education; 2 = complete middle school; 3 = complete secondary education, 4 = university degree).

To create a summary measure of the household resources, the reports of the amount of televisions, automobiles, computers, cellphones with internet connection, tablets, bedrooms with private restrooms, or electronic book readers, and musical instruments were considered. Thus, with this data a principal component analysis was developed to obtain the linear combination that captures the higher percentage of variance of these variables. This linear combination is the measure of household resources utilized in this study and this measure explained a 38% of the variables' variance. This index is presented in standardized units.

Reading Literacy

The reading evaluation conducted by PISA is computer based. The test was divided in three sets of questions (core, stage 1, and stage 2). Each set included a reading describing a real-life situation, as well as a number of multiple-choice questions or short answer questions. In addition, the test was conducted with an adaptive approach, meaning the sets of questions were assigned utilizing the information obtained in previous sets. The questions of the reading test were organized within a 1-h period.

For the reading literacy construct a single measure is not generated, instead, ten indicators called 'plausible values' are utilized. These values are obtained in the following way: a) A distribution of ability in reading literacy for each individual evaluated in PISA is generated based on the answers submitted in the test and other collected measures. Then, b) random values of this distribution are generated which are the plausible values. The use of plausible values is due to the total scores reflecting grades in a specific set of items, instead of the entire potential universe of items (OECD, 2019a; OECD, 2019b).

Procedure

The collection of data was executed by the OECD, as it is known. The selected students in the sampling completed the cognitive evaluation in their high schools' computer laboratories (the cognitive evaluation was composed of the reading evaluation already mentioned, a mathematics questionnaire, as well as a science questionnaire, the latter two are organized in a 1-h period). Then, the students completed a background questionnaire, which contained the information used in the creation of the variables considered in this study. This questionnaire was completed in 35 min, approximately, and was taken in a computer too (OECD, 2019a; OECD, 2019b).

The authorization to collect the students' information was provided to OECD by Education Department of Costa Rica.

Students were not obligated to complete the instruments. After the data recollection, all the variables related to the students' identification were dropped.

Data Analysis

First, a descriptive analysis of the variables was performed with the purpose of analyzing the distribution of the variables of interest among the population. All the statistics of the predictor variables were calculated using a weighted estimation based on the sampling weights of the observations which allowed the creation of unbiased estimates of the intended parameters. The weights used in this study were those estimated by PISA which sought to control for differences in the probabilities of selection of examinees, representation of strata, and school participation rates (OECD, 2009). The sampling weights used for this estimation were called final weights.

To calculate the sample variance of the estimated statistic ($\hat{\theta}$) other weights which were plausible in the population were considered and called replications. The replications were generated by the OECD by means of a Balanced Repeated Replication with Fay's modification with a factor of $k = 0.5$ and a total of 80 weight vectors were generated. Then, the statistic of interest was calculated with each of the weights given by the replicates, referred to as replicate statistics ($\hat{\theta}_r$). The formula for the sample variance of the statistic of interest, with the replicate construction method used, is

$$\sigma_s^2(\hat{\theta}) = \frac{1}{R(1-k)^2} \sum_{r=1}^R (\hat{\theta} - \hat{\theta}_r)^2, \quad R = \text{number of replications}$$

The square root from the formula above represents the estimated statistic sampling error and can be used for the calculation of the statistic t .

In the case of descriptive statistics of reading literacy, parameters were estimated based on plausible values and sampling weights. For this, with each of the 10 vectors of plausible values the statistic of interest was calculated and its respective sample variance, by means of the formulas indicated in the previous paragraph. These statistics were called plausible value statistics ($\hat{\theta}_{pv}$). The final statistic ($\hat{\theta}$) was the average of the plausible value statistics. The error variance of the statistic's estimate is a weighted sum of the sample variance and the imputation variance. The first is the average of the estimated sampling variances at each plausible value and the second is the variance of the plausible value statistics. The formula of the error variance is the following (OECD, 2009):

$$\sigma_e^2(\hat{\theta}) = \frac{1}{M} \sum_{pv=1}^M \sigma_s^2(\hat{\theta}_{pv}) + \left(1 + \frac{1}{M}\right) \frac{1}{M-1} \sum_{pv=1}^M (\hat{\theta} - \hat{\theta}_{pv})^2;$$

$M = \text{number of } pv$

Secondly, to determine if one of the variables of interest was associated with reading literacy performance, the correlation coefficient was estimated based on plausible values and sampling weights. The estimate was similar to that presented with the descriptive statistics. For a particular correlation of a variable of interest with reading literacy, the correlation with each

plausible value was calculated, considering the final weights. The final correlation coefficient was the average of the coefficients obtained. On the other hand, for the calculation of the standard errors, the parameter estimates based on the weights of the replicas and the formula of the standard error mentioned previously were considered. A correlation was considered relevant if its value exceeded the threshold of 0.20 in absolute value. The analysis of the results was based on the relevance of the coefficients, rather than on the p -values because most of the coefficients were significantly different from 0; the latter is to be expected due to the size of the sampling used (Lin et al., 2013).

Lastly, to determine which variables were relevant in explaining the variance of reading literacy, a regression analysis was carried out based on the plausible values and sampling weights. The independent variables of this analysis were those described in teacher practices, student's habits and contextual factors. As with the correlation, a multiple regression was performed on each plausible value considering the final weights. The regression coefficient of a particular variable was the average of the regression coefficients obtained in these regressions. A regression coefficient was considered relevant if its standardized value exceeded the threshold of 0.20 in absolute value (Acock, 2014).

The estimation of all the models was done with the software R, in version 3.6.3.

RESULTS

Descriptive Statistics

Table 1 presents the descriptive statistics of the variables considered in the study. In the teacher's practices, it was obtained that the median interest in the subject ($me = 3.00$, $se < 0.01$) and the disciplinary control ($me = 3.02$, $se = 0.06$) were higher than the central point of the scale (2.5); in contrast, the median interest in students' learning was located in the center of the scale ($me = 2.50$, $se = 0.33$). In the student's habits, it was observed that the median absenteeism was 0 ($se < 0.01$) which indicated that at least 50% of students marked level 0 of absenteeism (that is, they were not absent to any class in the two weeks prior to taking the questionnaire); the median interest in reading ($me = 2.40$, $se < 0.01$) was lower than the central point of the scale, and the median reading time was 1.00 ($se < 0.01$) which indicated that at least 50% of the students barely reached the lowest reading level: less than half an hour of reading per day. In the contextual factors, the medians in father's education and mother's education were equal to 2 ($se < 0.01$ in both). In the case of the first variable, this result indicated that at least 50% of the students have a parent with an education level less than or equal to 2 (completed middle school); then, in the resource index a positive asymmetry was observed ($me = -0.13 < \text{mean} = 0.01$) which suggests that there are fewer people in the higher levels of the index than those in the lower levels.

The predictor variables defined three groups of variables correlated with each other. As expected, the groups were

TABLE 1 | Descriptive statistics and correlations of the variables of the study.

	Mean	Med	Sd	1	2	3	4	5	6	7	8	9
1. Resources index	0.01 (0.03)	-0.13 (0.07)	1.03 (0.03)	1.00 (0.00)								
2. Mother's education	2.25 (0.04)	2.00 (0.00)	1.37 (0.01)	0.47 (0.02)	1.00 (0.00)							
3. Father's education	2.15 (0.04)	2.00 (0.00)	1.39 (0.01)	0.48 (0.02)	0.49 (0.02)	1.00 (0.00)						
4. Teacher's interest in the subject	3.01 (0.01)	3.00 (0.00)	0.74 (0.01)	0.01 (0.02)	0.00 (0.02)	0.01 (0.02)	1.00 (0.00)					
5. Teacher's interest in learning	2.66 (0.02)	2.50 (0.33)	0.81 (0.01)	0.07 (0.02)	0.04 (0.02)	0.05 (0.02)	0.51 (0.01)	1.00 (0.00)				
6. Teacher's group control	3.02 (0.01)	3.20 (0.06)	0.66 (0.01)	-0.01 (0.02)	0.00 (0.02)	-0.01 (0.01)	0.24 (0.01)	0.21 (0.01)	1.00 (0.00)			
7. Student absenteeism	0.52 (0.01)	0.00 (0.00)	0.74 (0.01)	0.00 (0.02)	0.00 (0.01)	0.00 (0.02)	-0.07 (0.01)	-0.05 (0.02)	-0.11 (0.02)	1.00 (0.00)		
8. Student's interest in reading	2.52 (0.01)	2.40 (0.00)	0.74 (0.01)	0.01 (0.01)	0.03 (0.01)	0.05 (0.02)	0.05 (0.01)	0.09 (0.02)	0.05 (0.02)	-0.05 (0.01)	1.00 (0.00)	
9. Student's reading time*		1.00 (0.00)		0.02 (0.01)	0.02 (0.01)	0.03 (0.01)	0.07 (0.02)	0.10 (0.01)	0.03 (0.02)	-0.02 (0.02)	0.67 (0.01)	1.00 (0.00)
10. PISA reading Literacy	425.09 (2.73)	423.36 (2.99)	8.58 (1.48)	0.39 (0.01)	0.31 (0.00)	0.31 (0.01)	0.13 (0.01)	0.12 (0.01)	0.12 (0.01)	-0.10 (0.00)	0.22 (0.00)	0.16 (0.00)

The values in parentheses are the sampling errors of the estimated statistics. All coefficients were significant at 5% with the exception of the mean and median of Resources Index. Values in bold are the correlations greater than 0.20. *Ordinal variable: for that reason, we don't include its mean and standard deviation.

TABLE 2 | Linear regression of the PISA reading literacy scores, using plausible values and sampling weights.

Variable	Coef	Std. coef	Samp. e	Imp. e	Se	t
Constant	296.75	0.00	8.10	3.79	9.02	32.90
Resources index	21.29	0.27	1.70	0.63	1.82	11.71
Mother's education	6.44	0.11	1.09	0.42	1.17	5.48
Father's education	6.97	0.12	1.01	0.30	1.06	6.60
Teacher's interest in the subject	7.12	0.07	1.93	0.69	2.07	3.45
Teacher's interest in stud. Learning	2.90	0.03	1.81	0.58	1.91	1.52
Teacher's group control	11.98	0.10	1.90	0.67	2.03	5.90
Student absenteeism	-6.80	-0.06	1.78	0.46	1.84	-3.69
Student's interest in reading	17.27	0.17	2.05	0.65	2.16	7.99
Student's reading time	2.98	0.05	1.16	0.31	1.20	2.48
R ²	0.27		0.02	0.01	0.02	13.11

Coef, coefficient; std. coef, standardized coefficient; samp. e, sampling error; imp. e, imputation error; se, standard error; t, t value, R², determination coefficient. All coefficients were significant at 5%. Values in bold are the standardized coefficients greater than 0.10.

determined by the divisions considered in the selection of the variables. In the group of contextual factors, the three variables had correlations between them of 0.47–0.49; in the group of teacher practices, the correlations were between 0.21 and 0.51; while in the group of student habits, the variable absenteeism was not associated significantly with the other two variables of the group, but these two variables, reading time and interest in reading, presented a correlation of 0.67.

As for the correlations with the variable reading literacy, it was obtained that the relevant variables in its prediction were the three contextual factors ($r = 0.39, 0.31$ and 0.31 for resource index, mother's education and father's education, respectively) and the interest in reading ($r = 0.22, se = 0.01$). The other two student's habits presented statistically significant correlations, but low in absolute value (absenteeism: $r = -0.10$; reading time: $r = 0.16$). Similarly, the teacher practices variables presented statistically significant correlations, but low, between 0.12 and 0.13.

Variables Relevance in the Reading Scores Explanation

Table 2 presents the results of the linear regression predicting reading literacy. It was obtained that all the variables included were statistically significant except for the teacher's variable: interest in learning. The set of variables used explained a 26.50% of the variance belonging to the reading literacy scores ($se = 2.02\%$). The regression coefficient b of each variable indicated that an increase of one unit in its score, keeping the other variables constant, is associated with an average increase of b units in the reading score, for instance, the increase of one unit in student's interest in reading was associated with an average increase of 17.27 units in reading literacy.

As for the contextual variables, it was concluded that the three indicators considered are positively associated with reading literacy. Based on the criterion of the standardized coefficient (β), it is concluded that the variable of the resource index is the

variable considered with the greatest relative importance in the prediction proposed ($\beta = 0.27$). The other two contextual variables had a weak relevance in the prediction (mother's education: $\beta = 0.11$, father's education: $\beta = 0.12$). As for the teacher's practices, the interest in the learning, the interest in the subject and the disciplinary control were positively associated with the reading literacy scores, all of them presented weak coefficients ($\beta = 0.03, 0.07$ y 0.10 , respectively).

In the student's habits, it was observed that reading time and interest in reading were positively associated with the variable studied while absenteeism was negatively associated. It is important to point out that within this group of variables the second most relevant factor in the prediction of reading literacy scores is found: interest in reading ($\beta = 0.17$); the other two variables presented low relative importance (absenteeism: $\beta = -0.06$; reading time: $\beta = 0.05$).

It is important to mention that the variables interest in reading and reading time, despite having a high correlation, did not show signs of collinearity in the model (reading time: $vif = 1.86$, $se = 0.44$; interest in reading: $vif = 1.85$, $se = 0.46$). However, two additional models were estimated considering only one of these variables within the group of predictors, to further analyze their associations. If only the variable interest in reading is considered, the coefficient of determination of the model is practically equal to that of the complete model ($R^2 = 26.46$, $se = 2.01$), but the standardized coefficient of the variable increases to 20.35 ($se = 0.01$). In the model that considers only the reading time, the determination coefficient decreases to 24.83 ($se = 2.06$) while the standardized coefficient of the variable increases considerably to 16.16 ($se = 0.14$). Therefore, both variables are almost relevant in the prediction of reading literacy (the coefficients were close to the threshold 0.20), but the prediction made by the interest in reading in the complete model absorbs part of the explanation that time for reading can offer.

Means of the two most relevant variables in the model were analyzed by strata using an ANOVA without replications. It was not found significant differences in the interest in reading variable ($F(4,6777) = 1.03$, $p = 0.39$) and all the means were close to 2.5 . On the other hand, the resources index showed relevant differences between strata ($F(4,6061) = 509.5$, $p < 0.001$). The highest value was obtained by students from private high schools. The other stratas' means, in descendent order, were urban public academic, urban public technical and rural high schools (there was not statistical significance difference between academic and technical rural high schools).

Finally, the explained variance of reading literacy provided by the model with only contextual variables was 18.65% , ($se = 1.90\%$); then, the increase in variance explained when including student and teacher elements was 7.47% ($se = .68\%$). This implies that 28.19% of the explained variance of the reading literacy by the independent variables is due only to non-contextual factors.

DISCUSSION

In this study a set of variables were analyzed that, according to the literature (Bormuth, 1973; Wilkinson, 1998; Artelt et al., 2001; Shiel and Cosgrove, 2002; Rasmussen, 2003; Connor et al., 2005;

Morrison et al., 2005; Brozo et al., 2014) could be associated with reading literacy. Individually, it was found that the contextual variables presented solid evidence of association with reading literacy, while from the teacher's and student's variables, only the interest in reading showed a relevant linear correlation as argued in the theory (Montero et al., 2012; Valdés, 2013; Castro, 2014; Dezcallar et al., 2014).

Another conclusion of the results obtained from the matrix correlations is the subsets of variables related between them. It was found that the variables of each group defined previously (contextual, student and teacher variables) presented high correlations between them, but low correlations with the rest of variables. The only exception was student absenteeism; this variable did not show relevant correlations with student's reading time nor with their interest in reading. This result suggests that students do not appreciate Spanish classes and reading in the same way, and maybe it is because reading it is not associate with a specific course. It should be remembered that in the Costa Rican context, literature is approached in the subject of the country's official language. On the other hand, it is expected that a student who loves reading, wants to go to a class about interesting things about books. This analysis implicates that students evaluate Spanish classes like a course far away from the hobby of reading.

These results show that the contextual factors present marked relations with reading literacy outcomes. The results support the hypothesis that students from households with high educational and economic climates have better reading literacy scores than those from households with less favorable conditions. This inequality is not due to the high values of these variables, per se, but to the large number of favorable conditions for the development of reading literacy that these variables entail: availability of books, early reading promotion, access to reading peers, investment of time in leisure and cultural recreation activities, among others.

The teacher variables did not present such marked associations with reading literacy as the contextual factors did. This result was expected because contextual variables have influenced students' lives throughout their lifespan while those of teachers only at specific times, being consistent with the studies conducted in Montero et al. (2012) and Dezcallar et al. (2014). On the other hand, the student's variables showed more relevant correlations than those observed in the teacher's factors. This may be because student's variables are highly determined by contextual factors, so that student's variables may reflect a part of the behavior of the contextual ones and, therefore, show some marked correlations.

The analysis of all the variables together in the linear regression with plausible values and sample weights showed that the variables with relevant individual correlations were the ones that presented the relevant regression coefficients. Nonetheless, the second most relevant variable was not a contextual one, but one associated with student's practices: interest in reading. As mentioned in the introduction, interest in reading has been linked to better performances in reading literacy (Montero et al., 2012; Valdés, 2013; Castro, 2014; Dezcallar et al., 2014). This result is due to the fact that people with a higher interest in reading develop better text comprehension skills and other areas, as they seek to understand in a deeper way the readings they undertake. Likewise, as mentioned before, those who have a better reading

comprehension develop an effective reading competence from which they draw a clear and motivational purpose for reading, ranging from the recreational enjoyment of the texts, as in the case of fiction books, to the acquisition of information and expansion of specific knowledge through scientific texts or specific subjects. Moreover, it was showed that interest in reading means by stratas were similar and low, it implies that there is a wide margin to improve this variable in all this groups.

It is important to mention that the variable reading time presents a similar relevance to that of interest in reading when the latter variable is removed from the model; therefore, it is an important variable in the prediction of reading literacy (Shiel and Cosgrove, 2002; OECD, 2011; Schiefele et al., 2012; Valdés, 2013; Brozo et al., 2014; Dezcallar et al., 2014; Yubero and Larrañaga, 2015; Guerra and Guevara, 2017). This implies that for people whose environments have the same considered variables in contextual and teacher's work aspects, the variable interest in reading or reading time is positively and significantly associated with reading literacy. This result is encouraging, as it shows two variables that can be worked on improving reading literacy, despite the contexts students face.

As for the teacher variables, these had little relevance, but we can analyze the variable with the more relevant coefficient (teacher's group control) because it showed a weak effect that can be useful to an intervention. This result indicates that proper group management can contribute to increased reading literacy scores (Omoteso and Semudara, 2011; Akiri, 2013; Duke et al., 2016). This result is justified by the fact that effective language teaching requires a suitable classroom environment. When there is no proper group control, students face many distractions that get in the way of the development of the intended competencies.

The teacher's and student's variables added 28.19% of the explanation of the variance of reading literacy given by the model with only contextual variables. This implies that a portion of the variability of the grades is explained by teacher's and student's variables alone with no incidence of contextual elements. Based on this, it is concluded that there is a range of action that can contribute to the improvement of reading literacy, despite the contextual factors of the students.

Finally, it is important to mention that even though the teacher variables were the less relevant among the non-contextual variables (because they got the lower standardized coefficients), the role of the instructor in the improvement of the student's variables is crucial. Based on the results obtained in this article, the teacher should look for ways to increase students' interest in reading and encourage them to dedicate more time to it which would lead to better results in reading literacy. This task falls on teachers, for example, uneducated or overworked parents cannot be asked to help their children become involved in reading.

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Among the activities that teachers can do so that students develop more interest in reading or devote more time to it are to provide reading material according to the student's preferences, without imposing a type of text, be it fiction or not; to establish meeting points or comparative exercises between reading and other texts such as filmic texts, paintings, comics, music, among others, and to promote collective readings with their consequent discussion.

Some of the limitations of the study were that from the 7,119 students initially chosen, only 4,691 completed all the instruments. Other limitation was the low level of explanation of the teacher's variables, one of the hypotheses of this study was that these variables had more impact in the reading literacy. We think that is necessary to study the validity of the teacher's scales because they showed unexpected results.

It is still pending to include new variables, for example, in contextual factors to which the support resources offered by the institution could be added which include time dedicated to Spanish or literature classes, technological stimuli and access to extra-class activities.

DATA AVAILABILITY STATEMENT

The datasets for this study can be found in the repository PISA 2018 database, available in <http://www.oecd.org/pisa/data/2018database/>

ETHICS STATEMENT

The Education Department of Costa Rica approved PISA test administration developed by OECD, along with the ethical aspects of the process.

AUTHOR CONTRIBUTIONS

LR was the primary author of the manuscript. All authors contributed to the writing and editing of the manuscript.

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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